TAQA Subsea Decommissioning Support Comparative Assessment Report

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EXECUTIVE SUMMARY

TAQA Bratani have conducted a Comparative Assessment (CA) for the decommissioning of the subsea infrastructure associated with their Northern North Sea Subsea Infrastructure. The following steps from the Oil and Gas UK CA Guidelines have been completed:



This CA report for the Northern North Sea Subsea Infrastructure presents the methodology, decisions taken, the preparation works carried out, and the outcomes (recommendations) from the internal and external (with stakeholders) workshops. A total of 18 decommissioning groups were considered during the CA with seven groups being confirmed at the CA Scoping and Screening stage to be required to be fully removed from the field. Full evaluation was conducted on the remaining eleven decommissioning groups with the outcomes obtained as described in the table below. Overall, the outcome of the CA process has made the following recommendations:

GROUP	TITLE	DECOMMISSIONING APPROACH
1	Pipe-in-Pipe Hybrids (Surface Laid and Exposed)	 Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial Pipelines will be disconnected Removal and recovery of line ends Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans to an appropriate depth of cover Future survey & monitoring programme
2	Trunk Lines (Partially Trenched and Buried) ¹	 Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial Pipeline will be disconnected Removal and recovery of offshore line end Rock placement to remediate snag risk from cut end Rock placement at all areas of spans, exposures and shallow burial to an appropriate depth of cover Future survey & monitoring programme
3	Flexible Pipelines and Umbilicals (Trenched and Buried)	 Option 5 – Remove Line Ends Only and Remediate Snag Risk Pipelines / Umbilicals will be disconnected Removal and recovery of line ends including trench transition Rock placement to remediate snag risk from cut ends Future survey & monitoring programme
4	Flexible Pipelines and Umbilicals (Trenched and Rock Covered)	 Option 5 – Remove Line Ends Only and Remediate Snag Risk Pipelines / Umbilicals will be disconnected Removal and recovery of line ends including trench transition

¹ While re-use opportunities were explored by TAQA as part of the CA process [14], it is recognised that general discussions surrounding the reuse opportunities for trunk lines are ongoing. This CA has been conducted on the basis that no viable re-use opportunities will remain for PL4 but shall not be taken to prejudice the outcome of those ongoing discussions between TAQA and the regulators.

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GROUP	TITLE	DECOMMISSIONING APPROACH
		Rock placement to remediate snag risk from cut endsFuture survey & monitoring programme
5	Umbilicals (Surface Laid)	Full Removal selected during scoping phase.
6	Rigid Pipelines (Surface Laid, Exposed and Non- Concrete Coated)	 Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial Pipeline will be disconnected Removal and recovery of line ends Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans to an appropriate depth of cover Future survey & monitoring programme
7	Rigid Pipelines (Surface Laid, Exposed and Concrete Coated)	 Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial Pipelines will be disconnected Removal and recovery of line ends Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans to an appropriate depth of cover Future survey & monitoring programme
8	Rigid Pipelines (Surface Laid and Rock Covered)	 Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial Pipeline will be disconnected Removal and recovery of line ends including transition to existing rock cover Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans, exposure and shallow burial to an appropriate depth of cover Future survey & monitoring programme
9	Rigid Pipelines (Trenched and Buried)	 Option 4C – Removal of areas of Spans / Exposures / Shallow Burial Pipelines will be disconnected Removal and recovery of line ends including trench transition Removal (by cut and lift) of all areas of spans, exposure and shallow burial Rock placement to remediate snag risk from cut ends Future survey & monitoring programme
10	Flexible Risers and Riser Umbilicals	Full Removal selected during scoping phase.
11	Rigid Risers	Full Removal selected during scoping phase.
12	Spools and Jumpers	Full Removal selected during scoping phase.
13	Large Structures	Full Removal selected during scoping phase.
14	Structures	Full Removal selected during scoping phase.
15	Protection and Stabilisation	Full Removal selected during scoping phase.

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GROUP	TITLE	DECOMMISSIONING APPROACH
16	Blocked Rigid Pipeline (Trenched and Buried)	 Option 5 – Remove Line Ends Only and Remediate Snag Risk Pipeline will be disconnected Removal and recovery of line ends including trench transition Rock placement to remediate snag risk from cut ends Future survey & monitoring programme
17	In-Use Rigid Pipelines (Trenched and Partially Buried)	 Option 3B – Trench and Bury Entirety of Line Pipelines will be disconnected Trench / re-trench and bury full length of the lines to remove areas of spans, exposure and shallow burial Future survey & monitoring programme
18	Uncertain Integrity and Concrete Coated Rigid Pipelines (Trenched and Buried)	 Option 5 – Remove Line Ends Only and Remediate Snag Risk Pipelines will be disconnected Removal and recovery of line ends including trench transition Rock placement to remediate snag risk from cut ends Future survey & monitoring programme

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



1 INTRODUCTION

1.1 Background

TAQA has engaged Xodus Group to conduct a comparative assessment (CA) for the decommissioning of their Northern North Sea (NNS) subsea assets across the Tern, Eider, Cormorant North and South, Cladhan, Pelican, Otter, Kestrel, Falcon and Hudson fields (collectively referred to as the Northern North Sea Subsea Infrastructure).

The infrastructure is located in the Northern North Sea as shown in Figure 1-1 below.

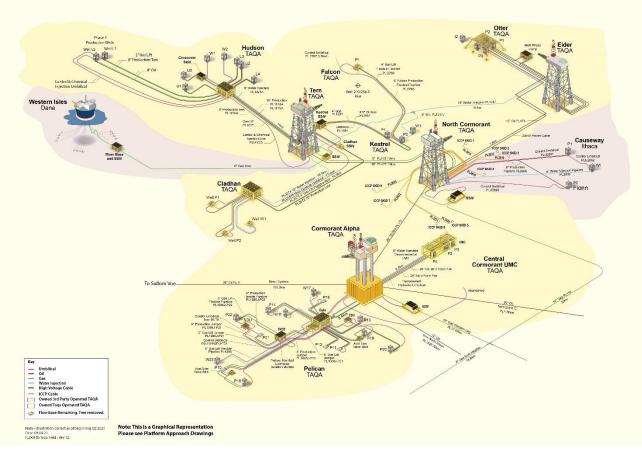


Figure 1-1 - NNS Assets Layout

The Cormorant Alpha Platform hosts the subsea facilities for the Central Cormorant Underwater Manifold Centre (UMC) and the Pelican Fields. The UMC Field consisted of 6 production wells and 3 water injection wells. The UMC itself is covered under Group 13, Large Structures, and was scoped out of the CA at the Scoping Stage. The options for UMC removal are to be considered in a separate study, albeit with full removal as the base case.

The Pelican Field consists of 12 production wells and four water injection wells.

Processed oil is exported via the Brent System Pipeline (PL4) to Sullom Voe. Gas is imported / exported from / to the Western Leg Pipeline (PL17) via a Subsea Isolation Valve (SSIV).



The Eider Platform was previously used to host the subsea facilities for the Otter Field. In 2017, the Eider bypass project was completed to reroute production fluids from the Otter Field to the North Cormorant Platform. Additionally, water injection to the Otter Field was rerouted and is now supplied to Otter from the 16" water injection pipeline from the Tern Platform. In January 2018, the Eider Platform reached Cessation of Production (CoP) and is now primarily used to provide power and controls to the Otter Field.

The Otter Field consists of three production wells and two water injection wells. The field is tied back to the North Cormorant Platform via a subsea manifold and multiphase pump. The Causeway Field (owned by Ithaca Energy) is also tied back to the North Cormorant Platform but is not part of this CA process. Processed oil is exported via PL113 to the Cormorant Alpha Platform. Gas is exported into the Western Leg Pipeline (PL17) via PL114.

The Tern Platform hosts the subsea facilities for the Cladhan, Falcon, Kestrel and Hudson fields and also supplies water injection to the Otter Field. The Cladhan Field consists of two production wells and one water injection well. The Falcon Field consists of a single production well tied back to the Tern Platform via the Kestrel Field. The Kestrel Field consists of two production wells and one water injection well. The Hudson Field consists of nine wells: seven production and two water injection which all remain in operation. The Western Isles Field (owned by Dana Petroleum) is also tied into the Tern pipeline system but is not part of this CA process. Oil and gas from the Tern Platform is exported to the Cormorant Alpha Platform via the North Cormorant Platform.

1.2 Purpose

The purpose of this document is to present the Comparative Assessment (CA) process and emerging recommendations for the Comparative Assessment of the Northern North Sea Subsea Infrastructure in support of the Decommissioning Programmes (DPs). It is produced to satisfy the requirement to perform a CA for all pipeline Decommissioning Programmes and considers all feasible decommissioning options 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 summary for Group 1 Pipe-in-Pipe Hybrids (Surface Laid and Exposed).
- Section 5 The CA summary for Group 2 Trunk Lines (Partially Trenched and Buried).
- Section 6 The CA summary for Group 3 Flexible Pipelines and Umbilicals (Trenched and Buried).
- Section 7 The CA summary for Group 4 Flexible Pipelines and Umbilicals (Trenched and Rock Covered).
- Section 8 The CA summary for Group 6 Rigid Pipelines (Surface Laid, Exposed and Non-Concrete Coated).
- Section 9 The CA summary for Group 7 Rigid Pipelines (Surface Laid, Exposed and Concrete Coated).
- Section 10 The CA summary for Group 8 Rigid Pipelines (Surface Laid and Rock Covered).
- Section 11 The CA summary for Group 9 Rigid Pipelines (Trenched and Buried).
- Section 12 The CA summary for Group 16 Blocked Rigid Pipeline (Trenched and Buried).
- Section 13 The CA summary for Group 17 In-Use Rigid Pipelines (trenched and Partially Buried).
- Section 14 The CA summary for Group 18 Uncertain Integrity and Concrete Coated Rigid Pipelines (Trenched and Buried).
- Section 15 Discussion and 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.
- Appendix G Group 6 Detailed Evaluation Results.
- Appendix H Group 7 Detailed Evaluation Results.
- Appendix I Group 8 Detailed Evaluation Results.
- Appendix J Group 9 Detailed Evaluation Results.
- Appendix K Group 16 Detailed Evaluation Results.
- Appendix L Group 17 Detailed Evaluation Results.
- Appendix M Group 18 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
BOM	Business Opportunity Manager
CA	Comparative Assessment
CNRL	Canadian Natural Resources Limited
СР	Cathodic Protection
CSV	Construction Support Vessel
DoC	Depth of Cover
DP	Decommissioning Programme
DSV	Dive Support Vessel
DWC	Diamond Wire Cutting
ESDV	Emergency Shutdown Valve
FAR	Fatal Accident Rate
HAZID	Hazard Identification
HCE	High Consequence Events
HSE	Health and Safety Executive
ID	Identifier
IP	Institute of Petroleum (now the Energy Institute)
ISBN	International Standard Book Number
JIP	Joint Industry Project
JNCC	Joint Nature Conservation Committee
JV	Joint Venture
KP	Kilometre Point
MCDA	Multi-Criteria Decision Analysis
MFE	Mass Flow Excavator
MPP	Multi-phase Pump
MS	Much Stronger
MW	Much Weaker
NB	Nominal Bore
NNS	Northern North Sea
NORM	Naturally Occurring Radioactive Material
NSTA	North Sea Transition Authority
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
PLL	Potential for Loss of Life
POB	Personnel on Board
PSR	Pipeline Safety Regulations
S	Stronger
SAC	Special Area of Conservation
SEPA	Scottish Environmental Protection Agency
SFF	Scottish Fisherman's Federation
SPA	Special Protection Area
SSIV	Subsea Isolation Valve
TA	Technical Authority
TFL	Test Flowline
UK	United Kingdom
UMC	Underwater Manifold Centre
VC	Video Conference
VMS	Very Much Stronger
VMW	Very Much Weaker
\mathbb{W}	Weaker

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 Scoping Report	Xodus, Subsea Comparative Assessment Scoping Report, Doc. No.: 77IFS-154925-L99-0001, Rev.: 02, Dated: 22/10/2019.
4. CA Screening Report	Xodus, Subsea Comparative Assessment Screening Report, Doc. No.: 77IFS-154925-L99-0003, Rev.: 02, Dated: 06/10/2020.
5. CA Screening Report (Hudson)	Xodus, CA Scoping & Screening Report, Doc. No.: A- 301661-S10-REPT-001, Rev.: A01, Dated: 04/02/2021.
6. Pipeline Status Report	Xodus, Pipelines Status Summary Report, Doc. No.: 77IFS-154925-H99-0004, Rev. 01, Dated: 09/04/2020.

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7. HAZID Report	Xodus, Subsea Comparative Assessment HAZID Report, Doc. No.: 77IFS-154925-H27-0001, Rev. 01, Dated: 05/05/2021.
8. Methodologies Report	Xodus, Subsea Decommissioning Methodologies Report, Doc. No.: 77IFS-154925-L99-0004, Rev.: 07, Dated: 27/08/2021.
9. 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.
10. Analytical Hierarchy Process	T.L. Saaty, The Analytical Hierarchy Process, 1980.
11. OGUK North Sea Pipeline Decommissioning Guidelines	Decommissioning of Pipelines in the North Sea Region – 2013, Issued by Oil & Gas UK.
12. IP 2000	The Institute of Petroleum, Guidelines for the Calculations of estimates of energy use and gaseous emissions in the decommissioning of offshore structures, Dated: February 2000, ISBN: 0 85293 255 3.
13. Memorandum Hudson L1 Pipeline Blockage	Dana Petroleum, Memorandum Hudson L1 Pipeline Blockage, 2020
14. Trunk Line Re-Use Assessment	Xodus, PL4 Trunk Line Re-Use Assessment, Doc. No.: 77IFS-189460-F99-0001, Rev.: 02, Dated: 12/09/2022.
15. Technical Note for Flexible Lines	TAQA, Technical Note: Comparative Assessment of Buried Flexible Lines in the CNS and NNS, Doc. No.: TB-DEC00009-X-TN-0001-000
16. Wax Discharge Assessment	Xodus, Wax Discharge Environmental Assessment, Doc. No.: A-30558-S38-A-REPT-001, Rev.: 01, Dated: 16/05/2024



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 TAQA for the Northern North Sea Subsea Infrastructure.

The OGUK 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).	\checkmark	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.	\checkmark	Screening workshops were held in 2019 and were attended by members of the project team and appropriate TAQA subject matter experts.
Preparation	Undertake technical, safety, environmental and other appropriate studies. Undertake stakeholder engagement.	\checkmark	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.	\checkmark	Internal workshops held Q2 2021 and Stakeholder Workshop on 30 th June 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.	\checkmark	The Stakeholder CA Review Workshop was held on 30 th June 2021 and the minutes can be found in Appendix B.
Submit	Submit to OPRED in support of Decommissioning Programme(s).	Planned Q1 2022	Planned Q1 2022

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 platforms and various subsea wells within the Northern North Sea are linked together via the subsea infrastructure including pipelines and subsea installations. The boundaries of the infrastructure are the low water mark of the trunk line shore approach, the ESDV / hang-off at the top of the risers / umbilicals and the wellhead tie-in flanges. The subsea installations are also included. The boundary limits of the infrastructure are detailed fully in the CA Scoping Report ref. [3]. As a summary, the Northern North Sea Subsea Infrastructure that will be considered under this CA is as follows:

- All subsea structures (installations) including their foundations.
- The large UMC structure including its foundations.
- All rigid risers.
- All flexible and umbilical risers.
- All rigid subsea pipelines and flexible flowlines.
- All umbilicals.
- All spools.
- All control and chemical jumpers.
- All mattresses and deposits.

The starting conditions for the CA are defined below:

- The following will be complete prior to the subsea infrastructure decommissioning scope commencing:
 - The pipelines will be flushed, cleaned and cut / disconnected from subsea infrastructure.
 - The umbilical cores will be flushed, cleaned and cut / disconnected from subsea infrastructure.



2.2.2 Physical Attributes of Equipment

All equipment within the scope of the Northern North Sea Subsea Infrastructure is considered along with the physical attributes that define the equipment. Attributes considered include the following:

- Structures:
 - **–** Туре.
 - 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 Northern North Sea 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. [11].

- Re-use Opportunities.
- Full Removal:
 - Cut and Lift Cut pipe into small sections and recover.
 - Lift and tow recover to surface using Ambient Lifter and tow to shore
 - Reverse Installation with de-burial Recover pipe using reverse s-lay or reverse reeling without prior deburial.
 - Reverse Installation without de-burial Recover pipe using reverse s-lay or reverse reeling with de-burial of any existing cover.
- Decommissioning In-situ Major Intervention:
 - Rock Placement over entirety of lines.
 - Trench and bury entirety of lines.
- Decommissioning In-situ Minor Intervention:
 - Rock Placement over areas of Spans / Exposure / Shallow Burial and remove line ends.
 - Trench and bury areas of Spans / Exposure / Shallow Burial and line ends.
 - Remove areas of Spans / Exposure / Shallow Burial and line ends.
 - Accelerated Decomposition of lines using reverse cathodic protection / chemicals / etc.
- Decommissioning In-situ Minimal Intervention:
 - Remove line ends only.
- Decommissioning In-situ No Intervention:
 - Leave lines in-situ as is.

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. [4] and the CA Screening Report (Hudson) ref. [5]. The methodology is briefly summarised below.



- Identify Northern North Sea Subsea Infrastructure 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:

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



• This approach was considered appropriate to ensure that the best-case full removal options were compared to the most onerous leave in-situ options. This ensures, during the evaluation phase, that the assessment is not skewed in favour of leave in-situ options over full removal options.

The outcomes for each group are summarised in Table 4.3, Table 5.3, Table 6.3, Table 8.3, Table 9.3, Table 10.3, Table 11.3, Table 12.3, Table 13.3 and Table 14.3.

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 Northern North Sea Subsea Infrastructure CA process were as follows:

- Burial Status Review
 Review of historical survey data to understand current and historical burial status of lines summarised in the Pipelines Status Report ref. [6].
- Cost Estimate The methodologies for each option were defined along with necessary resources to execute the option, detailed in the Methodologies Report ref. [8].
 From this, indicative costs were able to be calculated, also detailed in the Methodologies Report.
- Safety Calculations
 Using the methodologies detailed within the Methodologies Report, safety calculations are made for each of the options using the Fatal Accident Rates from the JIP conducted by Safetec ref. [9] into decommissioning activities. This allows cumulative PLL values to be provided to represent the risk exposure for the options for comparative purposes.
- HAZID Assessment
 A HAZID was conducted to identify options with a greater potential for High Consequence Events and to qualitatively inform the legacy risk assessment. The HAZID is detailed in the HAZID Report ref. [7].
- 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 according to the factors from IP2000 ref. [12] and detailed in the Methodologies Report ref. [8].
- 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 Methodologies Report ref. [8].
- Summary Data Sheets Compiling all necessary data together for evaluation purposes, data sheets were prepared for each option as detailed in the Methodologies Report ref. [8].



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, F, G, H, I, J, K, L and M.

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, F, G, H, I, J, K, L and M.

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 30th June 2021. The attendees were as detailed in Table 2.3.

COMPANY	NAME	ROLE
BP	Allen Deans	Commercial Advisor
CNRL	Caroline Lawford	Project Lead - Decommissioning
Fairfield	Peter Lee	Decommissioning Manager
HSE	Hywel Williams	Pipelines Inspector
	Tim Dean	Specialist Inspector
JNCC	Niki Piesinger	Offshore Industry Advisor
	Tetrienne Kerswell-Box	Offshore Industry Advisor
MOL Energy	Vivek Bansal	JV Asset & Facilities Manager
OPRED ODU	Ruth Ledingham	Senior Decommissioning Manager
	Caitlyn Cox	Decommissioning Manager
	Sam Pattie	Assistant Decommissioning Manager
OGA	Peter Cacela	Decommissioning Engineer (Strategy)

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COMPANY	NAME	ROLE	
SEPA	Louise Brown	Principle Decommissioning Officer	
SFF	Andrew Third	Offshore Industry Liaison	
	Steven Alexander	Managing Director	
Shell	James Blackburn	UK Decom BOM	
TAQA	Alan Campbell	Area Manager Tern, Eider and North Cormorant	
	Alastair McLean	Decommissioning Program Manager	
	David Holland	HSE Manager	
	lain Milne	Marine Focal Point	
	John Taylor	Subsea TA	
	Katie Lilford	Decommissioning Stakeholder & Compliance Analyst	
	Kevin Barrie	Production Optimisation Lead	
	Martin Rae	Subsea Inspection Engineer	
	Mik Crosby	Senior Pipeline Engineer	
	Robbie Jones	Senior Environmental Advisor	
	Robin Ritchie	Decommissioning Subsea Engineer	
	Steve Sapp	Decommissioning Manager – Subsea and Wells	
Xodus Group	Nic Duncan	Project Manager	
	John Foreman	Comparative Assessment Lead	
	Gareth Jones	Decommissioning Manager	
	Jeff McCleary	Senior Decommissioning Consultant	

Table 2.3 - Stakeholder Workshop Attendees & Roles



3 NORTHERN NORTH SEA SUBSEA INFRASTRUCTURE DECOMMISSIONING GROUPS

3.1 Decommissioning Scoping Groups

Table 3.1 lists all decommissioning groups identified for the Northern North Sea Subsea Infrastructure. Early CA scoping and screening activities, detailed in the CA Screening Report ref. [4], identified the decommissioning groups where full removal is the recommended decommissioning approach. 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	Pipe-in-Pipe Hybrids (Surface Laid and Exposed)	All Pipe-in-Pipe Hybrid lines across all fields. These lines are contained within a carrier pipe, were towed into position and surface laid when installed and have no cover.	Subject to full Comparative Assessment
2	Trunk Lines (Partially Trenched and Buried)	All rigid trunk lines running from the offshore field to the low water mark at shore approach.	Subject to full Comparative Assessment
3	Flexible Pipelines and Umbilicals (Trenched and Buried)	All flexible pipelines and umbilicals across all fields which were trenched and buried when installed.	Subject to full Comparative Assessment
		Inclusion of flexible pipelines and umbilicals in the same group deemed appropriate as they share similar design and manufacture characteristics, consisting of multiple layers of metals and polymers.	
4	Flexible Pipelines and Umbilicals (Trenched and Rock Covered)	All flexible pipelines and umbilicals across all fields which were trenched and rock covered when installed.	Subject to full Comparative Assessment
		Inclusion of flexible pipelines and umbilicals in the same group deemed appropriate as they share similar design and manufacture characteristics, consisting of multiple layers of metals and polymers.	
5	Umbilicals (Surface Laid)	All umbilicals that are surface laid with no cover.	Full Removal
6	Rigid Pipelines (Surface Laid, Exposed and Non- Concrete Coated)	All rigid pipelines without concrete coating that are surface laid with no cover.	Subject to full Comparative Assessment



GRP	TITLE	DESCRIPTION	DECOMMISSIONING APPROACH
7	Rigid Pipelines (Surface Laid, Exposed and Concrete Coated)	All rigid pipelines with concrete coating that are surface laid with no cover.	Subject to full Comparative Assessment
8	Rigid Pipelines (Surface Laid and Rock Covered)	All rigid pipelines that are surface laid and rock covered.	Subject to full Comparative Assessment
9	Rigid Pipelines (Trenched and Buried)	All rigid pipelines that are trenched and buried.	Subject to full Comparative Assessment
10	Flexible Risers and Riser Umbilicals	All flexible riser and dynamic umbilicals.	Full Removal
11	Rigid Risers	All rigid risers.	Full Removal
12	Spools 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
13	Large Structures	The Underwater Manifold Centre (UMC) Template and all internals.	Full Removal
14	Structures	All subsea structures excluding the UMC Template.	Full Removal
15	Protection and Stabilisation	All protection, support and stabilisation materials such as mattresses and grout bags.	Full Removal
16	Blocked Rigid Pipeline (Trenched and Buried)	Hudson rigid pipeline with known blockage, trenched and buried.	Subject to full Comparative Assessment
17	In-Use Rigid Pipelines (Trenched and Partially Buried)	All rigid pipelines, trenched and partially buried.	Subject to full Comparative Assessment
18	Uncertain Integrity ^{Note 1} and Concrete Coated Rigid Pipelines (Trenched and Buried)	All disused rigid pipelines (trenched and buried) with uncertain integrity. Also includes concrete coated pipelines (trenched and buried) as the full removal options are consistent for both types of line.	Subject to full Comparative Assessment

Table 3.1 - Decommissioning Groups and Initial Decommissioning Recommendation

Notes

1. In this context, uncertain integrity refers to pipelines which lack sufficient inspection data to have confidence that a reverse installation (reverse reel / reverse S-lay) decommissioning option would be considered viable, and thus, cut and lift is the appropriate feasible full removal option.



3.2 Decommissioning Groups for Evaluation

In summary, the 11 decommissioning groups for the Northern North Sea 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 Pipe-in-Pipe Hybrids (Surface Laid and Exposed)
- Group 2 Trunk Lines (Partially Trenched and Buried)
- Group 3 Flexible Pipelines and Umbilicals (Trenched and Buried)
- Group 4 Flexible Pipelines and Umbilicals (Trenched and Rock Covered)
- Group 6 Rigid Pipelines (Surface Laid, Exposed and Non-Concrete Coated)
- Group 7 Rigid Pipelines (Surface Laid, Exposed and Concrete Coated)
- Group 8 Rigid Pipelines (Surface Laid and Rock Covered)
- Group 9 Rigid Pipelines (Trenched and Buried)
- Group 16 Blocked Rigid Pipeline (Trenched and Buried)
- Group 17 In-Use Rigid Pipelines (Trenched and Partially Buried)
- Group 18 Uncertain Integrity and Concrete Coated Rigid Pipelines (Trenched and Buried)

Given that there are 11 groups retained for evaluation, due to the limited time available for the assessment participants the scope of the CA Stakeholder Workshop focussed on the following five representative groups:

- Group 1 Pipe-in-Pipe Hybrids (Surface Laid and Exposed)
- Group 2 Trunk Lines (Partially Trenched and Buried)
- Group 3 Flexible Pipelines and Umbilicals (Trenched and Buried)
- Group 16 Blocked Rigid Pipeline (Trenched and Buried)
- Group 18 Uncertain Integrity and Concrete Coated Rigid Pipelines (Trenched and Buried)

These groups were selected to give a broad cross-section of the line types being considered under the Northern North Sea Subsea Infrastructure.

3.3 **Potential Residual Wax Deposits**

During the decommissioning preparation activities progressed since the original CA was conducted in 2021, the potential for wax deposits in various lines within various groups has been discussed with OPRED. As with all pipeline contents, flushing and cleaning operations will be executed to best environmental practices and outcomes as was factored into the original CA conducted. Where there is potential for increased levels of wax deposits remaining post-cleaning, the environmental impact of these deposits has been considered in the Wax Discharge Assessment ref. [16]. No increase to the legacy impact considered during the original CA has been identified and therefore no amendments to the conclusions within this CA are required.



4 GROUP 1 – PIPE-IN-PIPE HYBRIDS (SURFACE LAID AND EXPOSED)

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
PL167 (N1208)	Oil Pipe-in-Pipe Hybrid – East [1] – from UMC to Cormorant A	26	3.345
PL167 (N1208)	Oil Pipe-in-Pipe Hybrid - East [2] – from UMC to Cormorant A	26	3.345
PL210 (N1209)	Oil Pipe-in-Pipe Hybrid - West [1] – from UMC to Cormorant A	26	3.343
PL210 (N1209)	Oil Pipe-in-Pipe Hybrid - West [2] – from UMC to Cormorant A	26	3.343
PL168 (N1207)	Oil Pipe-in-Pipe Hybrid – from UMC to Cormorant A	24	3.345
PL168 (N1207)	Oil Pipe-in-Pipe Hybrid – from UMC to Cormorant A	24	3.345
PL168 (N1207) Table 4.1 - Group		24	3.345

Refer to Appendix N for details of the Pipe in Pipe Hybrid components and appurtenances.

There are no crossings associated with this group.

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. [4] and summarised in Table 4.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipeline / umbilicals in-situ for use in any potential new developments	The integrity of (PL167 and PL210 in this group is unknown and this rules out re-use opportunities. The integrity of PL168 is known to be good, however a review of potential reuse options has indicated that there are no viable reuse options in this location. Option screened out as a technical showstopper on that basis.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2A – Cut and Lift with De-burial	Pipelines / umbilicals will be disconnected De-burial of pipelines / umbilicals using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as attractive in one, acceptable in two and unattractive in two criteria. Retained for evaluation as the most viable full removal option.
	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines / umbilicals will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Carrier pipe for these Pipe-in-Pipe Hybrid lines never designed for reverse reeling / reverse s-lay. Strength / integrity not expected to support reverse installation. Lines were tow installed and are not considered structurally suitable for catenary recovery. Option screened out as a technical showstopper on that basis.
	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines / umbilicals using MFE (if buried)	Not applicable option as lines are surface laid therefore no de-burial is needed making option same as 2B.
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected Surface laid line so no de-burial required Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Re-float of Pipe-in-Pipe Hybrid has never been done before. Considered highly novel and potentially a technical showstopper from an integrity of carrier pipe for re-float / tow purposes. Option screened out as a technical showstopper on that basis.
	2E – Cut, Float & Transport	Pipelines will be disconnected Surface laid line so no de-burial required Cut into 50m sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Various technical challenges such as the cutting of the lines, lifting / dropped object of the lines, line cleanliness / integrity of carrier pipe / towing over infrastructure. No significant benefits of this option over Option 2A – Cut and Lift. Option screened out as a technical showstopper on that basis.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines / umbilicals will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines / umbilicals	Assessed as attractive in one, acceptable in one and unattractive in three criteria. This is due to the impact of the high / long rock berm introduced and the large quantity / impact of rock required for this option. This is sufficient for option to be screened out on a cumulative basis.
	3B – Retrench and Bury entire line	Pipelines / umbilicals will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines / umbilicals No introduction of new material	Assessed as attractive in two and acceptable in three criteria. Trench and bury is believed to be achievable to the depth required for these lines. Retained for evaluation against other remaining options.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cuts ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in four and acceptable in one criterion. These are large diameter, surface laid lines so only spans would be considered a problem area as, by definition, surface laid lines are fully exposed. Retained for evaluation against other remaining options.
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Not applicable option as trenching only spans / exposed areas of surface laid lines not viable – rock cover or removal of problem areas is considered more applicable.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as acceptable in four and attractive in one criteria. These are large diameter, surface laid lines so only spans would be a considered a problem area as, by definition, surface laid lines are fully exposed. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4D – Accelerated Decomposition	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Accelerated Decomposition not proven technology for any lines at this stage. The technical challenges that may be associated with using novel / un-proven approach for Pipe-in-Pipe Hybrid lines likely to be even greater than for traditional rigid line. Option screened out as a technical showstopper on that basis.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Removing ends of these surface laid pipe-in-pipe hybrid lines offers little benefit given the remainder of the lines will remain in-situ. Option screened out as a technical showstopper on that basis. ^{Note 1}
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the ends of the surface laid lines once their structures have been removed. Option screened out as a safety showstopper on that basis.

Table 4.2 - Group 1 Decommissioning Options & Screening Summary

Note 1: During the original screening activity, Option 5 was considered a viable option, however additional information was identified during the preparation phase which subsequently resulted in this option being screened out.

4.3 Group 1 Decommissioning Options for Evaluation

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

- Full Removal
 - 2A Cut and Lift with De-burial
- Leave In-situ (Major intervention)
 - 3B Trench and Bury entire line
- Leave In-situ (Minor intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial

4.4 Group 1 Evaluation Summary

GROUP 1 – PIPE-IN-PIPE HYBRIDS (SURFACE LAID AND EXPOSED) (See Section 15.1 for detailed discussion and Appendix C for full attributes table and assessment)

Option 3B is assessed as being preferred from a Safety perspective.

All partial removal options are equally preferred over Option 2A (full removal) against the Operations Personnel criterion due to the lower offshore and onshore scopes with the partial removal options.

All partial removal options are equally preferred over Option 2A (full removal) against the Other Users criterion due to the full removal option having a higher number of vessel days of operations and a higher number of transits to / from the field.

Option 3B (trench entirety of lines) and Option 4A (rock placement over problem areas) are equally preferred over Option 4C (remove problem areas) and Option 2A (full removal) against the High Consequence Events criterion due to the potential for high consequence events from dropped object associated with the high number of offshore lifting operations in Option 4C (remove problem areas) and the much higher number of offshore lifting operations in Option 2A (full removal by cut and lift).

Option 2A (full removal) is preferred from a legacy risk perspective, marginally over Option 3B (trench entirety of lines) as both options present a clear seabed although the lines remain in-situ in Option 3B. There was stronger preference for Option 2A over the other options as the lines remain in-situ and surface laid in those options.

Option 2A is assessed as being preferred from an Environment perspective.

All partial removal options are equally preferred over Option 2A (full removal) against the Operational Marine Impact criterion due to the marginally higher noise impact from the longer duration of vessels on-site and cutting operations in the full removal option. There is additional impact from the discharges of pipeline contents and loss of insulation material at all cut locations in the full removal option.

All partial removal options are also equally preferred over Option 2A (full removal) against the Atmospheric Emissions & Fuel Use criterion due to the full removal option generating around 3 to 4 times higher atmospheric emissions than the other options.

The full removal option is marginally preferred over the other options against the Other Consumptions criterion. This is due to the lower lifecycle environmental impact from recycling the returned material in the full removal option when compared to the impact of replacing material left in-situ in the partial removal options.

The full removal option is also marginally preferred over the other options against the Seabed Disturbance criterion. This is due to the cut and lift of these surface laid lines having negligible seabed disturbance versus significant area of temporary impact in Option 3B (trenching entirety of lines) or the smaller area of permanent habitat change from the introduction of rock cover in the other options.

The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective. This is due to there being no legacy environmental impact from the full removal of these lines versus a small impact associated with the slow discharge of line contents / degradation products with the partial removal options as the lines remain in-situ.

Option 4A is assessed as being preferred from a Technical perspective.

Technical

Environment

Safety

All options employ relatively routine operations for their execution, however the simple and smaller scope associated with the rock cover operations in Option 4A are considered to carry the least technical risk of the options. Option 3B (trench entirety of lines) has potential for technical challenges associated with the geotechnical conditions in the area and trenching of lines with these diameters. Option 2A (full removal) has challenges associated with the stability of lift / retention of the pipe-in-pipe hybrid internals during recovery operations although the 'crimping' effect of the hydraulic shears on the carrier pipe are expected to mitigate this. Option 4C has similar challenges but is on a much smaller scale than full removal as only problem areas are recovered in this option.



				IRFACE LAID AND EX x C for full attributes ta	
Societal	Option 2A is assessed as being preferred from a Societal perspective. The full removal option is preferred from a Societal – Fishing perspective as the lines are fully removed versus the line remaining in-situ in the other options. There is also a small preference for the full removal option from Societal – Other Users perspective due to a combination of the quantity of useful, recyclable material (steel) returned and the job creation / retention offered by the larger scope in this option. It is noted that extraction of the useful steel from the insulation material on these pip in-pipe hybrids could be challenging.				
Economic	Option 4A and Option 4C are assessed as being equally preferred from an Economic perspective. There is a preference for Option 4A and Option 4C over the other options from a Short-term Costs perspective as t cost to deliver these options is lower than the Option 3B and much lower than Option 2A. All options are equally preferred from a Long-term Costs perspective as, while there are no costs associated with Option 2A, the costs associated with survey and monitoring of lines left in-situ are relatively low.				
	are modest. There is a significant preference the stability of lift / ret in Option 2A.	a stronger prefe over the full rer ention of intern criterion is includ	erence for the full remov moval option against the als when recovering aro ded, the small preferenc	al option against the Soci Technical Risk criterion c und 20 km of pipe-in-pip	ntal criteria, these preferences ietal criterion. Option 4A gets a lue to the concerns surrounding he hybrid lines in short sections chened and hence Option 4A is
	the emerging recomm	∎ 1. Safet	Group 1: Pi	pe-in-Pipe Hybric	ls
Summary	the emerging recomm 30.0% 25.0% 24.2 30.0% 7.1 15.0% 30.0% 7.1 7.1 30.0% 7.10% 7	∎1. Safetı	Group 1: Pi		ls
Summary	the emerging recomm 30.0% 25.0% 24.2 3. 20.0% 7. 15.0% 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3.	■ 1. Safety % 5%	Group 1: Pi y 2. Environmental 23.8% 4.6% 5.6%	annical 4. Societal 5. Econo 27.5% 5.9% 3.5%	ds mic 24.5% 5.9% 3.5%

Table 4.3 - Group 1 Evaluation Summary

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5 GROUP 2 – TRUNK LINES (PARTIALLY TRENCHED AND BURIED)

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	
PL4	Oil Pipeline from ESDV on Cormorant Alpha to landfall on Shetland.	36	153.3	
Table 5.1 - Group 2 Items				

In accordance with North Sea Transition Authority's (NSTA) decommissioning strategy, TAQA has considered whether there are any alternative uses (repurposing) for the PL4 pipeline prior to decommissioning. Findings of this assessment are documented within a technical note, 'PL4 Trunk Line Re-Use Assessment', ref. [14]. In summary, there were no re-use or re-purposing options identified. However, TAQA propose to maintain the integrity of the line post cessation of production such that future re-use or re-purposing options are not excluded.

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. [4] and summarised in Table 5.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipeline in-situ for use in any potential new developments	The integrity of the single trunk line (PL4) in this group is known to be good. A review of potential reuse options has indicated that there are no viable reuse options in this location, Ref [14]. Option screened out as a Technical Showstopper on that basis. ^{Note 1}
Full Removal	2A – Cut and Lift with De-burial	Pipeline will be disconnected De-burial of pipelines / umbilicals using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as acceptable in two and unattractive in three criteria. Retained for evaluation as the most viable full removal option.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipeline will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as acceptable in two and unattractive in three criteria. Significant concerns surrounding the ability to remove this line using reverse installation (s-lay) techniques, with the concrete coating likely to present significant challenges. Option screened out as a technical showstopper on that basis.
Full Removal	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines / umbilicals using MFE (if buried)	Assessed as acceptable in two and unattractive in three criteria. Significant concerns surrounding the ability to remove this line using reverse installation (s-lay) techniques, with the concrete coating likely to present significant challenges. Option screened out as a technical showstopper on that basis.
	2D – Reverse Installation (Buoyancy)	Pipeline will be disconnected Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as this line does not lend itself to reverse installation using buoyancy techniques.
	2E – Cut, Float & Transport	Pipeline will be disconnected Cut into 50m sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as this line does not lend itself to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipeline will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines / umbilicals	Assessed as attractive in one, acceptable in one and unattractive in three criteria. This is due to the impact of the high / extremely long rock berm introduced, and the extremely large quantity / impact of rock required for this option. This is sufficient for option to be screened out.
	3B – Retrench and Bury entire line	Pipeline will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines / umbilicals No introduction of new material	The original design basis for the installation of this line was for it to be trenched. This has been achieved in some areas but was unsuccessful in others. The likelihood of being able to successfully trench the line is consequently very low. Option screened out as a Technical Showstopper on that basis.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in four and acceptable in one criterion. Retained for evaluation against other remaining options.
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Not applicable option as trenching only spans / exposed areas of the line, where trenching has been attempted in the past and has been unsuccessful, is not viable – rock cover or removal of problem areas is considered more applicable.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as acceptable in three and attractive in two criteria. Retained for evaluation against other remaining options.
	4D – Accelerated Decomposition	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable decommissioning option for concrete coated lines as the coating would be left in-situ.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the presence of reportable spans along the line. Option screened out as a safety showstopper on that basis
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the subsea line end and presence of reportable spans along the line. Option screened out as a safety showstopper on that basis.

Table 5.2 - Group 2 Decommissioning Options and Screening Summary



Note 1: While there are no re-use options identified for the trunk line in Group 2 (PL4) at this stage [14], it is recognised that the general discussion around re-use of trunk lines is progressing. As such, a commitment is made to ensure that the chosen decommissioning solution for PL4 will not preclude any potential future re-use options.

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
 - 2A Cut and Lift with De-burial
- Leave In-situ (Minor intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial

5.4 Group 2 Evaluation Summary

GROUP 2 – TRUNK LINES (PARTIALLY TRENCHED AND BURIED) (See Section 15.2 for detailed discussion and Appendix D for full attributes table and assessment)

Option 4A is assessed as being preferred from a Safety perspective.

Option 4A (rock placement over problem areas) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes and lower risk operations associated with this option. The full removal option was least preferred due to the risk exposure associated with recovering 153 km of line by cut and lift.

Option 4A is also preferred against the Other Users criterion due to it having the fewest number of vessel days of operations and transits to / from the field of the options. Again, the full removal option was least preferred due to the much higher number of vessel days / transits associated with the large full removal scope.

Option 4A is also preferred against the High Consequence Events criterion due to there being no offshore lifting in Option 4A versus hundreds of offshore lifts in Option 4C to recover the problem areas and thousands of offshore lifts in Option 2A to fully recover the line.

Option 2A (full removal) is preferred from a legacy risk perspective as the line is fully removed versus remaining in-situ in the other options.

Option 4C is assessed as being preferred from an Environment perspective.

Option 4A is preferred against the Operational Marine Impact criterion as Option 4C has a higher noise impact from the longer duration of vessels on-site and cutting operations with Option 2A (full removal) being significantly higher again. This relative preference is magnified due to the potential impact on marine mammals and seal haul out area in nearshore location of the trunk line.

Option 4A is also preferred against the Atmospheric Emissions & Fuel Use criterion due to the full removal option generating around 16 times more atmospheric emissions than Option 4A.

Option 2A is preferred against the Other Consumptions criterion as no rock cover is required versus the moderate quantity of rock required in Option 4C and the significantly higher quantity of rock required in Option 4A.

Option 4C is preferred over the other options against the Seabed Disturbance criterion. This is due to the smaller area impacted by rock cover (permanent habitat change) in Option 4C, of which around 10% would be located in the East Mainland Coast Shetland SPA, over Option 4A.

The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective. This is due to there being no legacy environmental impact from the full removal of this line versus a small impact associated with the slow discharge of line contents / degradation products with the partial removal options as the line remains in-situ.

Option 4A is assessed as being preferred from a Technical perspective.

All options employ relatively routine operations for their execution, however the simple and smaller scope associated with the rock cover operations in Option 4A are considered to carry the least technical risk of the options. Option 2A (full removal) has challenges associated with the scale of the operations required to de-bury (where required) and cut and lift sections of this 153 km line. Option 4C has similar operations to Option 2A but is on a much smaller scale than full removal as only problem areas are recovered in this option.

Options 2A is assessed as being preferred from a Societal perspective.

NHT rer The Cretal

Technical

Safety

Environment

The full removal option is preferred from a Societal – Fishing perspective as the line is fully removed versus the line remaining in-situ in the other options.

There is a small preference for the partial removal options from a Societal – Other Users perspective despite the job creation / retention offered by the large scope and the large quantity of useful and recyclable steel associated with the full removal option. This is due to the detrimental impact from the large quantity of seawater contaminated concrete coating returned under the full removal option as it is likely to take up limited landfill capacity.





GROUP 2 – TRUNK LINES (PARTIALLY TRENCHED AND BURIED)

Table 5.3 - Group 2 Evaluation Summary



6 GROUP 3 – FLEXIBLE PIPELINES AND UMBILICALS (TRENCHED AND BURIED)

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
PL118 (N0701)	Oil 2 – TFL from Well P1 to Cormorant A	3	5.600
PL118 (N0702)	Oil 1 – TFL from Well P1 to Cormorant A	3	5.600
PL1558 (N0927)	Water Injection Pipeline from UMC to Well W4	6	3.537
PL169 (N0803)	Umbilical – East from Cormorant A to UMC	3	7.669
PL169 (N0804)	Umbilical – West from Well P1 to Cormorant A	3	7.962
PL308/PL309 (N0805)	Umbilical from UMC to Well P5	10	3.300
PLU6227 (N0806)	Umbilical from UMC to Well W4	10	3.845
PL1165 (N0874)	Replacement Umbilical Cormorant A to UMC	112 mm	7.200
PL1088/89/90 (N0843)	Control Umbilical from Cormorant A to Pelican	136 mm	8.542
PLU1944 (N1862)	Replacement Control Umbilical Cormorant A to Pelican	4	8.434
PL3815 (N0809)	Power Cable from North Cormorant to Eider	4	13.110
PLU1870 (T0127)	Control Umbilical from Eider to Otter	162 mm	21.000
PL4438 (T0126)	Power Cable (MPP Supply) from Eider to Otter	91 mm	21.600
PL4439	Power Cable (MPP Supply) from Eider to Otter	91 mm	21.600
PL4440	Power Cable (Manifold Supply) from Eider to Otter	91 mm	21.600
PLU3575 (N1869)	Control Umbilical from Tern to Cladhan	144 mm	16.600
PL1851 (N0791)	Oil Flexible Pipeline from Kestrel P1 to SSIV	8.5	7.796
PL1852 (N1128)	Gas Lift Flexible Pipeline from Tern to Kestrel	4	7.737
PLU1854 (N1827)	Umbilical from Tern to Kestrel P2	8.5	7.900
PL1023 Note 1	Hudson Main Umbilical from Tern to Hudson Manifold	N/A	11.000

Table 6.1 - Group 3 Items

Notes:

1. Includes PL1023.15, PL1023.16, PL1023.17, PL1023.20, PL1023.21, PL1023.22, PL1023.23, PL1023.24 and sections of PL1023.1 – 14, PL1023.18, PL1023.19, PL1023.26, PL1023.27, PL1023.28, PL1023.29, PL1023.30 and PL1023.31 that run between Tern Platform and the Hudson Manifold.



There are 119 crossings associated with this group, 72 under and 44 over. Where crossings under existing infrastructure are encountered an allowance to cut either side of the crossing and re-initiate reeling operations has been included within the supporting calculations for the full removal option, Ref. [8]. For over crossings, the lines shall be fully removed (in the full removal option).

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. [4] and summarised in Table 6.2 below.

Q2 2024 Update: In the original screening phase, the retained option for full removal of the equipment in this group was Option 2B – Reverse Installation (S-lay or Reel) without De-burial. Upon engagement with decommissioning contractors in 2024, full removal of the equipment in this group was considered not feasible as detailed in a Technical Note ref. [15]. The full removal methodology was changed to Option 2A – Cut and Lift with De-burial accordingly. The screening outcome described in Table 6.2 has been updated and a revised evaluation conducted as presented in Section 6.4.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipeline / umbilicals in-situ for use in any potential new developments	While the integrity of the lines in this group is known to be good, a review of potential reuse options has indicated that there are no viable reuse options at any of these locations. Option screened out as a Technical Showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipelines / umbilicals will be disconnected De-burial of pipelines / umbilicals using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Originally assessed as attractive in two, acceptable in one and unattractive in two criteria. An assessment of the feasibility of reverse reeling these lines was completed in Q2 2024 which concluded that reverse reeling was not feasible as detailed in a Technical Note ref. [15]. Option 2A retained for evaluation as the only viable full removal option.
	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines / umbilicals will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Originally assessed as attractive in two and acceptable in three criteria. Screened out due to findings of a Technical Note ref. [15].



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines / umbilicals using MFE (if buried)	Originally assessed as attractive in two and acceptable in three criteria. Screened out due to findings of a Technical Note ref. [15].
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected Surface laid line so no de-burial required Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to removal using buoyancy techniques.
	2E – Cut, Float & Transport	Pipelines will be disconnected Surface laid line so no de-burial required Cut into 50m sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines / umbilicals will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines / umbilicals	There are limited areas of spans / exposure or shallow burial on any of these lines and therefore there is no benefit in full rock cover. Option screened out as a technical showstopper on that basis.
	3B – Retrench and Bury entire line	Pipelines / umbilicals will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines / umbilicals No introduction of new material	There are limited areas of spans / exposure or shallow burial on any of these lines and therefore there is no benefit in full trench and bury. Option screened out as a technical showstopper on that basis.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Rock placement at all mid-line areas of spans, exposure and shallow burial depth	Assessed as attractive in four and acceptable in one criterion. There are limited areas of spans / exposure or shallow burial on any of these lines hence addressing just these areas by rock cover is a viable option. Retained for evaluation against other remaining options.
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury mid-line areas of spans, exposure and shallow burial depth Minimal introduction of new material	Assessed as attractive in two and acceptable in three criteria. There are limited areas of spans / exposure or shallow burial on any of these lines hence addressing just these areas by trenching is a viable option. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of mid-line areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as attractive in two and acceptable in three criteria. There are limited areas of spans / exposure or shallow burial on any of these lines hence addressing just these areas by removal is a viable option. Retained for evaluation against other remaining options.
	4D – Accelerated Decomposition	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable option due to the use of polymers and multiple layer construction method of the lines.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Assessed as attractive in four and acceptable in one criteria. There are limited areas of spans / exposure or shallow burial on any of these lines hence leaving these areas unaddressed considered a viable option. Retained for evaluation against other remaining options.
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their trench. Option screened out as a safety showstopper on that basis.

Table 6.2 - Group 3 Decommissioning Options and Screening Summary

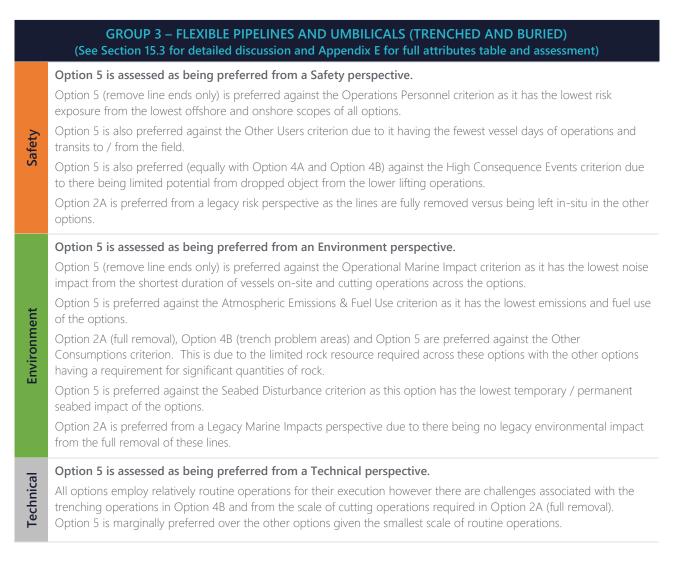


6.3 Group 3 Decommissioning Options for Evaluation

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

- Full Removal
 - 2A Cut and Lift with De-burial
- Leave In-situ (Minor intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4B Trench and Bury areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk

6.4 Group 3 Evaluation Summary





					RENCHED AND BL	
Societal	Option 2A The full rem remaining ir There is also combination	is assessed as b noval option is pre n-situ in the other o a small preferen	eing preferred from a eferred from a Societal options. Ice for the full removal of useful, recyclable ma	a Societal perspectiv – Fishing perspective option from Societal	/e.	emoved versus the lines tive due to a
Economic	There is a p significantly There is a sr	reference for Opt lower (minimum mall preference fo	of around 50% lower) or Option 2A over the	m Costs perspective a than any of the other other options from a	as the costs to deliver t	pective as there are no
	Safety, Envir these prefer Once the Ec	ronment and Tecl rences.	nical criteria. It being	less preferred agains	on 5 is preferred over t t the Societal criterion i mains and hence Optic	is insufficient to offset
	25.0%	Gr		Pipelines & U ntal = 3. Technical = 4. S		ched & Buried) 23.7%
nmary	25.0% 20.0%	Gr 17.7%			ocietal 5. Economic 18.5%	
Summary			 1. Safety 2. Environment 20.1% 	ntal = 3. Technical = 4. S 19.9% 3.5% 3.9%	ocietal 5. Economic	23.7%
Summary	20.0%	17.7% 3.5%	 1. Safety 2. Environment 20.1% 4.1% 3.4% 4.9% 	ntal = 3. Technical = 4. S 19.9% 3.5%	ocietal 5. Economic 18.5% 3.9%	23.7% 5.1% 3.0%
Summary	20.0% 15.0%	17.7% 3.5% 5.8%	 1. Safety 2. Environment 20.1% 4.1% 3.4% 	19.9% 3.5% 3.5%	000ietal 5. Economic 18.5% 3.9% 3.9%	5.1%





7 GROUP 4 – FLEXIBLE PIPELINES AND UMBILICALS (TRENCHED AND ROCK COVERED)

7.1 Group 4 Characteristics

The items that make up Group 4 and their key characteristics are listed in Table 7.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM	
PL2765 (N0793)	Production Flexible Flowline from Falcon to Kestrel P2 $^{\rm Note1}$	6	3.800	
PL2766 (N1129)	Gas Lift Flexible Flowline from Kestrel P2 to Falcon $^{\rm Note1}$	4	3.800	
PL2767 (N1864)	Control Umbilical from Kestrel P2 to Falcon Note 1	93 mm	3.800	
Table 7.1 - Group 4 Items				

Note 1: All three of these lines are laid in the same trench.

There are two crossings associated with these lines, both under. Where crossings under existing infrastructure are encountered an allowance to cut either side of the crossing and re-initiate reeling operations has been included within the supporting calculations, Ref. [8] for the full removal option.

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. [4] and summarised in Table 7.2 below.

Q2 2024 Update: In the original screening phase, the retained option for full removal of the equipment in this group was Option 2C – Reverse Installation (S-lay or Reel) with De-burial. Upon engagement with decommissioning contractors in 2024, full removal of the equipment in this group was considered not feasible as detailed in a Technical Note ref. [15]. The full removal methodology was changed to Option 2A – Cut and Lift with De-burial accordingly. The screening outcome described in Table 7.2 has been updated and the preferred option revised, based on the revised evaluation conducted for Group 3 as presented in Section 6.4.

there are no viable reuse options in this location. Option screened out as a Technical	CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Showstopper on that basis.	Re-use	1 – Re-use		group is known to be good, a review of potential reuse options has indicated that there are no viable reuse options in this location.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2A – Cut and Lift with De-burial	Pipelines / umbilicals will be disconnected De-burial of pipelines / umbilicals using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as attractive in two, acceptable in one and unattractive in two criteria. An assessment of the feasibility of reverse reeling these lines was completed in Q2 2024 which concluded that reverse reeling was not feasible as detailed in a Technical Note ref. [15]. Retained for evaluation as the only viable full removal option.
Full Removal	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines / umbilicals will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as attractive in two and acceptable in three criteria. Screened out due to findings reported in a Technical Note ref. [15].
	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines / umbilicals using MFE (if buried)	Assessed as attractive in two and acceptable in three criteria. Screened out due to findings reported in a Technical Note ref. [15].
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected De-burial of pipelines / umbilicals using MFE Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to removal using buoyancy techniques.
	2E – Cut, Float & Transport	Pipelines will be disconnected De-burial of pipelines / umbilicals using MFE Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines / umbilicals will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines / umbilicals	Not applicable option as these lines are already trenched and rock covered therefore there is no benefit in full rock cover.
	3B – Retrench and Bury entire line	Pipelines / umbilicals will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines / umbilicals No introduction of new material	Not applicable option as these lines are already trenched and rock covered therefore there is no benefit in full trench and bury.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in four and acceptable in one criterion. There are limited areas of spans / exposure or shallow burial on any of these lines hence addressing just these areas by rock cover is a viable option. Retained for evaluation against other remaining options.
Leave In-situ (Minor Intervention)	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Assessed as attractive in two and acceptable in three criteria. There are challenges associated with trenching lines already rock covered and alternative options would be selected. Option screened out as a technical showstopper on that basis.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as attractive in two and acceptable in three criteria. There are limited areas of spans / exposure or shallow burial on any of these lines hence addressing just these areas by removal is a viable option. Retained for evaluation against other remaining options.
	4D – Accelerated Decomposition	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable option due to the use of polymers and multiple layer construction method of the lines.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines / umbilicals will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Assessed as attractive in four and acceptable in one criterion. There are limited areas of spans / exposure or shallow burial on any of these lines hence leaving these areas unaddressed considered a viable option. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave As-is	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their trench. Option screened out as a safety showstopper on that basis.

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
 - 2A Cut and Lift with De-burial
- Leave In-situ (Minor Intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk

7.4 Group 4 Evaluation Summary

Given the similarity between the equipment in Group 3, where the flexible flowlines and umbilicals are trenched and buried and Group 4 where the flexible flowlines are trenched and rock covered, the outcome of the evaluation for Group 4 is in line with the outcome obtained during the evaluation of Group 3 as described in Section 6.4. On this basis, the preferred decommissioning option for Group 4 is Option 5, Remove Ends and Remediate Snag Risk. See also section 15.4 and Appendix F for further discussion.



8 GROUP 6 – RIGID PIPELINES (SURFACE LAID, EXPOSED AND NON-CONCRETE COATED)

8.1 Group 6 Characteristics

The items that make up Group 6 and their key characteristics are listed in Table 8.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PL1317 (N1002)	Water Injection Pipeline from Tern to Eider (Water Injection Tee)	16	16.104
Table 8.1 - Group 6	5 Items		

There are two crossings associated with this line, one under and one over. Where crossings under existing infrastructure are encountered an allowance to cut either side of the crossing and re-initiate reeling operations has been included within the supporting calculations, Ref. [8] for the full removal option.

8.2 Group 6 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. [4] and summarised in Table 8.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipeline in-situ for use in any potential new developments	While the integrity of the line in this group is known to be good, a review of potential reuse options has indicated that there are no viable reuse options in this location. Option screened out as a Technical Showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipeline will be disconnected De-burial of pipeline using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as attractive in three, and unattractive in two criteria. Option screened out as a more onerous full removal option than Option 2B.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipeline will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as attractive in three and acceptable in two criteria. Retained for evaluation as the most viable full removal option.
	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines / umbilicals using MFE (if buried)	Not applicable option as line is surface laid.
	2D – Reverse Installation (Buoyancy)	Pipeline will be disconnected Surface laid line so no de-burial required Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as this line does not lend itself to reverse installation using buoyancy techniques.
	2E – Cut, Float & Transport	Pipeline will be disconnected Surface laid line so no de-burial required Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as this line does not lend itself to recovery by floatation and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipeline will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipeline	Assessed as attractive in one, acceptable in two and unattractive in two criteria. This is due to the impact of the high / long rock berm introduced and the large quantity / impact of rock required for this option. This is sufficient for option to be screened out on a cumulative basis.
	3B – Retrench and Bury entire line	Pipeline will be disconnected Re-trench and backfill full length of pipeline to remove areas of spans, exposure & shallow burial depth No recovery of pipeline No introduction of new material	Assessed as attractive in two and acceptable in three criteria. Trench and bury is believed to be achievable to the depth required for this line. Retained for evaluation against other remaining options.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in three, acceptable in one and unattractive in one criterion. There are known areas of spanning on this line which would benefit from being addressed by rock cover. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Not applicable option as trenching only spans / exposed areas of surface laid lines not viable – rock cover or removal of problem areas is considered more applicable.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as attractive in three, acceptable in one and unattractive in one criterion. There are known areas of spanning on this line which would benefit from being addressed by removal. Retained for evaluation against other remaining options.
	4D – Accelerated Decomposition	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable option due to this line having a polymer liner.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the presence of known spans along the line. Option screened out as a safety showstopper on that basis
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the presence of known spans along the line and ends of the surface laid line once the structures have been removed. Option screened out as a safety showstopper on that basis.

Table 8.2 - Group 6 Decommissioning Options and Screening Summary



Group 6 Decommissioning Options for Evaluation 8.3

The decommissioning options for Group 6 remaining after screening and taken forward to evaluation are:

- Full Removal
 - 2B Reverse Installation (S-lay or Reel) without De-burial
- Leave In-situ (Major intervention)
 - 3B Trench and Bury entire line
- Leave In-situ (Minor intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial

Group 6 Evaluation Summary 8.4

	Group o Evaluation Summary
	GROUP 6 – RIGID PIPELINES (SURFACE LAID, EXPOSED AND NON-CONCRETE COATED) (See Section 0 for detailed discussion and Appendix G for full attributes table and assessment)
Safety	 Option 4A is assessed as being preferred from a Safety perspective. Option 4A (rock placement problem areas) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with this option. All options are equally preferred against the Other Users criterion as, while there are differences in the number of vessel days of operations and transits to / from the field across the options, these differences are insufficient to express a preference. Option 3B (trench entirety of line) and Option 4A are equally preferred against the High Consequence Events criterion due to there being limited potential from dropped object from the limited / no offshore lifting in these options. All
	other options have offshore lifting operations to varying degrees. Option 2B is preferred from a legacy risk perspective as the line is fully removed versus being left in-situ in the other options.
Environment	 Option 2B is assessed as being preferred from an Environment perspective. All options are equally preferred against the Operational Marine Impact criterion as the impact from all options is considered largely similar. All options are also equally preferred against the Atmospheric Emissions & Fuel Use criterion as, while there are differences in the atmospheric emissions generated across the options, these differences are insufficient to express a preference. All options are also equally preferred against the Other Consumptions criterion as, while there are differences in the impact from recycling returned material / replacing material left in-situ and the rock consumed across the options, these differences are insufficient to express a preference. Option 2B (full removal) is preferred against the Seabed Disturbance criterion as there is limited seabed disturbance from this surface laid line whereas all other options have varying degrees of temporary (from trenching) / permanent (from rock cover) seabed impact. Option 2B is also preferred from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of this line.
Technical	Option 4A and Option 4C are assessed as being equally preferred from a Technical perspective. Option 4A (rock placement over problem areas) and Option 4C (removal of problem areas by cut and lift) employ relatively routine operations for their execution, whereas there are challenges associated with reverse reeling a rigid line of this diameter and trenching a line with the prevailing geotechnical conditions and of this diameter.



	CDO					
	GROUP 6 – RIGID PIPELINES (SURFACE LAID, EXPOSED AND NON-CONCRETE COATED) (See Section 0 for detailed discussion and Appendix G for full attributes table and assessment)					
Societal	Option 2B is assessed as being preferred from a Societal perspective. Option 2B (full removal) is preferred from a Societal – Fishing perspective as the line is fully removed versus the line remaining in-situ in the other options. All options are equally preferred from a Societal – Other Users perspective as the societal impacts are considered largely similar across the options.					
Economic	Option 4A is assessed as being preferred from an Economic perspective. Option 4A (rock placement problem areas) is preferred from a Short-term Costs perspective as the costs to deliver this option is less than half the next least expensive option and significantly lower than the other options. All options are equally preferred from a Long-term Costs perspective as, while there are no costs associated with Option 2B, the costs associated with survey and monitoring of the line left in-situ are relatively low.					
	Overall Option 4A is the emerging recommendation. The outcome shows that the preference for Option 4A (rock placement over problem areas) is moderate. Option 4A is preferred over the other options against the Safety and Technical criteria. Option 4A is the least preferred option against the Environmental and Societal criteria where Option 2B (full removal) is most preferred, however there remains a preference for Option 4A overall. Once the Economics criterion is included, the preference for Option 4A is strengthened and hence Option 4A is the emerging recommendation for Group 6. Group 6: Rigid Pipelines (Surface Laid, Exposed and Non-concrete Coated)					
	30.0% —					
Summary	25.0% —	24.7%	24.6%	26.6%	24,1%	
Sum	20.0% —	4.7%	4.7%		5.0%	
	15.0%	6.9 %	5.0%	4.1%	4.1%	
		2.4%	4.2%	6.7%	6.7%	
	10.0% —	6.2%	4.9%	4.1%	4.7%	
	5.0% —	4.5%	5.8%	6.2%	3.6%	
	0.0% —					

Table 8.3 - Group 6 Evaluation Summary



9 GROUP 7 – RIGID PIPELINES (SURFACE LAID, EXPOSED AND CONCRETE COATED)

9.1 Group 7 Characteristics

The items that make up Group 7 and their key characteristics are listed in Table 9.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM		
PL113 (N0305)	Oil Pipeline from North Cormorant to Cormorant A	20	16.586		
PL477 (N0505)	Oil Pipeline from Tern to North Cormorant	16	12.597		
Table 9.1 - Group 7 Items					

There are five crossings associated with these lines, all over existing infrastructure and, as such, will be fully removed with an allowance to do so included within the supporting calculations, Ref. [8] for the full removal option.

9.2 Group 7 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. [4] and summarised in Table 9.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipelines in-situ for use in any potential new developments	While the integrity of the lines in this group are known to be good, a review of potential reuse options has indicated that there are no viable reuse options in this location. Option screened out as a Technical Showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipelines will be disconnected De-burial of pipelines using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as attractive in one, acceptable in two and unattractive in two criteria. Retained for evaluation as the most viable full removal option.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as attractive in one, acceptable in one and unattractive in three criteria. Significant concerns surrounding the ability to remove this line using reverse installation (S-lay) techniques, with the concrete coating likely to present significant challenges. This is sufficient for option to be screened out on a cumulative basis.
	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines using MFE (if buried)	Not applicable option as lines are surface laid.
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected Surface laid line so no de-burial required Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to reverse installation using buoyancy techniques.
	2E – Cut, Float & Transport	Pipelines will be disconnected Surface laid line so no de-burial required Cut into sections subsea (likely to be with diamond wire cutting) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to recovery by floatation and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines	Assessed as attractive in one, acceptable in two and unattractive in two criteria. This is due to the impact of the high / long rock berm introduced and the large quantity / impact of rock required for this option. This is sufficient for option to be screened out on a cumulative basis.
	3B – Retrench and Bury entire line	Pipelines will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines No introduction of new material	Assessed as attractive in two and acceptable in three criteria. Trench and bury is believed to be achievable to the depth required for these lines. Retained for evaluation against other remaining options.
Leave In-situ	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cuts ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in two, acceptable in two and unattractive in one criterion. There are known areas of spanning on these lines which would benefit from being addressed by rock cover. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Not applicable option as trenching only spans / exposed areas of surface laid lines not viable – rock cover or removal of problem areas is considered more applicable.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as attractive in three, acceptable in one and unattractive in one criterion. There are known areas of spanning on these lines which would benefit from being addressed by removal. Retained for evaluation against other remaining options.
	4D – Accelerated Decomposition	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable decommissioning option for concrete coated lines as the coating would be left in-situ.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the presence of known spans along the lines. Option screened out as a safety showstopper on that basis
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the presence of known spans along the lines and ends of the surface laid lines once the structures have been removed. Option screened out as a safety showstopper on that basis.

Table 9.2 - Group 7 Decommissioning Options and Screening Summary



9.3 Group 7 Decommissioning Options for Evaluation

The decommissioning options for Group 7 remaining after screening and taken forward to evaluation are:

- Full Removal
 - 2A Cut & Lift
- Leave In-situ (Major intervention)
 - 3B Trench and Bury entire line
- Leave In-situ (Minor intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial

9.4 Group 7 Evaluation Summary

GROUP 7 – RIGID PIPELINES (SURFACE LAID, EXPOSED AND CONCRETE COATED) (See Section 15.5.1 for detailed discussion and Appendix H for full attributes table and assessment)

Option 4A is assessed as being preferred from a Safety perspective.

Option 4A (rock placement over problem areas) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with this option.

All partial removal options are equally preferred over Option 2A (full removal) against the Other Users criterion due to the full removal option having a higher number of vessel days of operations and a higher number of transits to / from the field.

Option 3B (trench entirety of lines) and Option 4A are equally preferred against the High Consequence Events criterion due to there being limited potential from dropped object from the limited / no offshore lifting in these options. All other options have offshore lifting operations to varying degrees.

Option 2A is preferred from a legacy risk perspective as the lines are fully removed versus being left in-situ in the other options.

Option 2A is assessed as being preferred from an Environment perspective.

All partial removal options are equally preferred over Option 2A (full removal) against the Operational Marine Impact criterion due to the marginally higher noise impact from the longer duration of vessels on-site and cutting operations in the full removal option. There is additional impact from the discharges of pipeline contents at all cut locations in the full removal option.

All partial removal options are also equally preferred over Option 2A against the Atmospheric Emissions & Fuel Use criterion due to this option generating around 3 to 5 times higher atmospheric emissions than the other options.

The full removal option is marginally preferred over the other options against the Other Consumptions criterion due to the lower impact from recycling the returned material versus the impact of replacing material left in-situ in the partial removal options. Additionally, there is no rock resource required in Option 2A.

The full removal option is also preferred over the other options against the Seabed Disturbance criterion due to the cut and lift of these surface laid lines having negligible seabed disturbance whereas all other options have varying degrees of temporary (from trenching) / permanent (from rock cover) seabed impact.

The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of these lines.

Environment

Safety



	GROUP 7 – RIGID PIPELINES (SURFACE LAID, EXPOSED AND CONCRETE COATED)				
	(See Section 15.5.1 for detailed discussion and Appendix H for full attributes table and assessment)				
Technical	Option 4A and Option 4C are assessed as being equally preferred from a Technical perspective. Option 4A (rock placement over problem areas) and Option 4C (removal of problem areas by cut and lift) employ relatively routine operations for their execution, whereas there are challenges associated with the full removal of these lines with their aging concrete coating (spalling) on this scale (almost 30 km) or trenching lines of this diameter.				
Societal	Option 2A is assessed as being preferred from a Societal perspective. The full removal option is preferred from a Societal – Fishing perspective as the lines are fully removed versus the lines remaining in-situ in the other options. There is a small preference for the partial removal options from a Societal – Other Users perspective despite the job creation / retention offered by the large scope and the large quantity of useful and recyclable steel associated with the full removal option. This is due to the detrimental impact from the large quantity of seawater contaminated concrete coating returned under the full removal option as it is likely to take up limited landfill capacity.				
Economic	Option 4A is assessed as being preferred from an Economic perspective. Option 4A (rock placement problem areas) is preferred from a Short-term Costs perspective as the cost to deliver this option is almost a quarter of the next lowest cost option and significantly lower than the full removal option. All options are equally preferred from a Long-term Costs perspective as, while there are no costs associated with Option 2A, the costs associated with survey and monitoring of lines left in-situ are relatively low.				
Summary	Cverall Option 4A is the emerging recommendation. The outcome shows that the preference for Option 4A (rock placement over problem areas) is moderate. Option 4A is preferred over the other options against the Safety and Technical criteria. Option 4A is the least preferred option and Societal criteria where Option 2A (full removal) is most preferred, however there emains a preference for Option 4A overall. Once the Economics criterion is included, the preference for Option 4A is strengthened and hence Option 4A is the least preferred option 4A is the temerging recommendation for Group 7.				
	0.0%				

Table 9.3 - Group 7 Evaluation Summary

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10 GROUP 8 – RIGID PIPELINES (SURFACE LAID AND ROCK COVERED)

10.1 Group 8 Characteristics

The items that make up Group 8 and their key characteristics are listed in Table 10.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM		
PL114 (N0602)	Gas Pipeline from North Cormorant to Western Leg Tee	10	22.245		
Table 10.1 - Group 8 Items					

There are two crossings associated with these lines, both under. Where crossings under existing infrastructure are encountered an allowance to cut either side of the crossing and re-initiate reeling operations has been included within the supporting calculations, Ref. [8] for the full removal option.

10.2 Group 8 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse screening methodology. The assessment performed and the resultant outcomes are detailed fully in the CA Screening Report ref. [4] and summarised in Table 10.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipeline in-situ for use in any potential new developments	While the integrity of the line in this group is known to be good, a review of potential reuse options has indicated that there are no viable reuse options in this location. Option screened out as a Technical Showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipeline will be disconnected De-burial of pipelines using MFE Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as attractive in two, acceptable in one and unattractive in two criteria. Option screened out as a more onerous full removal option than Option 2C.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipeline will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Residual integrity to allow reverse installation (reel) through rock cover expected to be insufficient. Option screened out as a Technical Showstopper on that basis.
Full Removal	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines using MFE (if buried)	Assessed as attractive in one and acceptable in four criteria. Retained for evaluation as the most viable full removal option.
	2D – Reverse Installation (Buoyancy)	Pipeline will be disconnected De-burial of pipelines using MFE Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as the line does not lend itself to recovery using buoyancy techniques.
	2E – Cut, Float & Transport	Pipeline will be disconnected De-burial of pipelines using MFE Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as the line does not lend itself to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipeline will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines	Not applicable option as this line is already fully rock covered therefore there is no benefit in full rock cover.
	3B – Retrench and Bury entire line	Pipeline will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines No introduction of new material	Not applicable option as this line is already fully rock covered therefore there is no benefit in full trench and bury.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing cover Rock placement to remediate snag risk from cuts ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in one and acceptable in four criteria. There are limited areas of spans / exposure / areas of shallow burial hence rock cover to address these areas is justified. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing cover Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Not applicable option as trenching spans / exposures / areas of shallow burial of surface laid and rock covered lines not viable – rock cover or removal of problem areas is considered more applicable.
Leave In-situ (Minor Intervention)	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	There is insufficient areas of spans / exposure or shallow burial on any of these lines to justify removing the rock cover to remove problem areas. Option screened out as a technical showstopper on that basis.
	4D – Accelerated Decomposition	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Assessed as acceptable in four and unattractive in one criterion. Latest developments in accelerated decomposition still not sufficiently mature to be proposed as a viable decommissioning option. Option screened out as a technical showstopper due to insufficient maturity.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Assessed as attractive in four and acceptable in one criterion. There are limited areas of spans / exposure / areas of shallow burial hence leaving these areas unaddressed considered a viable option. Retained for evaluation against other remaining options.
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their rock cover. Option screened out as a safety showstopper on that basis.

Table 10.2 - Group 8 Decommissioning Options and Screening Summary



10.3 Group 8 Decommissioning Options for Evaluation

The decommissioning options for Group 8 remaining after screening and taken forward to evaluation are:

• Full Removal

Safety

Environment

Technical

- 2C Reverse Installation (S-lay or Reel) with De-burial
- Leave In-situ (Minor Intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk

10.4 Group 8 Evaluation Summary

GROUP 8 – RIGID PIPELINES (SURFACE LAID AND ROCK COVERED) (See Section 15.6.1 for detailed discussion and Appendix I for full attributes table and assessment)
Option 4A is assessed as being preferred from a Safety perspective.
Option 4A (rock placement problem areas) and Option 5 (remove line ends only) are equally preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with these options over Option 2C (full removal).
All options are equally preferred against the Other Users criterion as, while there are differences in the number of vessel days of operations and transits to / from the field across the options, these differences are insufficient to express a preference.
Option 4A and Option 5 are equally preferred against the High Consequence Events criterion due to the potential for residual torsion in the rigid line when offloading (reeling) to the quayside in Option 2C.
Option 2C is preferred from a legacy risk perspective as the line is fully removed versus being left in-situ in the other options.
Option 2C is assessed as being preferred from an Environment perspective.
All options are equally preferred against the Operational Marine Impact criterion as the impact from all options is considered largely similar.
All options are also equally preferred against the Atmospheric Emissions & Fuel Use criterion as, while there are differences in the atmospheric emissions generated across the options, these differences are insufficient to express a preference.
All options are also equally preferred against the Other Consumptions criterion as, while there are differences in the impact from recycling returned material / replacing material left in-situ and the rock consumed across the options, these differences are insufficient to express a preference.
Both partial removal options are equally preferred over the full removal option against the Seabed Disturbance criterion as the full removal option impacts a larger area of seabed during the de-burial operations to enable reverse reeling, the rock displaced represents a permanent impact. The area of permanent impact from the rock introduced in the other options is small and considered less significant.
The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of the line.
Option 4A and Option 5 are assessed as being equally preferred from a Technical perspective.
Option 4A (rock placement over problem areas) and Option 5 (removal of line ends only) employ relatively routine operations for their execution, whereas there are challenges associated with the de-burial and cut and lift of the line on this scale (over 22 km).



			ELINES (SURFACE LAID AND RO ussion and Appendix I for full attrib	•	
Societal	The full removal op remaining in-situ ir seabed	otion is preferred from a in the other options, altho ually preferred from a Soc	d from a Societal perspective. Societal – Fishing perspective as the lin rugh it is noted that displaced rock cove cietal – Other Users perspective as the s	er will remain on the surrounding	
Economic	Option 4A (rock pl costs to deliver the All options are equ	acement problem areas) ase options are similar an ually preferred from a Lor	being equally preferred from an Ec and Option 5 are equally preferred fro d lower than the full removal option. ng-term Costs perspective as, while the ponitoring of line left in-situ are relatively	m a Short-term Costs perspective as the re are no costs associated with Option	
	Overall Option 4A is the emerging recommendation. The outcome shows that the preference for Option 4A (rock placement over problem areas) is moderate. Option 4A is preferred over the other options against the Safety criterion, equally preferred (with Option 5) against the Technical criterion and only marginally less preferred (to Option 2C) against the Environmental criterion. Option 4A is less preferred (to Option 2C) against the Societal criteria however, there remains a preference for Option 4A overall. Once the Economics criterion is included, the preference for Option 4A is strengthened and hence Option 4A is the emerging recommendation for Group 8. Image: Strength Complexity of the strength option for Group 8. Image: Strength Complexity of the strength option for Group 8.				
Summary	40.0% 35.0% 30.0% 25.0% 20.0% 15.0% 10.0% 5.0%	30.2% 4.8% 7.6% 5.0% 6.7% 6.1%	35.4% 7.6% 6.6% 7.5% 6.6% 7.1%	34.4% 7.6% 5.8% 7.5% 6.6%	
	0.0% O2C - Full R		ith O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	

Table 10.3 - Group 8 Evaluation Summary



11 GROUP 9 – RIGID PIPELINES (TRENCHED AND BURIED)

11.1 Group 9 Characteristics

The items that make up Group 9 and their key characteristics are listed in Table 11.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PL1084 (N0740)	Oil Pipeline 1 from Pelican to Cormorant A	8	8.467
PL1085 (N0741)	Oil Pipeline 2 from Pelican to Cormorant A	8	8.338
PL1086 (N1121)	Gas Lift Pipeline from Cormorant A to Pelican	6	8.387
PL1087 (N0915)	Water Injection Pipeline from Cormorant A to Pelican	8	8.337
PL3572 (N0605)	Production Pipeline from Cladhan to Tern	10	16.800
PL3573 (N1149)	Gas Lift Pipeline from Tern to Cladhan (Piggybacked to PL3572)	4	16.866
PL3574 (N0942)	Water Injection Pipeline from Tern to Cladhan	10	16.600
PL1018/A	Production Pipeline from Hudson to Tern	10	10.167
PL1019/A	Production Pipeline from Hudson to Tern	10	10.150
PL1020/A	Production / Test Pipeline from Hudson to Tern	8	10.134
PL1025/A	L2 Production/Test Pipeline from Well L2 to Hudson Manifold	6	1.610

There are 19 crossings associated with this group. Where crossings under existing infrastructure are encountered an allowance to cut either side of the crossing and re-initiate reeling operations has been included within the supporting calculations, Ref. [8] for the full removal option.

11.2 Group 9 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. [4] and summarised in Table 11.2 below.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipelines in-situ for use in any potential new developments	While the integrity of the lines in this group are known to be good, a review of potential reuse options has indicated that there are no viable reuse options in this location. Option screened out as a Technical Showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipelines will be disconnected De-burial of pipelines using MFE Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as acceptable in three and unattractive in two criteria. Option screened out as a more onerous full removal option than Option 2C.
	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Residual integrity to allow reverse installation (reel) through cover expected to be insufficient. Option screened out as a Technical Showstopper on that basis.
	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines using MFE (if buried)	Assessed as attractive in one, acceptable in three and unattractive in one criterion. Retained for evaluation as the most viable full removal option.
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected De-burial of pipelines using MFE Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to recovery using buoyancy techniques.
	2E – Cut, Float & Transport	Pipelines will be disconnected De-burial of pipelines using MFE Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipelines	There are limited areas of spans / exposure or shallow burial on any of these lines and therefore there is no benefit in full rock cover. Option screened out as a technical showstopper on that basis.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Major Intervention)	3B – Retrench and Bury entire line	Pipelines will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipelines No introduction of new material	There are limited areas of spans / exposure or shallow burial on any of these lines and therefore there is no benefit in full trench and bury. Option screened out as a technical showstopper on that basis.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans, exposure and shallow burial depth	Assessed as attractive in four and acceptable in one criterion. There are limited areas of spans / exposure / areas of shallow burial hence rock cover to address these areas is justified. Retained for evaluation against other remaining options.
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	Assessed as attractive in three and acceptable in two criteria. There are limited areas of spans / exposure or shallow burial hence trench and bury of these areas is justified. Retained for evaluation against other remaining options.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as attractive in three and acceptable in two criteria. There are limited areas of spans / exposure or shallow burial hence removal of these areas is justified. Retained for evaluation against other remaining options.
Leave In-situ (Minor Intervention)	4D – Accelerated Decomposition	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Assessed as acceptable in four and unattractive in one criterion. Latest developments in accelerated decomposition still not sufficiently mature to be proposed as a viable decommissioning option. Option screened out as a technical showstopper due to insufficient maturity.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Assessed as attractive in three and acceptable in two criteria. There are limited areas of spans / exposure / areas of shallow burial hence leaving these areas unaddressed considered a viable option. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their trenches. Option screened out as a safety showstopper on that basis.

Table 11.2 - Group 9 Decommissioning Options and Screening Summary

11.3 Group 9 Decommissioning Options for Evaluation

The decommissioning options for Group 9 remaining after screening and taken forward to evaluation are:

• Full Removal

Safety

- 2C Reverse Installation (S-lay or Reel) with De-burial
- Leave In-situ (Minor Intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4B Trench and Bury areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk

11.4 Group 9 Evaluation Summary

GROUP 9 – RIGID PIPELINES (TRENCHED AND BURIED)

(See Section 15.7.1 for detailed discussion and Appendix J for full attributes table and assessment)

Option 4B is assessed as being preferred from a Safety perspective.

Option 5 (remove line ends only) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with this option.

All partial removal options are equally preferred over Option 2C (full removal) against the Other Users criterion due to the full removal option having a higher number of vessel days of operations and a higher number of transits to / from the field.

Option 2C, Option 4A, Option 4B, and Option 5 are equally preferred against the High Consequence Events criterion due Option 4C having more offshore lifting operations than the other options.

Option 2C is preferred from a legacy risk perspective as the lines are fully removed versus being left in-situ in the other options.



GROUP 9 – RIGID PIPELINES (TRENCHED AND BURIED) (See Section 15.7.1 for detailed discussion and Appendix J for full attributes table and assessment) Option 4B is assessed as being preferred from an Environment perspective. All partial removal options are equally preferred over Option 2C (full removal) against the Operational Marine Impact criterion due to the marginally higher noise impact from the longer duration of vessels on-site and cutting operations in the full removal option. There is additional impact from the discharges of pipeline contents at all cut locations in the full removal option. All partial removal options are also equally preferred over Option 2C against the Atmospheric Emissions & Fuel Use criterion due to this option generating more than double the atmospheric emissions of the other options. Options 2C, 4B, 4C and 5 are equally preferred. While there are differences in the impact associated with recycling material returned or generating replacement material for the lines left in-situ, these differences are insufficient to express a preference within these options. Option 4A is the least preferred option due to the greater quantity of rock required in this option. Option 4B (trenching problem areas) and Option 5 (remove line ends only) are equally preferred against the Seabed Disturbance criterion as they have the lowest area of temporary / permanent impact on the seabed. The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of the lines. Option 4A, Option 4C and Option 5 are assessed as being equally preferred from a Technical perspective. Option 4A (rock placement problem areas), Option 4C (removal of problem areas) and Option 5 (removal of line ends only) are equally preferred against the Technical criterion as, while all options employ relatively routine operations for their execution, there are greater technical challenges from the scale associated with the full removal of the lines (115 km) or successfully performing the trenching operations in Option 4B. Option 2C is assessed as being preferred from a Societal perspective. The full removal option is preferred from a Societal – Fishing perspective as the lines are fully removed versus the lines remaining in-situ in the other options. All options are equally preferred from a Societal – Other Users perspective as the societal impacts are considered largely similar across the options. Option 4A, Option 4B, Option 4C and Option 5 are assessed as being equally preferred from an Economic perspective. All options are equally preferred over the full removal option from a Short-term Costs perspective as the costs to deliver the full removal option is much higher than the other options. The differences in costs across the remaining options are considered insufficient to express a preference.

All options are equally preferred from a Long-term Costs perspective as, while there are no costs associated with Option 2C, the costs associated with survey and monitoring of line left in-situ are relatively low.

Environment

Technical

Societal

Economic



GROUP 9 – RIGID PIPELINES (TRENCHED AND BURIED) (See Section 15.7.1 for detailed discussion and Appendix J for full attributes table and assessment)

Overall Option 4C is the emerging recommendation.

The outcome shows that the preference for Option 4C (remove problem areas) is small. Option 4C is preferred over the other options against the Technical criteria. Option 4C is marginally less preferred to other options against the Safety, Environmental and Societal criteria however, there remains a preference for Option 4C overall.

Once the Economics criterion is included, the preference for Option 4C remains and hence Option 4C is the emerging recommendation for Group 9.

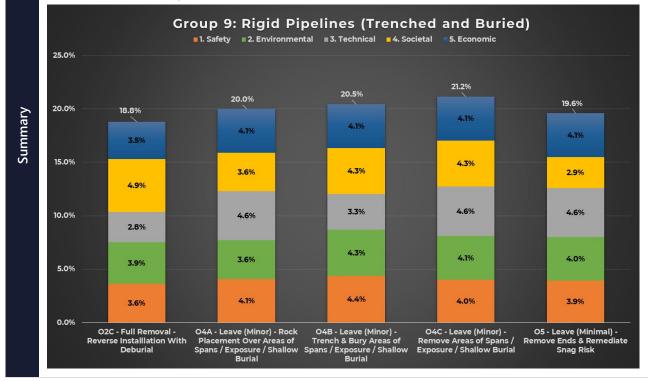


Table 11.3 - Group 9 Evaluation Summary



12 GROUP 16 – BLOCKED RIGID PIPELINE (TRENCHED AND BURIED)

12.1 Group 16 Characteristics

The items that make up Group 16 and their key characteristics are listed in Table 12.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM		
PL1024/A	L1 Production / Test Pipeline (Disused) from Well L1 to Hudson Manifold	6	1.631		
Table 12.1 - Group 16 Items					

A file note was produced, 'Memorandum Hudson L1 Pipeline Blockage', ref. [13], that describes the potential scenarios causing the blockage. TAQA plan to investigate the blockage during the 2023 offshore campaign.

There are no crossings associated with this line.

12.2 Group 16 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. [4] and summarised in Table 12.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipeline in-situ for use in any potential new developments	Field reviewed for any additional opportunities - review indicated that there are no opportunities as detailed in Hudson CoP Application. Option screened out as a technical showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipeline will be disconnected De-burial of pipeline using MFE Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire	Assessed as attractive in one, acceptable in three and unattractive in one criterion. Retained for evaluation as the most viable full removal option.



CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipeline will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as unattractive from a Safety and Technical perspective due to concerns regarding integrity of the lines to recover using reverse installation techniques. Option screened out as a less credible full removal option than Option 2A.
Full Removal	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipeline using MFE (if buried)	Assessed as unattractive from a Safety and Technical perspective due to concerns regarding integrity of the lines to recover using reverse installation techniques. Option screened out as a less credible full removal option than Option 2A.
	2D – Reverse Installation (Buoyancy)	Pipeline will be disconnected De-burial of pipeline using MFE Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to reverse installation using buoyancy techniques.
	2E – Cut, Float & Transport	Pipeline will be disconnected De-burial of pipeline using MFE Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipeline will be disconnected Rock placement over full length of pipeline / umbilical to address areas of spans, exposure & shallow burial No recovery of pipeline	As the line is fully trenched and buried to sufficient DoC there is no benefit in rock covering full length of the line. Option screened out as a technical showstopper accordingly.
	3B – Retrench and Bury entire line	Pipeline will be disconnected Re-trench and backfill full length of pipeline / umbilical to remove areas of spans, exposure & shallow burial depth No recovery of pipeline No introduction of new material	As the line is fully trenched and buried to sufficient DoC there is no benefit in trenching full length of the line. Option screened out as a technical showstopper accordingly.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cuts ends Rock placement at all areas of spans, exposure and shallow burial depth	As the line is fully trenched and buried to sufficient DoC there are no areas of spans, exposure or shallow burial to be addressed and this option becomes the same as Option 5. Option screened out as a technical showstopper accordingly.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	As the line is fully trenched and buried to sufficient DoC there are no areas of spans, exposure or shallow burial to be addressed and this option becomes the same as Option 5. Option screened out as a technical showstopper accordingly.
Leave In-situ (Minor Intervention)	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	As the line is fully trenched and buried to sufficient DoC there are no areas of spans, exposure or shallow burial to be addressed and this option becomes the same as Option 5. Option screened out as a technical showstopper accordingly.
	4D – Accelerated Decomposition	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable option as no benefit in exploring Accelerated Corrosion options for polymer coated lines.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipeline will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	This option has been assessed as being unattractive in one, acceptable in two and attractive in the remaining two criteria. As the line is fully trenched and buried to sufficient DoC there are no areas of spans, exposure or shallow burial to be addressed and removing the line ends only is a viable option. Retained for evaluation against other remaining options.
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their trenches. Option screened out as a safety showstopper on that basis.

 Table 12.2 - Group 16 Decommissioning Options and Screening Summary



12.3 Group 16 Decommissioning Options for Evaluation

The decommissioning options for Group 16 remaining after screening and taken forward to evaluation are:

- Full Removal
 - 2A Cut and Lift with De-burial
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk

12.4 Group 16 Evaluation Summary

	GROUP 16 – BLOCKED RIGID PIPELINE (TRENCHED AND BURIED) (See Section 15.8.1 for detailed discussion and Appendix K for full attributes table and assessment)
	Option 5 is assessed as being preferred from a Safety perspective.
	Option 5 (remove line ends only) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with this option.
Safety	Both options are equally preferred against the Other Users criterion as, while there are differences in the number of vessel days of operations and transits to / from the field across the options, these differences are insufficient to express a preference.
•	Option 5 is preferred against the High Consequence Events criterion due to there being lower potential from dropped object from the limited offshore lifting in Option 5.
	Option 2A is preferred from a legacy risk perspective as the line is fully removed versus being left in-situ in the other option.
	Option 5 is assessed as being preferred from an Environment perspective.
	Option 5 is preferred against the Operational Marine Impact criterion due to the discharge of contents from the blocked line associated with the full removal option.
ment	Both options are equally preferred against the Atmospheric Emissions & Fuel Use criterion as, while there are differences in the atmospheric emissions generated across the options, these differences are insufficient to express a preference.
Environment	Both options are also equally preferred against the Other Consumptions criterion due to the impact from recycling the returned material versus the impact of replacing material left in-situ being largely similar.
	Option 5 is preferred against the Seabed Disturbance criterion due to larger area of impact to de-burial of the line in the full removal option.
	The full removal option is preferred from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of the line.
اد	Option 2A and Option 5 are assessed as being equally preferred from a Technical perspective.
Technical	Both options are equally preferred against the Technical criterion as they both employ relatively routine operations for their execution. While there are greater challenges relating to the de-burial and recovery of the line, given the small scale (1.6 km) this is considered insufficient to express a preference.
	Option 2A and Option 5 are assessed as being equally preferred from a Societal perspective.
Societal	Both options are equally preferred from a Societal – Fishing perspective as, while the line is fully removed in Option 2A, it remains fully trenched and buried in Option 5 and thus presents a clear seabed in both options.
So	Both options are also equally preferred from a Societal – Other Users perspective as the societal impacts are considered largely similar across the options.





Table 12.3 - Group 16 Evaluation Summary



13 GROUP 17 – IN-USE RIGID PIPELINES (TRENCHED AND PARTIALLY BURIED)

13.1 Group 17 Characteristics

The items that make up Group 17 and their key characteristics are listed in Table 13.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM	
PL1022	Gas Lift Pipeline from Tern to Hudson Manifold	6	10.161	
PL1021/A	Water Injection Pipeline from Tern to Hudson Manifold	8	10.185	
Table 13.1 - Group 17 Items				

There are no crossings associated with this line.

13.2 Group 17 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. [4] and summarised in Table 13.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipelines in-situ for use in any potential new developments	Field reviewed for any additional opportunities - review indicated that there are no opportunities as detailed in Hudson CoP Application. Option screened out as a technical showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipelines will be disconnected De-burial of pipelines using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or diamond wire depending on diameter / coating type	Assessed as unattractive in one, acceptable in three and attractive in one criteria. Retained for evaluation as the most viable full removal option.
Full Removal	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as unattractive from a Safety and Technical perspective due to concerns regarding integrity of the lines to recover using reverse installation techniques. Option screened out as a less credible full removal option than Option 2A.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines using MFE (if buried)	Assessed as unattractive from a Safety and Technical perspective due to concerns regarding integrity of the lines to recover using reverse installation techniques. Option screened out as a less credible full removal option than Option 2A.
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected De-burial of pipelines using MFE Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to reverse installation using buoyancy techniques.
	2E – Cut, Float & Transport	Pipelines will be disconnected De-burial of pipelines using MFE Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines will be disconnected Rock placement over full length of pipeline to address areas of spans, exposure & shallow burial No recovery of pipelines	As the majority of the lines fail to meet the required DoC, rock cover over the entire length of the lines is a justifiable solution. Retained for evaluation against other remaining options.
	3B – Retrench and Bury entire line	Pipelines will be disconnected Re-trench and backfill full length of pipeline to remove areas of spans, exposure & shallow burial depth No recovery of pipelines No introduction of new material	As the majority of the lines fail to meet the required DoC, trench and bury along the entire length of the lines is a justifiable solution. Retained for evaluation against other remaining options.
Leave In-situ (Minor Intervention)	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cuts ends Rock placement at all areas of spans, exposure and shallow burial depth	As the majority of the lines fail to meet the required DoC, the entire length of the lines needs to be addressed and this option becomes the same as Option 3A. Option screened out as a technical showstopper accordingly.
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposure and shallow burial depth Minimal introduction of new material	As the majority of the lines fail to meet the required DoC, the entire length of the lines needs to be addressed and this option becomes the same as Option 3B. Option screened out as a technical showstopper accordingly.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	As the majority of the lines fail to meet the required DoC, the entire length of the lines needs to be addressed and this option becomes the same as the full removal options. Option screened out as a technical showstopper accordingly.
	4D – Accelerated Decomposition	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Not applicable option as no benefit in exploring Accelerated Corrosion options for polymer coated lines.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	While the majority of the lines fails to meet the required DoC, there are few areas of spans hence removing the line ends only is a viable option. This option has been assessed as being unattractive in one, acceptable in two and attractive in the remaining two criteria. Retained for evaluation against other remaining options.
Leave As-is and Monitor	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their trenches. Option screened out as a safety showstopper on that basis.

Table 13.2 - Group 17 Decommissioning Options and Screening Summary

13.3 Group 17 Decommissioning Options for Evaluation

The decommissioning options for Group 17 remaining after screening and taken forward to evaluation are:

- Full Removal
 - 2A Cut & Lift
- Leave In-situ (Major intervention)
 - 3A Rock Cover entire line
 - 3B Trench and Bury entire line
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk

13.4 Group 17 Evaluation Summary

	GROUP 17 – IN-USE RIGID PIPELINES (TRENCHED AND PARTIALLY BURIED) (See Section 15.9.1 for detailed discussion and Appendix L for full attributes table and assessment)
	Option 3B is assessed as being preferred from a Safety perspective.Option 3B (trench entirety of lines) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with this option.Option 3B and Option 5 are equally preferred against the Other Users criterion due to these options having a lower
Safety	number of vessel days of operations and transits to / from the field. Option 3A (rock cover entirety of line) and Option 3B (trench entirety of lines) are equally preferred against the High Consequence Events criterion due to there being limited potential from dropped object from the limited / no offshore lifting in these options. All other options have offshore lifting operations to varying degrees. Option 2A is preferred from a legacy risk perspective as the lines are fully removed versus being left in-situ in the other
	Option 5 is assessed as being preferred from an Environment perspective.
t	All partial removal options are equally preferred over Option 2A (full removal) against the Operational Marine Impact criterion due to the marginally higher noise impact from the longer duration of vessels on-site and cutting operations in the full removal option. There is additional impact from the discharges of pipeline contents at all cut locations in the full removal option.
Environment	All partial removal options are also equally preferred over Option 2A against the Atmospheric Emissions & Fuel Use criterion due to this option generating around 2 to 3 times higher atmospheric emissions than the other options. Option 3A is less preferred to the other options against the Other Consumptions criterion due to the large quantity of rock resource required in Option 3A.
	Option 5 is preferred against the Seabed Disturbance criterion due the small area of impact versus all other options which have varying degrees of temporary (from trenching or de-burial) / permanent (from rock cover) seabed impact. The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of these lines.
Technical	Option 3A, Option 3B and Option 5 are assessed as being equally preferred from a Technical perspective. Option 2A (full removal) is less preferred than the other options against the Technical criterion as, while all options employ relatively routine operations for their execution, there are challenges associated with the de-burial and cut and lift of the lines on this scale (over 20 km).
Societal	Option 2A is assessed as being preferred from a Societal perspective. The full removal option is preferred from a Societal – Fishing perspective as the lines are fully removed versus the lines remaining in-situ in the other options. All options are equally preferred from a Societal – Other Users perspective as the societal impacts are considered largely similar across the options.
Economic	Option 3B and Option 5 are assessed as being equally preferred from an Economic perspective. Option 3B and Option 5 are equally preferred from a Short-term Costs perspective as the cost to deliver these options are similar and much lower than the other options. All options are equally preferred from a Long-term Costs perspective as, while there are no costs associated with Option 2A, the costs associated with survey and monitoring of lines left in-situ are relatively low.



GROUP 17 – IN-USE RIGID PIPELINES (TRENCHED AND PARTIALLY BURIED) (See Section 15.9.1 for detailed discussion and Appendix L for full attributes table and assessment)

Overall Option 3B is the emerging recommendation.

The outcome shows that the preference for Option 3B (trench entirety of lines) is moderate. Option 3B is preferred against the Safety and Technical criteria and marginally less preferred (to Option 5) against the Environmental criterion. Option 3B is less preferred against the Societal criterion however, there remains a preference for Option 3B overall. Once the Economics criterion is included, the preference for Option 3B remains and hence Option 3B is the emerging recommendation for Group 17.

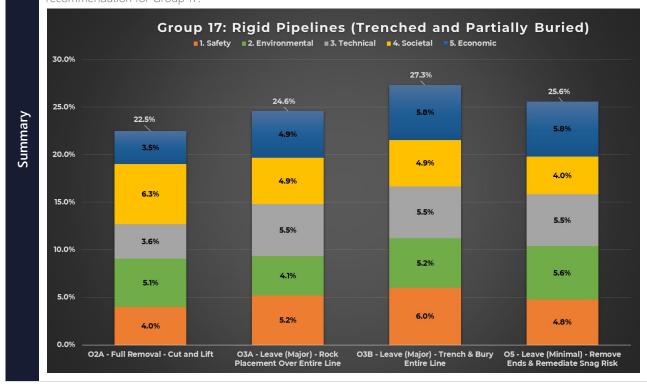


Table 13.3 - Group 17 Evaluation Summary



14 GROUP 18 – UNCERTAIN INTEGRITY AND CONCRETE COATED RIGID PIPELINES (TRENCHED AND BURIED)

14.1 Group 18 Characteristics

The items that make up Group 18 and their key characteristics are listed in Table 14.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PL1022.1	L1 Gas Lift Pipeline (piggybacked to PL1024) from Well L1 to Hudson Manifold	2	1.641
PL1022.2	L2 Gas Lift Pipeline (piggybacked to PL1025) from Well L2 to Hudson Manifold	2	1.761
PL1018	Production Pipeline (disused) from Hudson Manifold to Tern	10	10.410
PL1019	Production Pipeline (disused) from Hudson Manifold to Tern	10	10.410
PL1020	Production/Test Pipeline (disused) from Hudson Manifold to Tern	8	10.410
PL1024	L1 Production/Test Pipeline (disused) from Well L1 to Hudson Manifold	8	1.761
PL1025	L2 Production/Test Pipeline (disused) from Well L2 to Hudson Manifold	8	1.761
PL1021	Water Injection Pipeline (disused) from Tern to Hudson Manifold	8	10.410
PL475 (N0506)	Oil Pipeline from Eider (Oil Production Tee) to North Cormorant	12	13.145
PL476 (N1001)	Water Injection Pipeline – Disused from Tern to Eider	12	16.400
PL478 (N0604)	Gas Pipeline from North Cormorant to Tern	8	13.000
PL304 (N0902)	2 x Well Injection Flowlines from UMC to Well W4	3	3.524
PL305 (N0903)	2 x Well Injection Flowlines from UMC to Well W4	3	3.524
PL306 (N0707)	Oil – TFL from Well P5 to UMC	3	3.142
PL307 (N0708)	Oil – TFL from Well P5 to UMC	3	3.100
PL184 (N0901)	Water Injection Pipeline – New from Cormorant A to UMC	8	7.700
PL184 (N0930)	Water Injection Pipeline – Old from Cormorant A to UMC	8	7.500
PL3132 (T0129)	Water Injection Pipeline from Eider (Oil Production Tee) to Otter	10	21.100
PL1869 (T0124)	Water Injection Pipeline from Eider to Otter	10	21.100



Table 14.1 - Group 18 Items

There are 19 crossings associated with this group. Where crossings under existing infrastructure are encountered a clearance either side of the crossing has been included within the supporting calculations, Ref. [8] for the full removal option.

14.2 Group 18 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. [4] and summarised in Table 14.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Re-use	1 – Re-use	Leave pipelines in-situ for use in any potential new developments	A review of potential reuse options has indicated that there are no viable reuse options in these locations. Option screened out as a Technical Showstopper on that basis.
Full Removal	2A – Cut and Lift with De-burial	Pipelines will be disconnected De-burial of pipelines using MFE (if buried) Recover by cutting into sections and removal Cutting by hydraulic shears or Diamond Wire Cutting (DWC) depending on diameter / coating type	Assessed as unattractive in one, acceptable in three and attractive in one criterion. Retained for evaluation as the most viable full removal option.
	2B – Reverse Installation (S-lay or Reel) without De-burial	Pipelines will be disconnected No de-burial prior to removal Recover by reverse reel or reverse s-lay Removal technique based on diameter / construction type / coating type If removal by reverse reel, lines are recovered by reeling to vessel, if removal by reverse s-lay, lines are recovered to vessel and cut into sections on vessel	Assessed as unattractive from a Safety and Technical perspective due to concerns regarding integrity of the lines to recover using reverse installation techniques. Option screened out as a less credible full removal option than Option 2A.
	2C – Reverse Installation (S-lay or Reel) with De- burial	As per 2B but with de-burial of pipelines using MFE (if buried)	Assessed as unattractive from a Safety and Technical perspective due to concerns regarding integrity of the lines to recover using reverse installation techniques. Option screened out as a less credible full removal option than Option 2A.
	2D – Reverse Installation (Buoyancy)	Pipelines will be disconnected De-burial of pipelines using MFE Perform re-float using a suitable technique (Added buoyancy / aided lift / existing buoyancy, other) Entire line returned to shore via tow	Not applicable option as these lines do not lend themselves to removal using buoyancy techniques.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
	2E – Cut, Float & Transport	Pipelines will be disconnected De-burial of pipelines using MFE Cut into sections subsea (likely to be with hydraulic shears) Float to surface using a suitable technique Return to shore on vessel / towed in basket / retained buoyancy system	Not applicable option as these lines do not lend themselves to floatation for recovery and transportation to shore.
Leave In-situ (Major Intervention)	3A – Rock Placement over entire line	Pipelines will be disconnected Rock placement over full length of pipeline to address areas of spans, exposure & shallow burial No recovery of pipelines	There are limited areas of spans / exposure or shallow burial on any of these lines and therefore there is no benefit in full rock cover. Option screened out as a technical showstopper on that basis.
	3B – Retrench and Bury entire line	Pipelines will be disconnected Re-trench and backfill full length of pipeline to remove areas of spans, exposure & shallow burial depth No recovery of pipelines No introduction of new material	There are limited areas of spans / exposure or shallow burial on any of these lines and therefore there is no benefit in full trench and bury. Option screened out as a technical showstopper on that basis.
	4A – Rock Placement over areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Rock placement at all areas of spans, exposures and shallow burial depth	Assessed as attractive in four and acceptable in one criterion. There are limited areas of spans / exposures / areas of shallow burial hence rock cover to address these areas is justified. Retained for evaluation against other remaining options.
	4B – Trench & Bury areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Trench / bury areas of spans, exposures and shallow burial depth Minimal introduction of new material	Assessed as attractive in three and acceptable in two criteria. There are limited areas of spans / exposures or shallow burial hence trench and bury of these areas is justified. Retained for evaluation against other remaining options.
	4C – Remove areas of Spans / Exposure / Shallow Burial	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques	Assessed as attractive in three and acceptable in two criteria. There are limited areas of spans / exposure or shallow burial hence removal of these areas is justified. Retained for evaluation against other remaining options.

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CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Minor Intervention)	4D – Accelerated Decomposition	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench Rock placement to remediate snag risk from cut ends Introduce material / techniques to accelerate the decomposition process Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Assessed as acceptable in four and unattractive in one criterion. Latest developments in accelerated decomposition still not sufficiently mature to be proposed as a viable decommissioning option. Also, not a beneficial solution for the concrete coated lines. Option screened out as a technical showstopper due to insufficient maturity.
Leave In-situ (Minimum Intervention)	5 – Remove Line Ends & Remediate Snag Risk	Pipelines will be disconnected Removal and recovery of surface laid sections out with existing trench (including transitions) Rock placement to remediate snag risk from cut ends	Assessed as attractive in three and acceptable in two criteria. There are limited areas of spans / exposures / areas of shallow burial hence leaving these areas unaddressed considered a viable option. Retained for evaluation against other remaining options.
Leave As-is and Monitored	6 – Leave As-is	There will be no planned subsea intervention Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Considered an unacceptable solution from a safety perspective due to the potential residual snag risk from the surface laid sections of these lines out with their trenches. Option screened out as a safety showstopper on that basis.

Table 14.2 - Group 18 Decommissioning Options and Screening Summary

14.3 Group 18 Decommissioning Options for Evaluation

The decommissioning options for Group 18 remaining after screening and taken forward to evaluation are:

- Full Removal
 - 2A Cut and Lift with De-burial
- Leave In-situ (Minor intervention)
 - 4A Rock Placement over areas of Spans / Exposure / Shallow Burial
 - 4B Trench and Bury areas of Spans / Exposure / Shallow Burial
 - 4C Remove areas of Spans / Exposures / Shallow Burial
- Leave In-situ (Minimal Intervention)
 - 5 Remove Line Ends and Remediate Snag Risk



14.4 Group 18 Evaluation Summary

C	GROUP 18 – UNCERTAIN INTEGRITY AND CONCRETE COATED RIGID PIPELINES (TRENCHED AND BURIED)
	(See Section 15.10.1 for detailed discussion and Appendix M for full attributes table and assessment)
Safety	 Option 4B is assessed as being preferred from a Safety perspective. Option 5 (remove line ends only) is preferred against the Operations Personnel criterion due to the lower offshore and onshore scopes with this option. Option 4B (trench problem areas) and Option 5 are equally preferred against the Other Users criterion due to these options having a lower number of vessel days of operations and transits to / from the field. Option 4A (rock placement over problem areas), Option 4B and Option 5 are equally preferred against the High Consequence Events criterion due to there being limited potential from dropped object from the limited / no offshore lifting in these options. Other options have offshore lifting operations to varying degrees.
	Option 2A is preferred from a legacy risk perspective as the lines are fully removed versus being left in-situ in the other options.
	Option 4B is assessed as being preferred from an Environment perspective.
	Option 4A, Option 4B and Option 5 are equally preferred against the Operational Marine Impact criterion due to the lower noise impact from the shorter duration of vessels on-site and cutting operations in these options.
ent	Option 4A, Option 4B and Option 5 are also equally preferred against the Atmospheric Emissions & Fuel Use criterion as the other options generate around 5 to 8 times higher atmospheric emissions.
Environment	Option 2A is preferred against the Other Consumptions criterion due to the lower impact from recycling the returned material versus the impact of replacing material left in-situ in the partial removal options. Additionally, there is no rock resource required in Option 2A.
	Option 5 is preferred against the Seabed Disturbance criterion due the small area of impact versus all other options which have varying degrees of temporary (from trenching or de-burial) / permanent (from rock cover) seabed impact.
	The full removal option is significantly preferred over the partial removal options from a Legacy Marine Impacts perspective due to there being no legacy environmental impact from the full removal of these lines.
a l	Option 5 is assessed as being preferred from a Technical perspective.
Technical	Option 5 is preferred against the Technical criterion as, while all options employ relatively routine operations for their execution, there are greater technical challenges from the scale associated with the full removal of the lines (189 km) or successfully performing the trenching operations in Option 4B.
	Option 2A is assessed as being preferred from a Societal perspective.
le	The full removal option is preferred from a Societal – Fishing perspective as the lines are fully removed versus the lines remaining in-situ in the other options.
Societal	There is also a small preference for the full removal option from Societal – Other Users perspective due to a combination of the quantity of useful, recyclable material (steel) returned and the job creation / retention offered by the larger scope in this option. While this is offset somewhat by the large quantity of concrete returned which is likely to go to landfill, there remains a small preference for the full removal option over the others.
U	Option 5 is assessed as being preferred from an Economic perspective.
Economic	Option 5 is preferred from a Short-term Costs perspective as the cost to deliver this option is less than half the next least expensive option and much less than the other options.
Ecor	There is a small preference for Option 2A over the other options from a Long-term Costs perspective as there are no costs associated with Option 2A versus moderate costs associated with survey and monitoring of the lines left in-situ.



GROUP 18 – UNCERTAIN INTEGRITY AND CONCRETE COATED RIGID PIPELINES (TRENCHED AND BURIED)

(See Section 15.10.1 for detailed discussion and Appendix M for full attributes table and assessment)

Overall Option 5 is the emerging recommendation.

The outcome shows that the preference for Option 5 (remove line ends only) is moderate. Option 5 is preferred against the Technical criterion and marginally less preferred (to Option 4B) against the Safety and Environmental criteria. Option 2A is preferred from a Societal perspective however, there remains a preference for Option 5 overall Once the Economics criterion is included, the preference for Option 5 is strengthened and hence Option 5 is the emerging recommendation for Group 18.

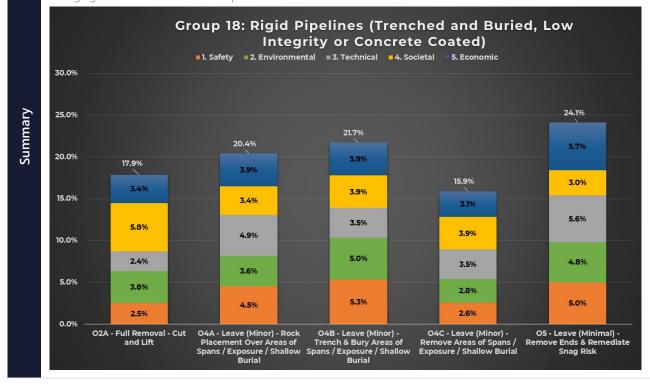


Table 14.3 - Group 18 Evaluation Summary



15 DISCUSSION AND RECOMMENDATIONS

The comparative assessment of each of the decommissioning groups for the Northern North Sea Subsea Infrastructure has identified several groups where the recommended decommissioning approach was full removal, with no further evaluation necessary. These are:

- Group 5 Umbilicals (Surface Laid)
- Group 10 Flexible Risers and Riser Umbilicals
- Group 11 Rigid Risers
- Group 12 Spools and Jumpers
- Group 13 Large Structures
- Group 14 Structures
- Group 15 Protection and Stabilisation

The full comparative assessment process was applied to the remaining decommissioning groups (1, 2, 3, 4, 6, 7, 8, 16, 17 and 18). A discussion of the key drivers for the outcomes obtained from the comparative assessment of the decommissioning options within these decommissioning groups are provided here.

15.1 Group 1 Discussion

The following sections provide a discussion of the evaluation of the four most viable Group 1 – Pipe-in-Pipe Hybrids (Surface Laid and Exposed) decommissioning options (Option 2A – Full Removal by Cut and Lift, Option 3B – Trench and Bury Entire Line, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial and Option 4C – Remove areas of Spans / Exposure / Shallow Burial) against the five criteria.

15.1.1 Safety

In all the options evaluated, all operations considered are diverless, including removal of trim chains and vent valve assemblies, and pipe cutting operations. For all options, some equipment recovery to a support vessel deck is necessary; these being towheads and appurtenances as a minimum, specific sections of the pipe-in-pipe hybrids in addition to towheads and appurtenances or the pipe-in-pipe hybrids in their entirety. Against the Operations Personnel criterion, all partial removal options are equally preferred over Option 2A (full removal). This is due to the greater risk exposure associated with the more extensive scope to fully remove the lines and the greater onshore scope associated with the returned lines. There are differences in the risk exposure associated with the partial removal options, but these differences are considered minor and insufficient to express a preference within this evaluation. A HAZID was conducted ref. [7] to assess these operations.

Against the Other Users criterion, again all partial removal options are equally preferred over the full removal option. This is due the impact on the safety of other users expected to be marginally higher for the full removal option than the partial removal options. This marginally higher impact is due to the much higher number of days of vessel operations and higher number of transits to / from the field to execute the full removal option. The safety impact on other users is similar across the partial removal options.

Against the High Consequence Events criterion, Option 3B (trench entirety of lines) and Option 4A (rock placement over problem areas) are equally preferred as Option 3B has limited offshore lifting relating to deployment and recovery of cutting equipment to remove chains and appurtenances and trenching equipment to perform trenching and burial of the lines. Option 4A has no offshore lifting associated with the rock placement operations as they are conducted from a Fall Pipe Vessel. It does, however, also include the deployment and recovery of cutting equipment to remove chains as there is a larger number of offshore lifting operations associated with the deployment and recovery of cutting equipment and the recovery of sections of the lines. Again, deployment and recovery of cutting equipment to remove chains and appurtenances is required. Option 2A is the worst option due to the very high number of offshore lifting operations (when compared to the other options) associated with the deployment and recovery of the cutting equipment and the recovery of approximately 20 km of lines in 10 m sections.

Against the Legacy Risk criterion, the full removal option is preferred over Option 3B as, while both options effectively leave a clear seabed, the line does remain in-situ in Option 3B and there is the legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ. These options are significantly preferred over Option 4C (remove problem areas) as the majority of the lines will remain on the seabed, albeit with existing areas of spans removed and Option 4A, where the majority of the lines will also remain on the seabed with large rock berms over existing areas of spans. Again, each of these options has an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 3B is the equally preferred option from an Operations Personnel, impact on Other Users and High Consequence Events perspective. It is marginally less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 3B from a Safety perspective.

15.1.2 Environment

Against the Operational Marine Impact criterion, all partial removal options are equally preferred over Option 2A (full removal). This is due to the greater noise impact from the longer durations that vessels are on-site and the longer duration cutting operations, although noise impact from cutting operations conducting using hydraulic shears is a smaller factor. It is noted that, while there is a preference for the partial removal operations, that preference is marginal as the greater noise impact is minor. There is an additional preference for the partial removal options due to the discharges of line contents and loss of insulation material that occurs at each cut location in the full removal option, but again, the impacts are minor.

Against the Atmospheric Emissions and Fuel Use criterion, all partial removal options are equally preferred over Option 2A. This is due to the increased emissions generated and fuel used from the extended offshore scope in the full removal option. There are differences in the emission generated and fuel used across the partial removal options, however these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, Option 2A is marginally preferred over Option 3B (trench entirety of lines) and Option 4C (remove problem areas) as the environmental impact from recycling returned material in Option 2A

is smaller than the impact associated with generating replacement material for the lines left in-situ in these options. Option 4A (rock placement over problem areas) is marginally less preferred again due to the quantity of rock required to deliver Option 4A is much greater than the other options, where the rock required is either negligible or zero.

Against the Seabed Disturbance criterion, Option 2A is preferred as there is negligible seabed disturbance associated with the cut and lift of these surface laid lines. Option 3B and Option 4C are less preferred but for different reasons. Option 3B is less preferred due to the large area of seabed impacted by trenching operations to bury the lines. While the area impacted is large, the impact is temporary in nature, with the seabed habitat recovering quickly. Option 4C has a much smaller area impact but as the impact is from the introduction of rock cover (over the cut line ends), this represents a greater impact on the seabed as it is a permanent habitat change. Option 4A is the least preferred option due to it having the largest area of permanent habitat change from rock covering the areas of spans on these lines.

Against the Legacy Marine Impact criterion, Option 2A is preferred as there are no legacy marine impacts associated with these lines being fully removed. While Option 3B is less preferred than the full removal option, it is preferred over the other options as it will be left in-situ but fully trenched and buried. As such, the legacy environmental impact is considered lower than the other partial removal options as the lines are isolated from the marine environment.

Option 2A is the least preferred option from an Operational Marine Impact and Atmospheric Emissions and Fuel Use perspective, although the preference for the partial removal options is relatively minor. Option 2A is however, significantly preferred from a Seabed Disturbance and Legacy Marine Impact perspective. This significant preference, along with a minor preference from an Other Consumptions perspective, results in an overall preference for Option 2A from an Environmental perspective.

15.1.3 Technical

Against the Technical criterion, Option 4A (rock placement over problem areas) is preferred over Option 4C (remove problem areas) and significantly preferred over Option 2A (full removal) and Option 3B (trench entirety of lines). While all options employ relatively routine operations such as de-burial, line cutting, trenching and rock cover, there are significant concerns regarding the lift stability and retention of loose internal equipment when recovering sections of these pipe-in-pipe hybrid lines under the full removal option. Hydraulic shears are proposed and there is an expectation that the 'crimping' effect will mitigate these concerns, however there is greater technical risk associated with this option than simple rock cover operations in Option 4A. Option 4C, which requires removal of problem areas, will face the same challenges, albeit on a much smaller scale than addressing the 20 km of the lines in the full removal option. Option 3B is the least preferred option from a technical perspective as, while trenching of lines is routine, the diameter of the lines (26" and 24") would require trenching equipment that is near the limit of current technology. That, coupled with the concerns regarding the geotechnical conditions in the area (stiff clays and 'shelly deposits') result in this being the least preferred option. It is noted that trim chains and appurtenance removal is included in all partial removal options.

15.1.4 Societal

Against the Societal – Fishing criterion, Option 2A (full removal) is preferred over Option 3B (trench entirety of lines) as, while both options effectively leave a clear seabed, the line does remain in-situ in Option 3B. These options are significantly preferred over Option 4C (remove problem areas) as the majority of the lines will remain on the seabed, albeit with existing areas of spans removed and Option 4A (rock placement over problem areas), where the majority of the lines will also remain on the seabed with large rock berms over existing areas of spans.

Against the Societal – Other Users criterion, Option 2A is preferred marginally over the partial removal options. This is due to the societal benefits of returning the steel for recycling in the full removal option. The benefit of this is tempered by the challenges that are associated with separating the useful steel from the insulation material surrounding the internal lines in these pipe-in-pipe hybrids. There is also a small preference due to the job creation / retention associated with the larger scope for the full removal option. All partial removal options have similar, minimal societal benefits / impacts.

As Option 2A (full removal) is preferred from a Fishing and Other Users perspective, overall, there is a moderate preference for Option 2A from a Societal perspective.

15.1.5 Economic

Against the Short-term Costs criterion, Option 4A (rock placement over problem areas) and Option 4C (remove problem areas) are equally preferred over the other options. This is due to the costs to execute these options being similar (\pounds 3.4 million and \pounds 4.5 million respectively) and around half the cost of Option 3B (trench entirety of lines - \pounds 8.4 million). They are also much less than Option 2A (full removal - \pounds 17.7 million).

Against the Long-term Costs criterion, all options are equally preferred. While there are no long-term costs associated with the full removal option, the long-term costs associated with the survey and monitoring of the lines left in-situ in the partial removal options are minor (less than £1 million) and would be spread out over many years. As such, the differences between the options are insufficient to express a preference.

As Option 4A and Option 4C are equally preferred from both a Short-term Costs and Long-term Costs perspective, overall, Option 4A and Option 4C are equally preferred from an Economic perspective.

15.1.6 Group 1 Recommendation

The recommended decommissioning option for Group 1 – Pipe-in-Pipe Hybrids (Surface Laid and Exposed) is Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial. This option involves the following key activities:

- Pipelines will be disconnected
- Removal and recovery of line ends
- Removal of venting appurtenances and trim chains
- Rock placement to remediate snag risk from cut ends



- Rock placement at all areas of spans to an appropriate depth of cover
- Future survey & monitoring programme

15.2 Group 2 Discussion

The following sections provide a discussion of the evaluation of the three most viable Group 2 – Trunk Lines (Partially Trenched and Buried) decommissioning options (Option 2A – Full Removal by Cut and Lift, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial and Option 4C – Remove areas of Spans / Exposure / Shallow Burial) against the five criteria.

15.2.1 Safety

Against the Operations Personnel criterion, Option 4A (rock placement over problem areas) is significantly preferred over the other options. This is due to the greater risk exposure associated with the greater scope to remove the problem areas in Option 4C and the much greater scope for fully remove the line in Option 2A. There is also a much greater onshore scope associated with the returned line in Option 2A.

Against the Other Users criterion, Option 4A is preferred over Option 4C due to the higher number of days of vessel operations and higher number of transits to / from the field to remove the problem areas. The preference for Option 4A over Option 2A is more significant again due to the much higher number of days of vessel operations and higher number of transits to / from the field to execute the full removal option.

Against the High Consequence Events criterion, Option 4A is preferred over Option 4C as Option 4A has no offshore lifting associated with the rock placement operations as they are conducted from a Fall Pipe Vessel, whereas Option 4C has as a large number of offshore lifting operations associated with the deployment and recovery of cutting equipment and the recovery of sections of the line. Option 2A is the worst option due to the very high number of offshore lifting operations (many thousands) associated with the deployment and recovery of the cutting equipment and the recovery of 153 km of line in 10 m sections.

Against the Legacy Risk criterion, the full removal option is preferred over Option 4C as the majority of the line will remain in-situ, albeit with existing areas of spans removed and Option 4A, where the majority of the line will also remain in-situ with rock berms over existing areas of spans. Each of these options has an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the line left in-situ.

Option 4A is the preferred option from an Operations Personnel, impact on Other Users and High Consequence Events perspective. It is less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 4A from a Safety perspective.

15.2.2 Environment

Against the Operational Marine Impact criterion, Option 4A (rock placement over problem areas) is preferred over Option 4C (remove problem areas). This is due to the greater noise impact from the longer durations that vessels



are on-site and the cutting operations (with diamond wire) to remove problem areas. In addition, there are discharges of line contents at each cut location in Option 4C, although the impact of these discharges is less significant due to the line being flushed and cleaned prior to the line being cut into. Option 2A (full removal) is the least preferred option due to the much greater noise impact from the much longer durations that vessels are on-site, and the much greater cutting operation scope associated with cutting this 153 km line into 10m sections. The impact of these operations is also magnified when being conducted at the near shore portion of the trunk line where it impacts marine mammals (harbour porpoise) and seal haul out area. Again, there are line content discharges as each location, but the impact is considered minimal.

Against the Atmospheric Emissions and Fuel Use criterion, Option 4A is preferred over Option 4C due to the increased emissions generated and fuel used (almost 3 times higher) from the greater offshore scope to remove problem areas. Option 2A is the least preferred option as it involves by far the largest offshore scope and hence the emissions generated and fuel used are around 16 times higher for Option 2A over Option 4A.

Against the Other Consumptions criterion, Option 2A is preferred over Option 4C as the environmental impact from recycling returned material in Option 2A is smaller than the impact associated with generating replacement material for the line left in-situ in Option 4C. This is also true when comparing Option 2A to Option 4A, however, Option 4A is less preferred again due to the large quantity of rock required deliver Option 4A.

Against the Seabed Disturbance criterion, Option 4C is preferred as, while there is a significant area of seabed impacted by the rock cover introduced over cut ends of the line where problem areas are removed (permanent habitat change), this area is much smaller than the area impacted by de-burial operations to enable full removal of the line in Option 2A, although this impact is temporary in nature. Option 4A is the least preferred option as the area of permanent impact is much greater than Option 4C. It is noted that, of the areas impacted by rock cover in both Option 4A and Option 4C only a small amount (less than 10% in both cases) is within the East Mainland Coast Shetland SPA which reduces the overall impact of the introduced rock cover.

Against the Legacy Marine Impact criterion, Option 2A is significantly preferred over the other options as there are no legacy marine impacts associated with the line being fully removed versus the line remaining in-situ and exposed to the marine environment in the other options.

Option 4C is less preferred than Option 4A from an Operational Marine Impact and Atmospheric Emissions and Fuel Use perspective and less preferred than Option 2A from an Other Consumptions and Legacy perspective. Option 4C is however, significantly preferred from a Seabed Disturbance perspective. This significant preference, along with marginally lower preference across the other criteria results in a small overall preference for Option 4C from an Environmental perspective.

15.2.3 Technical

Against the Technical criterion, Option 4A (rock placement over problem areas) is preferred over Option 4C (remove problem areas) and significantly preferred over Option 2A (full removal). While all options employ relatively routine operations such as de-burial, line cutting and rock cover, there are significant concerns regarding performing the deburial, cutting and lifting operations both in Option 4C and to a much greater extent when considering performing these operations over 153 km of line in Option 2A. In addition, there are challenges associated with the recovery of



the spalling of the concrete coating likely to occur at cut locations, especially on the scale of the full removal option. The simple operation of rock covering the problem areas in Option 4A carries much lower technical risk.

15.2.4 Societal

Against the Societal – Fishing criterion, Option 2A (full removal) is significantly preferred over the other options as, while there will be significant disruption to fishing operations from the removal of the line, a clear seabed is preferred from a fishing operations perspective. This is also a significant preference for Option 4C (remove problem areas) over Option 4A (rock placement over problem areas) due to the large rock berms that will be introduced when covering problem areas of this surface laid line with rock, which is less desirable than the removal of the problem areas with rock cover over cut line ends.

Against the Societal – Other Users criterion, Option 2A is less preferred than the other options as, while there are societal benefits of returning the steel for recycling in the full removal option, this is more than offset by the large quantity of seawater contaminated concrete, which is likely to take up limited landfill capacity on shore. There are also challenges in the segregation of the steel and concrete for recycling due to the coal tar layer between the materials and the concrete coating having 'chicken wire' type steel reinforcement further exacerbating the segregation challenges. This societal impact was considered to be a more significant contributor to the assessment than any benefits associated with the job creation / retention from the much larger scope to execute Option 2A. The other options were assessed to have similar, minimal societal benefits / impacts.

As Option 2A (full removal) is significantly preferred over the other options from a Fishing perspective but only marginally less preferred than the other options from an Other Users perspective, overall, there is a moderate preference for Option 2A from a Societal perspective.

15.2.5 Economic

Against the Short-term Costs criterion, Option 4A (rock placement over problem areas) is significantly preferred over the other options. This is due to the costs to execute this option (\pounds 4.3 million) being around a quarter of the cost of Option 4C (remove problem areas - \pounds 19.6 million) and much less than Option 2A (full removal - \pounds 170 million).

Against the Long-term Costs criterion, Option 2A is marginally preferred as there are no long-term costs associated with the full removal option whereas both Option 4A and Option 4C have long-term costs associated with the survey and monitoring of the line left in-situ. While these costs are relatively modest (c. £2 million) and would be spread over many years, they were sufficient to express a small preference for the full removal option.

As Option 4A is significantly preferred from a Short-term Costs and only marginally less preferred from a Long-term Costs perspective, overall, Option 4A is preferred from an Economic perspective.

15.2.6 Group 2 Recommendations

The recommended decommissioning option for Group 2 – Trunk Lines (Partially Trenched and Buried) is Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial. This option involves the following key activities:



- Pipeline will be disconnected
- Removal and recovery of offshore line end
- Rock placement to remediate snag risk from cut ends
- Rock placement at all areas of spans, exposures and shallow burial to an appropriate depth of cover
- Future survey & monitoring programme



15.3 Group 3 Discussion

The following sections provide a discussion of the evaluation of the five most viable Group 3 – Flexible Pipelines and Umbilicals (Trenched and Buried) decommissioning options (Option 2A – Full Removal by Cut and Lift, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial, Option 4B – Trench and Bury areas of Spans / Exposure / Shallow Burial, Option 4C – Remove areas of Spans / Exposure / Shallow Burial) and Option 5 – Remove Line Ends and Remediate Snag Risk) against the five criteria.

15.3.1 Safety

Against the Operations Personnel criterion, Option 5 (remove line ends only) is the preferred option. It is marginally preferred over Option 4A (rock placement over problem areas) as the scope to rock cover over the problem areas is higher and therefore presents a marginally higher risk exposure. Option 5 is further preferred over Option 4B (trench and bury problem areas) and Option 4C (remove problem areas) as the scope associated with these options and the risk exposure is greater again. Option 2A (full removal) is the least preferred option as the scope to fully remove these lines is the greatest and thus has the highest risk exposure of all options. There is also a greater onshore scope associated with the returned lines.

Against the Other Users criterion, Option 5 (remove line ends only) is preferred over Options 4A, 4B and 4C (which are equally preferred). This is due the impact on the safety of other users expected to be lower in Option 5 as it has a lower number of days of vessel operations and transits to / from the field than the other options. The preference is marginal. Option 2A is least preferred due to the much higher number of vessel days and transits associated with the full removal option.

Against the High Consequence Events criterion, 4A (rock placement over problem areas), Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred as there are less offshore lifting operations and hence lower potential for high consequence events than in Option 2A and Option 4C where there are thousands of offshore lifting operations to deploy and recover cutting equipment and recover line ends, thus presenting a greater risk of dropped object.

Against the Legacy Risk criterion, the full removal option is preferred over the other options as there is no legacy risk associated with the full removal of the lines. All other options are less preferred as the lines remain in-situ, albeit with the problem areas rock covered in Option 4A, trenched in Option 4B or removed in Option 4C. Option 5 is the least preferred option due to existing areas of spans, exposure and shallow burial remaining. All partial removal options also have an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 5 is the preferred option from an Operations Personnel, Other Users and High Consequence Events perspective. While it is less preferred from a Legacy Risk perspective, overall, there remains a preference for Option 5 from a Safety perspective.



15.3.2 Environment

Against the Operational Marine Impact criterion, Option 5 (remove line ends only) is preferred over all other options due to all other options have greater noise impact from the longer duration of vessels on-site and / or cutting operations in those options. The relative preference is however minor.

Against the Atmospheric Emissions and Fuel Use criterion, Option 5 (remove line ends only) is marginally preferred over the other options as it generates the lowest emissions of the options. Option 2A (full removal) is the least preferred option due to the increased emissions generated and fuel used from the longer durations associated with the full removal of the lines.

Against the Other Consumptions criterion, Option 2A (full removal), Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred. While there are differences in the impact associated with recycling material returned or generating replacement material for the lines left in-situ, these differences are insufficient to express a preference within these options. Option 4C (remove problem areas) is less preferred due to the rock required over cut locations in this option. Option 4A (rock cover over problem areas) is the least preferred option due to the large quantity of rock required in this option.

Against the Seabed Disturbance criterion, Option 5 (remove line ends only) is preferred as there is minor seabed disturbance associated with the cut and lift of the surface laid line ends, limited to the footprint of the rock placed over cut locations. Option 4B (trench and bury problem areas) is marginally less preferred as, while the area impacted by trenching the problem areas is greater, the impact is temporary in nature. Option 2A (full removal) is less preferred again as the area impacted from the de-burial operations over these lines is much greater although, again, this is temporary in nature however there is an area of rock cover introduced at the line crossings. Option 4C (remove problem areas) is less preferred again due to the large area of permanent habitat change from the rock cover introduced over cut locations when removing problem areas. Option 4A (rock placement over problem areas) is the least preferred option as the area of permanent habitat change from rock covering problem areas is the greatest impact of all options.

Against the Legacy Marine Impact criterion, Option 2A (full removal) is preferred as there are no legacy marine impacts associated with these lines being fully removed. Option 4A (rock cover over problem areas), Option 4B (trench and bury problem areas) and Option 4C (remove problem areas) are less preferred as there will be slow discharges and degradation products from these lines remaining in-situ, although these will occur over a long time period and as such, their legacy environmental impact is expected to be minor, especially given these lines will be isolated from the marine environment. Option 5 (remove line ends only) is the least preferred option as any discharges and degradation products will occur over a shorter time period than the other options as the areas of existing spans and exposure will remain and are exposed to the marine environment. The legacy environmental impact is still expected to be minor.

Option 5 is preferred from an Operational Marine Impact, Atmospheric Emissions and Fuel Use and Seabed Disturbance perspective and equally preferred from an Other Consumptions perspective. Option 2A is preferred over Option 5 from a Legacy Marine Impact perspective. Overall, this results in Option 5 being preferred from an Environmental perspective.

15.3.3 Technical

Against the Technical criterion, Option 5 (remove line ends only) is preferred. While all options employ relatively routine operations such as de-burial, line cutting, trenching and rock cover, Option 4B (trenching of problem areas) and Option 4C are less preferred due to the increased scope over Option 5 leading to greater technical challenges on a cumulative basis. Option 2A (cut and lift) is least preferred due to de-burial, cut and lift operations over the 200+ km of lines in this group presenting the greatest technical challenges on a cumulative basis.

15.3.4 Societal

Against the Societal – Fishing criterion, Option 2A (full removal) is preferred over the other options as, while there will be disruption to fishing operations from the removal of the lines, a clear seabed is preferred from a fishing operations perspective. Option 4A (rock placement over problem areas) and Option 5 (remove line ends only) were least preferred due to the existing of rock berms or existing spans remaining respectively.

Against the Societal – Other Users criterion, Option 2A is also preferred over the partial removal options. This is due to the societal benefits of returning the steel and copper for recycling in the full removal option. The benefit of this is tempered by the quantity of polymer returned which is likely to end up in landfill. All partial removal options have similar, minimal societal benefits / impacts.

As Option 2A (full removal) is preferred over the other options from both a Fishing perspective and from an Other Users perspective, overall, there is a preference for Option 2A from a Societal perspective.

15.3.5 Economic

Against the Short-term Costs criterion, Option 5 (remove line ends only) is preferred over the other options. This is due to the costs to execute this option (\pounds 8 million) being around a half of the cost of next lowest option (Option 4A – rock placement over problem areas - \pounds 15.5 million) and less again than the other options.

Against the Long-term Costs criterion, Option 2A is marginally preferred as there are no long-term costs associated with the full removal option whereas all partial removal options have long-term costs associated with the survey and monitoring of the lines left in-situ. While these costs are relatively modest (c. £2 million) and would be spread over many years, they are sufficient to express a small preference for the full removal option.

As Option 5 is preferred from a Short-term Costs and only marginally less preferred from a Long-term Costs perspective, overall, Option 5 is preferred from an Economic perspective.



15.3.6 Group 3 Recommendations

The recommended decommissioning option for Group 3 – Flexible Pipelines and Umbilicals (Trenched and Buried) is Option 5 – Remove Line Ends Only and Remediate Snag Risk. This option involves the following key activities:

- Pipelines / umbilicals will be disconnected
- Removal and recovery of line ends including trench transition
- Rock placement to remediate snag risk from cut ends
- Future survey & monitoring programme



15.4 Group 4 Discussion

Given the similarity between the equipment in Group 3, where the flexible flowlines and umbilicals are trenched and buried and Group 4 where the flexible flowlines are trenched and rock covered, the outcome of the evaluation for Group 4 is in line with the outcome of the Group 3 evaluation. The discussion regarding group 3 as detailed in Section 15.3 applies to Group 4.

15.4.1 Group 4 Recommendations

The recommended decommissioning option for Group 4 – Flexible Pipelines and Umbilicals (Trenched and Rock Covered) is Option 5 – Remove Line Ends Only and Remediate Snag Risk. This option involves the following key activities:

- Pipelines / umbilicals will be disconnected
- Removal and recovery of line ends including trench transition
- Rock placement to remediate snag risk from cut ends
- Future survey & monitoring programme



15.5 Group 6 Discussion

The following sections provide a discussion of the evaluation of the four most viable Group 6 – Rigid Pipelines (Surface Laid, Exposed and Non-Concrete Coated) decommissioning options (Option 2B – Full Removal by Reverse Installation (Reeling) without De-burial, Option 3B – Trench and Bury Entire Line, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial and Option 4C – Remove areas of Spans / Exposure / Shallow Burial) against the five criteria.

15.5.1 Safety

Against the Operations Personnel criterion, Option 4A (rock placement over problem areas) is significantly preferred over the other options. This is due to the greater risk exposure associated with the greater scope to trench and bury the entire line in Option 3B or to remove the problem areas in Option 4C and the much greater scope to fully remove the line in Option 2B. There is also a much greater onshore scope associated with the returned line in Option 2B.

Against the Other Users criterion, all options are equally preferred as, while there are differences in the number of days of vessel operations and transits to / from the field across the options, these differences are considered insufficient to express a preference from a safety impact on other users' perspective.

Against the High Consequence Events criterion, Option 3B (trench entirety of line) and Option 4A (rock cover over problem areas) are equally preferred. This is due to these options having limited / no offshore lifting whereas Option 4C (remove problem areas) has as a large number of offshore lifting operations associated with the deployment and recovery of cutting equipment and the recovery of sections of the line. Option 2B is the least preferred option due to potential for High Consequence Events associated with the potential residual torsion in the line during offloading (reeling) to the quayside.

Against the Legacy Risk criterion, the full removal option is preferred over Option 3B (trench entirety of line) as, while both options effectively leave a clear seabed, the line does remain in-situ in Option 3B and there is the legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ. These options are significantly preferred over Option 4C (remove problem areas) as the majority of the lines will remain on the seabed, albeit with existing areas of spans removed and Option 4A, where the majority of the lines will also remain on the seabed with rock berms over areas existing areas of spans. Again, each of these options has an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 4A is the preferred option from an Operations Personnel perspective and equally preferred from an impact on Other Users and High Consequence Events perspective. It is less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 4A from a Safety perspective.

15.5.2 Environment

Against the Operational Marine Impact criterion, all options are equally preferred as the differences in the environmental impacts across the options are minor, and insufficient to express a preference.

Against the Atmospheric Emissions and Fuel Use criterion, all options are equally preferred. There are differences in the emissions generated and fuel used across the options, however these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, all options are equally preferred as, while there are differences in environmental impact from recycling returned material or generating replacement material for the lines left in-situ, and in the rock consumed across the options, these differences are considered minor and insufficient to express a preference within these options.

Against the Seabed Disturbance criterion, Option 2B (full removal) is preferred over all partial removal options as there is negligible seabed disturbance associated with the cut and lift of this surface laid line. Option 4C (remove problem areas) is less preferred as there is small area of seabed impacted by the rock cover over the cut line ends, which represents a permanent habitat change. Option 3B (trench entirety of lines) is less preferred again, due to the larger area of seabed impacted by trenching the entire line, although it is recognised that this impact is temporary in nature. Option 4A (rock placement over problem areas) is the least preferred option as there is a large area of seabed impacted from the rock cover over problem areas which is a permanent habitat change.

Against the Legacy Marine Impact criterion, Option 2B (full removal) is preferred as there are no legacy marine impacts associated with the line being fully removed. While Option 3B (trench entirety of line) is less preferred than the full removal option, it is preferred over the other options as it will be left in-situ but fully trenched and buried. As such, the legacy environmental impact is considered lower than the other partial removal options as the line is isolated from the marine environment.

Option 2B is the preferred option from a Legacy Marine Impacts perspective and equally preferred from an Operational Marine Impact, Atmospheric Emissions and Fuel Use and Other Consumptions perspective. While Option 2B is less preferred from a Seabed Disturbance perspective, overall, there remains a preference for Option 2B from an Environmental perspective.

15.5.3 Technical

Against the Technical criterion, Option 4A (rock placement over problem areas) and Option 4C (remove problem areas) are equally preferred. While all options employ relatively routine operations such as line cutting, trenching and rock cover, there are challenges associated with Option 3B (trench entirety of line) due to the geotechnical conditions in this location, although it is noted that the Kestrel line (not in this group but in the same general location) was trenched. Option 2B (reverse reeling) is the least preferred option as there are concerns regarding the reverse reeling of rigid lines of this diameter (16-inch) as this is near the limit of reverse reeling capabilities.

15.5.4 Societal

Against the Societal – Fishing criterion, Option 2B (full removal) is preferred over the other options as, while there will be disruption to fishing operations from the removal of the line, a clear seabed is preferred from a fishing operations perspective.



Against the Societal – Other Users criterion, all options are equally preferred as the positive and negative societal impacts are largely insignificant across all options due to the limited scope of returned material associated with the single, 16-inch, 16 km line in this group.

As Option 2B (full removal) is preferred over the other options from a Fishing perspective and equally preferred from an Other Users perspective, overall, there is a preference for Option 2B from a Societal perspective.

15.5.5 Economic

Against the Short-term Costs criterion, Option 4A (rock placement over problem areas) is preferred over the other options. This is due to the costs to execute this option (\pounds 1 million) being less than half the cost of next lowest option (Option 4C – remove problem areas - \pounds 2.5 million) and less again than the other options.

Against the Long-term Costs criterion, all options are equally preferred. While there are no long-term costs associated with the full removal option, the long-term costs associated with the survey and monitoring of the line left in-situ in the partial removal options are minor (less than £1 million) and would be spread out over many years. As such, the differences between the options are insufficient to express a preference.

As Option 4A is preferred from a Short-term Costs perspective and equally preferred from a Long-term Costs perspective, overall, Option 4A is preferred from an Economic perspective.

15.5.6 Group 6 Recommendations

The recommended decommissioning option for Group 6 – Rigid Pipelines (Surface Laid, Exposed and Non-Concrete Coated) is Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial. This option involves the following key activities:

- Pipeline will be disconnected
- Removal and recovery of line ends
- Rock placement to remediate snag risk from cut ends
- Rock placement at all areas of spans to an appropriate depth of cover
- Future survey & monitoring programme



15.6 Group 7 Discussion

The following sections provide a discussion of the evaluation of the four most viable Group 7 – Rigid Pipelines (Surface Laid, Exposed and Concrete Coated) decommissioning options (Option 2A – Full Removal by Cut and Lift, Option 3B – Trench and Bury Entire Line), Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial and Option 4C – Remove areas of Spans / Exposure / Shallow Burial) against the five criteria.

15.6.1 Safety

Against the Operations Personnel criterion, Option 4A (rock placement over problem areas) is significantly preferred over the other options. This is due to the greater risk exposure associated with the greater scope to trench and bury the entire line in Option 3B or to remove the problem areas in Option 4C and the much greater scope to fully remove the line in Option 2A. There is also a much greater onshore scope associated with the returned line in Option 2A.

Against the Other Users criterion, again all partial removal options are equally preferred over the full removal option. This is due the impact on the safety of other users expected to be marginally higher for the full removal option than the partial removal options. This marginally higher impact is due to the much higher number of days of vessel operations and higher number of transits to / from the field to execute the full removal option. The safety impact on other users is similar across the partial removal options.

Against the High Consequence Events criterion, Option 3B (trench entirety of line) and Option 4A (rock cover over problem areas) are equally preferred. This is due to these options having limited / no offshore lifting whereas Option 4C (remove problem areas) has as a large number of offshore lifting operations associated with the deployment and recovery of cutting equipment and the recovery of sections of the line. Option 2A is the least preferred option due to the very high number of offshore lifting operations (when compared to the other options) associated with the deployment and recovery of the cutting equipment and the recovery of approximately 29 km of lines in 10 m sections.

Against the Legacy Risk criterion, the full removal option is preferred over Option 3B (trench entirety of line) as, while both options effectively leave a clear seabed, the line does remain in-situ in Option 3B and there is the legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ. These options are significantly preferred over Option 4C (remove problem areas) as the majority of the lines will remain on the seabed, albeit with existing areas of spans removed and Option 4A, where the majority of the lines will also remain on the seabed with rock berms over areas existing areas of spans. Again, each of these options has an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 4A is the preferred option from an Operations Personnel perspective and equally preferred from an impact on Other Users and High Consequence Events perspective. It is less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 4A from a Safety perspective.



15.6.2 Environment

Against the Operational Marine Impact criterion, all partial removal options are equally preferred over Option 2A (full removal). This is due to the greater noise impact from the longer durations that vessels are on-site and the longer duration cutting operations (with diamond wire) to fully remove the lines. There is an additional preference for the partial removal options due to the discharges of line contents that occur at each cut location in the full removal option. The preference for the partial removal options over the full removal option is marginal as the environmental impacts associated with the full removal are minor.

Against the Atmospheric Emissions and Fuel Use criterion, all partial removal options are equally preferred over Option 2A (full removal). This is due to the increased emissions generated and fuel used from the extended offshore scope in the full removal option. There are differences in the emission generated and fuel used across the partial removal options, however these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, Option 2A (full removal) is marginally preferred over Option 3B (trench entirety of lines) and Option 4C (remove problem areas) as the environmental impact from recycling returned material in Option 2A is smaller than the impact associated with generating replacement material for the lines left in-situ and, both options require more rock resource than Option 2A. Option 4A (rock cover over problem areas) is marginally less preferred again due to the quantity of rock required to deliver Option 4A is much greater than the other options, where the rock required is less significant.

Against the Seabed Disturbance criterion, Option 2A (full removal) and Option 4C (remove problem areas) are equally preferred as there is negligible seabed disturbance associated with the cut and lift of these surface laid lines and a small area impacted by the rock cover over the cut line ends in Option 4C. Option 3B is less preferred due to the large area of seabed impacted by trenching operations to bury the lines. While the area impacted is large, the impact is temporary in nature, with the seabed habitat recovering quickly. Option 4A is the least preferred option due to it having the largest area of permanent habitat change from rock covering the problem areas on these lines.

Against the Legacy Marine Impact criterion, Option 2A is preferred as there are no legacy marine impacts associated with these lines being fully removed. All partial removal options are considered to present a similar and minor legacy marine impact.

Option 4C is equally preferred from an Operational Marine Impact, Atmospheric Emissions and Fuel Use and Seabed Disturbance perspective, and only marginally less preferred from an Other Consumptions perspective. While it is less preferred from a Legacy Marine Impact perspective, overall, there remains a preference for Option 4C from an Environmental perspective.

15.6.3 Technical

Against the Technical criterion, Option 4A (rock placement over problem areas) and Option 4C (remove problem areas) are equally preferred. While all options employ relatively routine operations such as line cutting, trenching and rock cover, there are challenges associated with Option 3B (trench entirety of line) due to the geotechnical

conditions in this location and the limited track record of trenching rigid lines of this diameter (16-inch and 20-inch). There are also challenges associated with Option 2A (cut and lift) due to the likely spalling of the aging concrete coating on these lines.

15.6.4 Societal

Against the Societal – Fishing criterion, Option 2A (full removal) is preferred over Option 3B (trench entirety of lines) as, while both options effectively leave a clear seabed, the line does remain in-situ in Option 3B. These options are significantly preferred over Option 4C (remove problem areas) as the majority of the lines will remain on the seabed, albeit with existing areas of spans removed and Option 4A (rock placement over problem areas), where the majority of the lines will also remain on the seabed with rock berms over areas existing areas of spans.

Against the Societal – Other Users criterion, Option 2A is less preferred than the other options as, while there are societal benefits of returning the steel for recycling in the full removal option, this is offset by the seawater contaminated concrete, which is likely to take up limited landfill capacity on shore. The other options were assessed to have similar, minimal societal benefits / impacts.

As Option 2A (full removal) is preferred over the other options from a Fishing perspective but only marginally less preferred than the other options from an Other Users perspective, overall, there is a moderate preference for Option 2A from a Societal perspective.

15.6.5 Economic

Against the Short-term Costs criterion, Option 4A (rock placement over problem areas) is preferred over the other options. This is due to the costs to execute this option (\pounds 1.2 million) being almost a quarter of the cost of next lowest option (Option 4C – remove problem areas - \pounds 4.6 million) and less again than the other options.

Against the Long-term Costs criterion, all options are equally preferred. While there are no long-term costs associated with the full removal option, the long-term costs associated with the survey and monitoring of the line left in-situ in the partial removal options are minor (around £1 million) and would be spread out over many years. As such, the differences between the options are insufficient to express a preference.

As Option 4A is preferred from a Short-term Costs perspective and equally preferred from a Long-term Costs perspective, overall, Option 4A is preferred from an Economic perspective.

15.6.6 Group 7 Recommendations

The recommended decommissioning option for Group 7 – Rigid Pipelines (Surface Laid, Exposed and Concrete Coated) is Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial. This option involves the following key activities:

- Pipelines will be disconnected
- Removal and recovery of line ends



- Rock placement to remediate snag risk from cut ends
- Rock placement at all areas of spans to an appropriate depth of cover
- Future survey & monitoring programme



15.7 Group 8 Discussion

The following sections provide a discussion of the evaluation of the three most viable Group 8 – Rigid Pipelines (Surface Laid and Rock Covered) decommissioning options (Option 2C – Full Removal by Reverse Installation (Reeling) with De-burial, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial and Option 5 – Remove Line Ends and Remediate Snag Risk) against the five criteria.

15.7.1 Safety

Against the Operations Personnel criterion, all partial removal options are equally preferred over Option 2C (full removal). This is due to the greater risk exposure associated with the greater scope to fully remove the line and the greater onshore scope associated with the returned line. There are differences in the risk exposure associated with the partial removal options, but these differences are considered minor and insufficient to express a preference within these options.

Against the Other Users criterion, all options are equally preferred as, while there are differences in the number of days of vessel operations and transits to / from the field across the options, these differences are considered insufficient to express a preference from a safety impact on other users' perspective.

Against the High Consequence Events criterion, Option 4A (rock placement over problem areas) and Option 5 (remove line ends only) are equally preferred over Option 2C (full removal) as the potential for High Consequence Events from dropped object from the limited offshore lifting in Option 4A and Option 5 to deploy and recover cutting equipment and line ends is considered lower than the potential from the residual torsion in the line during offloading (reeling) to the quayside.

Against the Legacy Risk criterion, the full removal option is preferred over the other options as there is no legacy risk associated with the full removal of the line. Option 4A is less preferred as the line remains in-situ, albeit with the problem areas rock covered. Option 5 is the least preferred option due to existing areas of spans, exposure and shallow burial remaining. All partial removal options also have an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 4A is equally preferred from an Operations Personnel, impact on Other Users and High Consequence Events perspective. It is marginally less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 4A from a Safety perspective.

15.7.2 Environment

Against the Operational Marine Impact criterion, all options are equally preferred as the differences in the environmental impacts across the options are minor, and insufficient to express a preference.

Against the Atmospheric Emissions and Fuel Use criterion, all options are equally preferred. There are differences in the emissions generated and fuel used across the options, however these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, all options are equally preferred as, while there are differences in environmental impact from recycling returned material or generating replacement material for the lines left in-situ, and in the rock consumed across the options, these differences are considered minor and insufficient to express a preference within these options.

Against the Seabed Disturbance criterion, Option 4A (rock cover over problem areas and Option 5 (remove line ends only) are equally preferred over Option 2C (full removal). This is due to the limited area impacted by the small amount of rock cover introduced in Option 4A and Option 5 versus the much larger area of seabed impacted by the de-burial operations to enable the line to be fully removed in Option 2C, although it is recognised that the impact will be temporary in nature.

Against the Legacy Marine Impact criterion, Option 2C (full removal) is preferred as there are no legacy marine impacts associated with these lines being fully removed. All partial removal options are considered to present a similar and minor legacy marine impact.

Option 2C is the preferred option from a Legacy Marine Impact perspective and equally preferred from an Operational Marine Impact, Atmospheric Emissions and Fuel Use and Other Users perspective. It is marginally less preferred that the other options from a Seabed Disturbance perspective but overall, there remains a preference for Option 2C from an Environmental perspective. This preference is very marginal over the other options.

15.7.3 Technical

Against the Technical criterion, Option 4A (rock placement over problem areas) and Option 5 (remove line ends only) are equally preferred. While all options employ relatively routine operations such as de-burial, line cutting and rock cover, there are challenges associated with Option 2C (reverse reeling) due to the de-burial of the existing rock cover to enable full removal along 22 km of line.

15.7.4 Societal

Against the Societal – Fishing criterion, Option 2C (full removal) is preferred over the other options as, while there will be disruption to fishing operations from the removal of the line, a clear seabed is preferred from a fishing operations perspective.

Against the Societal – Other Users criterion, all options are equally preferred as the positive and negative societal impacts are largely insignificant across all options due to the limited scope of returned material associated with the single, 10-inch, 22 km line in this group.

As Option 2C (full removal) is preferred over the other options from a Fishing perspective and equally preferred from an Other Users perspective, overall, there is a preference for Option 2C from a Societal perspective.



15.7.5 Economic

Against the Short-term Costs criterion, Option 4A (rock placement over problem areas) and Option 4C (remove problem areas) are equally preferred over the other options. This is due to the costs to execute these options being similar (£1.5 million and £1.2 million respectively) and much less than Option 2C (full removal - £6.6 million).

Against the Long-term Costs criterion, all options are equally preferred. While there are no long-term costs associated with the full removal option, the long-term costs associated with the survey and monitoring of the line left in-situ in the partial removal options are minor (less than £1 million) and would be spread out over many years. As such, the differences between the options are insufficient to express a preference.

As Option 4A and Option 4C are equally preferred from both a Short-term Costs and Long-term Costs perspective, overall, Option 4A and Option 4C are equally preferred from an Economic perspective.

15.7.6 Group 8 Recommendations

The recommended decommissioning option for Group 8 – Rigid Pipelines (Surface Laid and Rock Covered) is Option 4A – Rock Placement over areas of Spans / Exposures / Shallow Burial. This option involves the following key activities:

- Pipeline will be disconnected
- Removal and recovery of exposed line ends to existing rock cover
- Rock placement to remediate snag risk from cut ends
- Rock placement at all areas of spans, exposure and shallow burial to an appropriate depth of cover
- Future survey & monitoring programme



15.8 Group 9 Discussion

The following sections provide a discussion of the evaluation of the five most viable Group 9 – Rigid Pipelines (Trenched and Buried) decommissioning options (Option 2C – Full Removal by Reverse Installation (Reeling) with Deburial, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial, Option 4B – Trench and Bury areas of Spans / Exposure / Shallow Burial, Option 4C – Remove areas of Spans / Exposure / Shallow Burial) and Option 5 – Remove Line Ends and Remediate Snag Risk) against the five criteria.

15.8.1 Safety

Against the Operations Personnel criterion, Option 5 (remove line ends only) is preferred over the other options as it has the lowest offshore and onshore scope of all options and hence the lowest risk exposure. The other partial removal options are equally less preferred as, while there are differences in the scope and risk exposure across these options, the differences are considered minor and insufficient to express a preference within these options. Option 2C (full removal) is the least preferred option as the offshore and onshore scope to fully remove these lines is the greatest of all the options and hence carries the highest risk exposure.

Against the Other Users criterion, all partial removal options are equally preferred over the full removal option. This is due to the impact on the safety of other users expected to be marginally higher for the full removal option than the partial removal options. This marginally higher impact is due to the higher number of days of vessel operations and higher number of transits to / from the field to execute the full removal option. The safety impact on other users is similar across the partial removal options.

Against the High Consequence Events criterion, Option 2C (full removal, Option 4A (rock placement over problem areas), Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred over Option 4C (remove problem areas). This is due to Option 4C having more offshore lifting operations to cut and recover the problem areas of the lines presenting the greatest potential for dropped object. The offshore lifting is similar in Option 4A, Option 4B and Option 5. There is less offshore lifting associated with Option 2C as the full removal of the lines is performed using reverse reeling techniques, however there is the potential for High Consequence associated with the potential residual torsion in the rigid lines during offloading (reeling) to the quayside.

Against the Legacy Risk criterion, the full removal option is preferred over the other options as there is no legacy risk associated with the full removal of the line. Option 4B (trench and bury problem areas) and Option 4C (remove problem areas) are less preferred as the lines remain in-situ, albeit with the problem areas trenched or removed thus presenting a largely clear seabed. Option 4A (rock placement over problem areas) is less preferred again as the lines remain in-situ, albeit with the problem areas) as the lines remain in-situ, albeit with the problem areas of spans, exposure and shallow burial remaining. All partial removal options also have an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 4B is the equally preferred option from an impact on Other Users and High Consequence Events perspective. It is marginally less preferred from an Operations Personnel and Legacy Risk perspective however, overall, there remains a preference for Option 4B from a Safety perspective.



15.8.2 Environment

Against the Operational Marine Impact criterion, all partial removal options are equally preferred over Option 2C (full removal). This is due to the greater noise impact from the longer durations that vessels are on-site and the de-burial operations. It is noted that, while there is a preference for the partial removal operations, that preference is marginal as the greater noise impact is minor. There is an additional preference for the partial removal options due to the discharge of line contents in one location from reverse reeling. Again, the preference is minor as the lines are cleaned and flushed prior to removal meaning any discharges will have a minor environmental impact.

Against the Atmospheric Emissions and Fuel Use criterion, all partial removal options are equally preferred over Option 2C (full removal). This is due to the increased emissions generated and fuel used from the extended offshore scope in the full removal option. There are differences in the emission generated and fuel used across the partial removal options, however these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, Option 2C (full removal), Option 4B (trench and bury problem areas), Option 4C (remove problem areas) and Option 5 (remove line ends only) are equally preferred. While there are differences in the impact associated with recycling material returned or generating replacement material for the lines left in-situ, these differences are insufficient to express a preference within these options. Option 4A (rock cover over problem areas) is the least preferred option due to the greater quantity of rock required in this option.

Against the Seabed Disturbance criterion, Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred as, while there is a moderate area of seabed impacted by the trenching operations, the impact is temporary in nature. There is also a minor area of seabed disturbance associated with the rock cover introduced in these options over cut line ends which is a permanent habitat change. Option 4C (remove problem areas) is less preferred due to the larger area of permanent habitat change from the rock cover introduced over cut locations when removing problem areas. Option 2C (full removal) is marginally less preferred again as the area impacted from the de-burial operations over these lines is much greater although, again, this is temporary in nature. Finally, Option 4A (rock placement over problem areas) is the least preferred option as the area of permanent habitat change from rock covering problem areas has the greatest impact of all options.

Against the Legacy Marine Impact criterion, Option 2C (full removal) is preferred as there are no legacy marine impacts associated with these lines being fully removed. Option 4A (rock cover over problem areas), Option 4B (trench and bury problem areas) and Option 4C (remove problem areas) are less preferred as there will be slow discharges and degradation products from these lines remaining in-situ, although these will occur over a long time period and as such, their legacy environmental impact is expected to be minor, especially given these lines will be isolated from the marine environment. Option 5 (remove line ends only) is the least preferred option as any discharges and degradation products will occur over a shorter time period than the other options as the areas of existing spans and exposure will remain and are exposed to the marine environment. The legacy environmental impact is still expected to be minor.

Option 4B is the equally preferred option from an Operational Marine Impact, Atmospheric Emissions and Fuel Use, Other Consumptions and Seabed Disturbance perspective. It is less preferred than the full removal option from a



Legacy Marine Impact perspective but overall, there remains a preference for Option 4B from an Environmental perspective.

15.8.3 Technical

Against the Technical criterion, Option 4A (rock placement over problem areas), Option 4C (remove problem areas) and Option 5 (remove line ends only) are equally preferred. While all options employ relatively routine operations such as de-burial, line cutting, trenching and rock cover, there are challenges associated with Option 4B (trench and bury of problem areas) due to the geotechnical conditions in this location and challenges in successfully trenching areas of spans, exposure and shallow burial. There are also challenges associated with Option 2C (reverse reeling) due to de-burial and reeling required on the 115 km of lines in this group presenting technical challenges on a cumulative basis.

15.8.4 Societal

Against the Societal – Fishing criterion, Option 2C (full removal) is preferred over the other options as, while there will be significant disruption to fishing operations from the removal of the lines, a clear seabed is preferred from a fishing operations perspective.

Against the Societal – Other Users criterion, all options are equally preferred as, while there are societal benefits of returning the steel for recycling in the full removal option, this is offset by the quantity of polymer returned, which is likely to take up limited landfill capacity on shore.

As Option 2C (full removal) is preferred over the other options from a Fishing perspective and equally preferred from an Other Users perspective, overall, there is a preference for Option 2C from a Societal perspective.

15.8.5 Economic

Against the Short-term Costs criterion, all partial removal options are equally preferred over the full removal option as, while there are differences in the costs to execute these options (ranging from £3.7 million to £6 million), these differences are considered insufficient to express a preference. The full removal option (£29.9 million) is significantly more expensive.

Against the Long-term Costs criterion, Option 2C is marginally preferred as there are no long-term costs associated with the full removal option whereas all partial removal options have long-term costs associated with the survey and monitoring of the lines left in-situ. While these costs are relatively modest (between £1.6 million and £1.9 million) and would be spread over many years, they are sufficient to express a small preference for the full removal option.

As all partial removal options are equally preferred from a Short-term Costs and only marginally less preferred from a Long-term Costs perspective, overall, all removal options are equally preferred from an Economic perspective.



15.8.6 Group 9 Recommendations

The recommended decommissioning option for Group 9 – Rigid Pipelines (Trenched and Buried) is Option 4C – Removal of areas of Spans / Exposures / Shallow Burial. This option involves the following key activities:

- Pipelines will be disconnected
- Removal and recovery of line ends including trench transitions
- Removal (by cut and lift) of all areas of spans, exposure and shallow burial
- Rock placement to remediate snag risk from cut ends
- Future survey & monitoring programme



15.9 Group 16 Discussion

The following sections provide a discussion of the evaluation of the two most viable Group 16 – Blocked Rigid Pipeline (Trenched and Buried) decommissioning options (Option 2A – Full Removal by Cut and Lift and Option 5 – Remove Line Ends and Remediate Snag Risk) against the five criteria.

15.9.1 Safety

Against the Operations Personnel criterion, Option 5 (remove line ends only) is preferred over Option 2A (full removal) due to the greater risk exposure associated with the greater scope to fully remove the line and the greater onshore scope associated with the returned line.

Against the Other Users criterion, both options are equally preferred as, while there are differences in the number of days of vessel operations and transits to / from the field across the options, these differences are considered insufficient to express a preference from a safety impact on other users' perspective.

Against the High Consequence Events criterion, Option 5 (remove line ends only) is preferred over Option 2A (full removal) due to the higher number of offshore lifting operations to recover the full line.

Against the Legacy Risk criterion, the full removal option is preferred over Option 5 (remove line ends only) as there is no legacy risk associated with the full removal of the line whereas the line will remain in-situ in Option 5, albeit fully trenched and buried. Option 5 also have an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 5 is the preferred option from an Operations Personnel and High Consequence Events perspective. It is equally preferred from an impact on Other Users perspective. It is less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 5 from a Safety perspective.

15.9.2 Environment

Against the Operational Marine Impact criterion, Option 5 (remove line ends only) is preferred over Option 2A (full removal). This is due to the greater noise impact from the longer durations that vessels are on-site and the de-burial and cutting operations. There is an additional preference for Option 5 due to the discharges of line contents at each cut location in Option 2A. As the line in this group is blocked, it will not be able to be flushed and cleaned prior to removal. As such, the discharges at each cut location will have a greater impact, with the maximum residual contents being identified as 0.4 m³ of oil, 10.3 m³ of water and 17.9 m³ of gas totalling 28.3 m³ of discharges. The environmental impact of these discharges will be minor but are sufficient to express a preference for Option 5.

Against the Atmospheric Emissions and Fuel Use criterion, both options are equally preferred as, while there are differences in the emission generated and fuel used across the options, these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, both option are equally preferred as the differences in the impact associated with recycling material returned or generating replacement material for the line left in-situ and any rock required are negligible.

Against the Seabed Disturbance criterion, Option 5 (remove line ends only) is marginally preferred over the full removal option. There is a small area of permanent habitat change from the rock introduced over the cut line ends in Option 5, however the larger area of, albeit temporary impact, from the de-burial operations in Option 2A is less preferred.

Against the Legacy Marine Impact criterion, Option 2A (full removal) is preferred as there are no legacy marine impacts associated with the line being fully removed. Option 5 (remove line ends only) is less preferred as there will be discharges and degradation products from these lines left in-situ, although these will occur over a long time period. Again, as the line in this group is blocked, it will not be able to be flushed and cleaned prior to removal. As such, the discharges that occur will be the maximum residual contents which are identified as 0.4 m³ of oil, 10.3 m³ of water and 17.9 m³ of gas totalling 28.3 m. The legacy environmental impact is still expected to be minor.

Option 5 is the preferred option from an Operational Marine Impact and Seabed Disturbance perspective and equally preferred from an Atmospheric Emissions and Fuel Use and Other Consumptions perspective. It is less preferred than the full removal option from a Legacy Marine Impact perspective but overall, there remains a preference for Option 5 from an Environmental perspective.

15.9.3 Technical

Against the Technical criterion, both options are equally preferred as they employ relatively routine operations and the scale of operations, while greater for Option 2A (full removal) is not sufficiently greater on this 1.6 km line to express a preference from a potential for greater technical risk on a cumulative basis perspective.

15.9.4 Societal

Against the Societal – Fishing criterion, both options are equally preferred, while the line is removed in Option 2A (full removal) the line that remains in-situ in Option 5 (remove line ends only) will be fully trenched and buried and as such, both options present a clear seabed. In addition, the line is this group is short (1.6 km) thus any line left in-situ will present a minimal impact on fishing operations, should it become de-buried in the future.

Against the Societal – Other Users criterion, both options are equally preferred as they are assessed to have similar, minimal societal benefits / impacts.

As both options are equally preferred from a Fishing perspective and an Other Users perspective, overall, both options are preferred from a Societal perspective.



15.9.5 Economic

Against the Short-term Costs criterion, both options are equally preferred as, while there are differences in the costs to execute these options (ranging from \pounds 1 million to \pounds 1.8 million), these differences are considered insufficient to express a preference.

Against the Long-term Costs criterion, both options are equally preferred. While there are no long-term costs associated with the full removal option, the long-term costs associated with the survey and monitoring of the line left in-situ in the partial removal option are minor (less than £1 million) and would be spread out over many years. As such, the differences between the options are insufficient to express a preference.

As both options are equally preferred from both a Short-term Costs and Long-term Costs perspective, overall, both options are equally preferred from an Economic perspective.

15.9.6 Group 16 Recommendations

The recommended decommissioning option for Group 16 – Blocked Rigid Pipeline (Trenched and Buried) is Option 5 – Remove Line Ends Only and Remediate Snag Risk. This option involves the following key activities:

- Pipeline will be disconnected
- Removal and recovery of line ends including trench transition
- Rock placement to remediate snag risk from cut ends
- Future survey & monitoring programme



15.10 Group 17 Discussion

The following sections provide a discussion of the evaluation of the four most viable Group 17 – In-Use Rigid Pipelines (Trenched and Partially Buried) decommissioning options (Option 2A – Full Removal by Cut and Lift, Option 3A – Rock Cover Entire Lines, Option 3B – Trench and Bury Entire Line) and Option 5 – Remove Line Ends and Remediate Snag Risk) against the five criteria.

15.10.1 Safety

Against the Operations Personnel criterion, Option 3B (trench and bury problem areas) is preferred over the other options as it has the lowest offshore and onshore scope of all options and hence the lowest risk exposure. The other partial removal options are less preferred as the offshore scope to rock cover the entirety of the lines in Option 3A or to remove line ends only in Option 5 is greater. Option 2A (full removal) is the least preferred option as the offshore and onshore scope to fully remove these lines is the greatest of all the options and hence carried the highest risk exposure.

Against the Other Users criterion, Option 3B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred. This is due the impact on the safety of other users expected to be marginally higher for the Option 2A (full removal) and Option 3A (rock placement over entirety of lines) due to the higher number of days of vessel operations and higher number of transits to / from the field to execute these options.

Against the High Consequence Events criterion, Option 3A (rock placement over entirety of lines) and Option 3B (trench entirety of lines) are equally preferred as Option 3A has no offshore lifting operations and Option 3B has limited offshore lifting relating to deployment and recovery of trenching equipment to perform trenching and burial of the lines. Option 5 is marginally less preferred as the is greater offshore lifting and hence potential for dropped object from the deployment and recovery of cutting equipment and recovery of the line ends. Option 2A is the least preferred option due to the high number of offshore lifting operations associated with the deployment and recovery of the cutting equipment and the recovery of approximately 22 km of lines in 10 m sections.

Against the Legacy Risk criterion, the full removal option is preferred over the other options as there is no legacy risk associated with the full removal of the line. Option 3A (rock placement over entirety of lines) and Option 3B (trench entirety of lines) are equally less preferred as the lines remain in-situ, albeit with rock cover over the lines to the top of the existing trench or lines fully trenched and buried. Option 5 is the least preferred option due to existing areas of spans, exposure and shallow burial remaining. All partial removal options also have an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.

Option 3B is the preferred option from an Operations Personnel perspective and equally preferred from an impact on Other Users and High Consequence Events perspective. It is marginally less preferred from a Legacy Risk perspective however, overall, there remains a preference for Option 3B from a Safety perspective.



15.10.2 Environment

Against the Operational Marine Impact criterion, all partial removal options are equally preferred over Option 2A (full removal). This is due to the greater noise impact from the longer durations that vessels are on-site and the longer duration de-burial and cutting (with DWC) operations. It is noted that, while there is a preference for the partial removal operations, that preference is marginal as the greater noise impact is minor. There is an additional preference for the partial removal options due to the discharges of line contents that occur at each cut location in the full removal option, but again, the impacts are minor.

Against the Atmospheric Emissions and Fuel Use criterion, all partial removal options are equally preferred over Option 2A. This is due to the increased emissions generated and fuel used from the extended offshore scope in the full removal option. There are differences in the emission generated and fuel used across the partial removal options, however these differences are considered minor and insufficient to express a preference within these options.

Against the Other Consumptions criterion, Option 3A (rock placement over entirety of lines) is less preferred than all other options, which are equally preferred. This is due to the large quantity of rock required to deliver Option 3A whereas the rock required in the other options is either negligible or zero. The environmental impact from recycling returned material or generating replacement material for the lines left in-situ is largely similar across all options.

Against the Seabed Disturbance criterion, Option 5 (remove line ends only) is preferred as there is small area of seabed disturbance associated with the rock cover introduced over the cut line ends in this option, which is a permanent habitat change. Option 2A (full removal) and Option 3B (trench entirety of lines) are less preferred due to much larger area impacted by de-burial operations in Option 2A and trenching operations in Option 3B, although these impacts are temporary in nature. Option 3A (rock placement over entirety of lines) is the least preferred option as the area of permanent habitat change from rock covering the lines has the greatest impact of all options.

Against the Legacy Marine Impact criterion, Option 2A (full removal) is preferred as there are no legacy marine impacts associated with these lines being fully removed. Option 3A (rock placement over entirety of lines) and Option 3B (trench entirety of lines) are less preferred as there will be slow discharges and degradation products from these lines remaining in-situ, although these will occur over a long time period and as such, their legacy environmental impact is expected to be minor, especially given these lines will be isolated from the marine environment. Option 5 (remove line ends only) is the least preferred option as any discharges and degradation products will occur over a shorter time period than the other options as the areas of existing spans and exposure will remain and are exposed to the marine environment. The legacy environmental impact is still expected to be minor.

Option 5 (remove line ends only) is the equally preferred option from an Operational Marine Impact, Atmospheric Emissions and Fuel Use, Other Consumptions and Seabed Disturbance perspective. It is the least preferred option from a Legacy Marine Impact perspective however, overall, there remains a preference for Option 5 from an Environmental perspective.

15.10.3 Technical

Against the Technical criterion, Option 3A (rock placement over entirety of lines), Option 3B (trench entirety of lines) and Option 5 (remove line ends only) are equally preferred. While all options employ relatively routine operations such as de-burial, line cutting, trenching and rock cover, there are challenges associated with Option 2A (cut and lift) due to de-burial, cut and lift operations over the 20 km of lines in this group presenting technical challenges on a cumulative basis.

15.10.4 Societal

Against the Societal – Fishing criterion, Option 2A (full removal) is preferred over the other options as, while there will be significant disruption to fishing operations from the removal of the lines, a clear seabed is preferred from a fishing operations perspective.

Against the Societal – Other Users criterion, all options are equally preferred as the positive and negative societal impacts are largely insignificant across all options due to the limited scope of returned material associated with the two lines (6-inch, 10 km and 8-inch, 10 km) in this group.

As Option 2A (full removal) is preferred over the other options from a Fishing perspective and equally preferred from an Other Users perspective, overall, there is a preference for Option 2A from a Societal perspective.

15.10.5 Economic

Against the Short-term Costs criterion, Option 3B (trench entirety of lines) and Option 5 (remove line ends only) are equally preferred over the other options. This is due to the costs to execute these options being similar (£2.5 million and £1.6 million respectively) and around half the cost of Option 3A (rock placement over entirety of lines - £4.8 million). They are also much less than Option 2A (full removal - £12.8 million).

Against the Long-term Costs criterion, all options are equally preferred. While there are no long-term costs associated with the full removal option, the long-term costs associated with the survey and monitoring of the line left in-situ in the partial removal options are minor (less than £1 million) and would be spread out over many years. As such, the differences between the options are insufficient to express a preference.

As Option 3B and Option 5 are equally preferred from both a Short-term Costs and Long-term Costs perspective, overall, Option 3B and Option 5 are equally preferred from an Economic perspective.

15.10.6 Group 17 Recommendations

The recommended decommissioning option for Group 17 – In-Use Rigid Pipelines (Trenched and Partially Buried) is Option 3B – Trench and Bury Entirety of Line. This option involves the following key activities:

• Pipelines will be disconnected



- Trench / re-trench and bury full length of the lines to remove areas of spans, exposure and shallow burial
- Future survey & monitoring programme



15.11 Group 18 Discussion

The following sections provide a discussion of the evaluation of the five most viable Group 18 – Uncertain Integrity and Concrete Coated Rigid Pipelines (Trenched and Buried) decommissioning options (Option 2A – Full Removal by Cut and Lift, Option 4A – Rock Placement over areas of Spans / Exposure / Shallow Burial, Option 4B – Trench and Bury areas of Spans / Exposure / Shallow Burial, Option 4C – Remove areas of Spans / Exposure / Shallow Burial) and Option 5 – Remove Line Ends and Remediate Snag Risk) against the five criteria.

15.11.1 Safety

Against the Operations Personnel criterion, Option 5 (remove line ends only) is the preferred option. It is marginally preferred over Option 4B (trench and bury problem areas) as the scope to trench the problem areas is higher and therefor presents a marginally higher risk exposure. Option 5 is further preferred over Option 4A (rock placement over problem areas) as the scope to rock cover the problem areas and recover line ends is higher again. Option 4C (remove problem areas) is less preferred again due to the further increase in scope and risk exposure to remove the problem areas of the lines. Option 2A (full removal) is the least preferred option as the scope to fully remove these lines is the greatest and thus has the highest risk exposure of all options. There is also a greater onshore scope associated with the returned lines.

Against the Other Users criterion, Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred over the other options. This is due the impact on the safety of other users expected to be lower in these options as they have a lower number of days of vessel operations and transits to / from the field than the other options. Option 4A (rock placement over problem areas) is less preferred due the higher number of days of vessel operations and transits to / from the field. Option 4C (remove problem areas) is less preferred again due to the much higher number of vessel days of operations. Option 2A (full removal) is the least preferred option as there are a much higher number of vessel days of operations and transits to / from the field in the full removal option.

Against the High Consequence Events criterion, Option 4A (rock placement over problem areas), Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred as there are less offshore lifting operations (deployment and recovery of cutting and trenching equipment and recovery of line end sections) than the other options. Option 4C (removal of problem areas) is less preferred as there is a large number (thousands) of offshore lifting operations associated with the deployment and recovery of cutting equipment and the recovery of sections of the lines. Option 2A is the least preferred option due to the very high number of offshore lifting operations (tens of thousands) associated with the deployment and recovery of the cutting equipment and the recovery of approximately 189 km of lines in 10 m sections.

Against the Legacy Risk criterion, the full removal option is preferred over the other options as there is no legacy risk associated with the full removal of the lines. All other options are less preferred as the lines remain in-situ, albeit with the problem areas rock covered in Option 4A, trenched in Option 4B or removed in Option 4C. Option 5 is the least preferred option due to existing areas of spans, exposure and shallow burial remaining. All partial removal options also have an associated legacy risk exposure from the future survey and monitoring to mitigate future snag risk of the lines left in-situ.



Option 4B is the equally preferred option from an Other Users and High Consequence Events perspective. It is marginally less preferred (to Option 5) from an Operations Personnel perspective. While it is less preferred from a Legacy Risk perspective, overall, there remains a preference for Option 4B from a Safety perspective.

15.11.2 Environment

Against the Operational Marine Impact criterion, Option 4A (rock placement over problem areas), Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred. Option 4C (remove problem areas) is less preferred due to the greater noise impact from the longer durations that vessels are on-site and the longer duration cutting operations (with DWC) to remove the problem areas. Option 2A (full removal is less preferred again due to the impact from the even longer durations that vessels are on-site and the longer duration de-burial and cutting operations (with DWC) to fully remove the lines.

Against the Atmospheric Emissions and Fuel Use criterion, Option 4A (rock placement over problem areas), Option 4B (trench and bury problem areas) and Option 5 (remove line ends only) are equally preferred. Again, Option 4C remove problem areas) is less preferred as the longer duration operations results in greater emissions. Option 2A (full removal) is least preferred as the even longer duration operations results in the greatest emissions of all options.

Against the Other Consumptions criterion, Option 2A (full removal) is marginally preferred over Option 4B (trench and bury problem areas) as the environmental impact from recycling returned material in Option 2A is smaller than the impact associated with generating replacement material for the lines left in-situ in Option 4B. Option 5 (remove line ends only) is less preferred for similar reasons and incudes a requirement for a moderate quantity of rock. Option 4C (remove problem areas) is less preferred again, due to the greater quantity of rock required over the cut ends when removing problem areas. Option 4A (rock placement over problem areas) is the least preferred option as it has a much higher rock requirement than any of the other options.

Against the Seabed Disturbance criterion, Option 5 (remove line ends only) is the preferred option as it has the smallest area of seabed impact, although, as this is from rock introduced over cut line ends, this represents a permanent habitat change. Option 4B (trench and bury problem areas) is less preferred as there is a much larger area impacted by the trenching operations, although this is offset by the impact being temporary in nature. Option 2A (full removal) is less preferred again, due to it having the largest area of impact from the de-burial operations to allow full removal of the lines. Again, this impact is offset by it being temporary in nature. Option 4C (remove problem areas) is less preferred again, as while the area impacted is smaller than in Option 4B and Option 2A, it is a significant area of permanent habitat change. Option 4A (rock placement over problem areas) is the least preferred option as it has significant area of permanent habitat change from the rock cover introduced.

Against the Legacy Marine Impact criterion, Option 2A (full removal) is preferred as there are no legacy marine impacts associated with these lines being fully removed. All other options are less preferred as there will be slow discharges and degradation products from these lines remaining in-situ, although these will occur over a long time period and as such, their legacy environmental impact is expected to be minor, especially given these lines will be isolated from the marine environment. Option 5 (remove line ends only) is the least preferred option as any discharges and degradation products will occur over a shorter time period than the other options as the areas of existing spans and exposure will remain and are exposed to the marine environment. The legacy environmental impact is still expected to be minor.



Option 4B is the equally preferred option from an Operational Marine Impact and Atmospheric Emissions and Fuel Use perspective. While it is less preferred from an Other Consumptions, Seabed Disturbance Legacy Marine Impact perspective, overall, there remains a preference for Option 4B from an Environmental perspective.

15.11.3 Technical

Against the Technical criterion, Option 5 (remove line ends only) is preferred. While all options employ relatively routine operations such as de-burial, line cutting, trenching and rock cover, Option 4B (trenching of problem areas) and Option 4C are less preferred due to the increased scope over Option 5 leading to greater technical challenges on a cumulative basis. Option 2A (cut and lift) is least preferred due to de-burial, cut and lift operations over the 189 km of lines in this group presenting the greatest technical challenges on a cumulative basis.

15.11.4 Societal

Against the Societal – Fishing criterion, Option 2A (full removal) is preferred over the other options as, while there will be significant disruption to fishing operations from the removal of the lines, a clear seabed is preferred from a fishing operations perspective.

Against the Societal – Other Users criterion, Option 2A is also preferred over the partial removal options. This is due to the societal benefits of returning the steel for recycling in the full removal option. The benefit of this is tempered by the quantity of concrete and polymer returned which is likely to end up in landfill. All partial removal options have similar, minimal societal benefits / impacts.

As Option 2A (full removal) is preferred over the other options from both a Fishing perspective and from an Other Users perspective, overall, there is a preference for Option 2A from a Societal perspective.

15.11.5 Economic

Against the Short-term Costs criterion, Option 5 (remove line ends only) is preferred over the other options. This is due to the costs to execute this option (\pounds 8.9 million) being less than the cost of next lowest option (Option 4A – rock placement over problem areas - \pounds 21.2 million) and less again than the other options.

Against the Long-term Costs criterion, Option 2A is marginally preferred as there are no long-term costs associated with the full removal option whereas all partial removal options have long-term costs associated with the survey and monitoring of the lines left in-situ. While these costs are relatively modest (between £2.1 million and £2.7 million) and would be spread over many years, they are sufficient to express a small preference for the full removal option.

As Option 5 is preferred from a Short-term Costs and only marginally less preferred from a Long-term Costs perspective, overall, Option 5 is preferred from an Economic perspective.



15.11.6 Group 18 Recommendations

The recommended decommissioning option for Group 18 – Uncertain Integrity and Concrete Coated Rigid Pipelines (Trenched and Buried) is Option 5 – Remove Line Ends Only and Remediate Snag Risk. This option involves the following key activities:

- Pipelines will be disconnected
- Removal and recovery of line ends including trench transition
- Rock placement to remediate snag risk from cut ends
- Future survey & monitoring programme. 128 spans are identified across the group, of which only three are classed as FishSafe spans (exceeding 10 m long and 0.8 m high) and all of those are located at the pipelines ends which will be removed. The remaining mid-line exposures and spans will be surveyed and monitored on a regular basis. Should the survey and monitoring programme provide evidence of an increase in the level of potential risk (from snagging), the areas of concern shall be remediated on a case-by-case basis.



APPENDIX A EVALUATION METHODOLOGY

A.1 CA Evaluation Methodology

TAQA 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. [10]. 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 during 2019 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 criterion 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 ref. [9]. 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 days, 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 HAZID ref. [7] is conducted to identify activities associated with the decommissioning options that have potential for High Consequence Events. This is a qualitative assessment.

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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.	A HAZID ref. [7] is conducted to identify areas of potential legacy risk associated with the decommissioning options.
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. [12] 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.

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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.Assessment of imp is a qualitative nar both positive and of the decommiss and general comr Tonnage and type	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. TAQA decided that equal weightings offer the most transparency and a balanced view from all perspectives.

Primary Criteria	l. Safety	2. Environmental	3. Technical	4. Societal	5. Economic	Weighting
1. Safety	N	Z	N	Z	z	20.0%
2. Environmental	N	N	N	N	Я	20.0%
3. Technical	N	N	N	z	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, F, G, H, I, J, K, L and M the completed Attributes Tables for Groups 1, 2, 3, 4, 6, 7, 8, 9, 16, 17 and 18 respectively.

Any additional discussion around the relative merits of the options was also recorded in the attributes table. 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, TAQA 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

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

Using this transposed scoring system made it simpler and, more importantly, more effective at capturing the mindset 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.

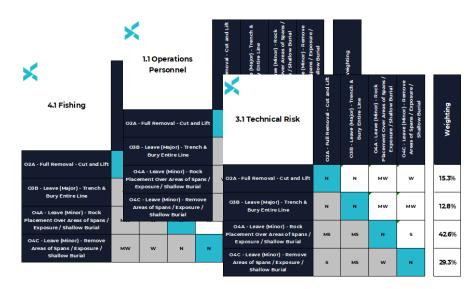


Figure A.3 - Example Option Pairwise Comparison

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, F, G, H, I, J, K, L and M. An example of the visual output obtained is shown in the Figure below.

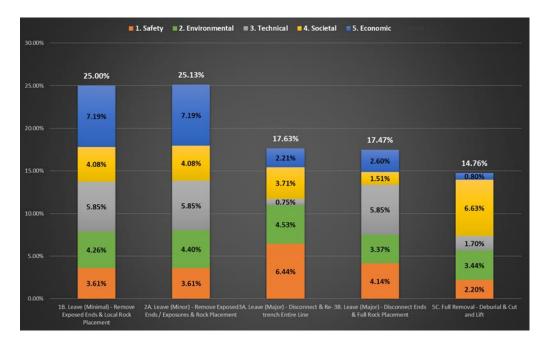


Figure A.4 - Visual Output Example

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: TAQA Northern North Sea Subsea Comparative Assessment Evaluation Workshop Location: Video Conference Date: 30th June 2021 Reference: A-30259-S00-MINS-001 Minuted By: Nic Duncan

Issued On: 5th July 2021

Attending:

Andrew Third	SFF	Offshore Industry Liaison
Ruth Ledingham	BEIS	Senior Decommissioning Manager
Caitlyn Cox	BEIS	Decommissioning Manager
Sam Pattie	BEIS	Assistant Decommissioning Manager
Hywel Williams	HSE	Pipelines Inspector
Niki Piesinger	JNCC	Offshore Industry Advisor
Tetrienne Kerswell-Box	JNCC	Offshore Industries Advisor
Peter Cacela	OGA	Decommissioning Engineer (Strategy)
Louise Brown	SEPA	Principle Decommissioning Officer
Peter Lee	Fairfield	Decommissioning Manager
James Blackburn	Shell	UK Decom BOM
Allen Deans	BP	Commercial Advisor
Caroline Lawford	CNRL	Project Lead - Decommissioning
Alastair McLean	TAQA	Decommissioning Program Manager
Steve Sapp	TAQA	Decommissioning Manager – Subsea and Wells
Katie Lilford	TAQA	Decommissioning Stakeholder & Compliance Analyst
Robin Ritchie	TAQA	Decommissioning Subsea Engineer
Mik Crosby	TAQA	Senior Pipeline Engineer
David Holland	TAQA	HSE Manager
Alan Campbell	TAQA	Area Manager Tern, Eider and North Cormorant
John Taylor	TAQA	Subsea TA
Kevin Barrie	TAQA	Production Optimisation Lead
Robbie Jones	TAQA	Senior Environmental Advisor
Iain Milne	TAQA	Marine Focal Point
Martin Rae	TAQA	Subsea Inspection Engineer
Nic Duncan	Xodus Group	Project Manager
John Foreman	Xodus Group	Senior Risk Analyst
Gareth Jones	Xodus Group	Decommissioning Manager
Jeff McCleary	Xodus Group	Senior Decommissioning Consultant

Distribution: Attendees



ITEM	COMMENT	ACTION			
1.0	Pre-Workshop Discussion				
1.1	 Due to time limitations, it has been proposed that a live review of five groups only would be conducted. The groups selected are considered to be representative of all of the infrastructure, these are: Group 2 Trunk Line – this line is unique within the infrastructure, and therefore will be reviewed within the workshop. Group 1 Pipe in Pipe Hybrids – the lines are a unique configuration within the infrastructure, and therefore will be reviewed within the vorkshop. Group 3 Flexibles and Umbilicals, Trenched and Buried – this is a large group considered to be representative of the flexibles and umbilicals across the infrastructure. Group 16 Blocked Rigid Pipeline, Trenched and Buried – this line is unique as it is the only blocked line within the infrastructure. Group 18 Uncertain Integrity or Concrete Coated Trenched and Buried Rigid Pipelines – this is a large group considered to be representative. 	Info			
2.0	Introductions and Background				
2.1	The session was opened by Alastair MacLean, TAQA Decommissioning Program Manager and Katie Lilford, TAQA Stakeholder and Compliance Analyst, who thanked the attendees for attending.				
2.2	Steve Sapp, TAQA Subsea and Wells Decommissioning Manager, provided an overview to the assets to be evaluated and the indicative scale of the lines under review.				
3.0	Environmental and Societal Baseline				
3.1	Gareth Jones, Xodus Decommissioning Manager, provided an overview of the environmental and societal base line against which the decommissioning shall be conducted. Details of the benthic environment, threatened and/or declining habitats and species as well as relevant conservation sites were described.				
3.2	The proximity of Special Protected Areas (SPAs) was explained, there are no SPAs directly affected by the infrastructure except for the inshore section of the PL4 trunk line which runs through the East Coast Mainland, Shetland SPA.				
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, the means by which the data was developed within the preparation phase to inform the evaluation and a summary of the options which would be considered within evaluation. Hywel Williams, HSE, re-iterated that the Pipeline Safety Regulations (PSR) should be followed with any decommissioning option considered. Specifically, the statement from Regulation 14: "(1) The operator shall ensure that a pipeline which has ceased to be used for the conveyance of any fluid is left in a safe condition.	Info			



ITEM	COMMENT	ACTI	ON				
	(2) The operator of a pipeline shall ensure that work done in discharge of the duty contained in paragraph (1) is performed safely."						
4.2	John Foreman, Xodus Senior Risk Analyst, explained the methodology behind the Info evaluation process.						
4.3	 Information provided to inform workshop attendees was as follows: Terms of Reference including the definition of sub-criteria applied within the evaluation; NNS Subsea Comparative Assessment Briefing Pack; Presentation slides (appended to these minutes). 						
5.0	Group 2: Trunk Line						
5.1	Infrastructure details						
	Eleid / Platform Description From Lo Pipeline No .	eline NB /) (inches)	Length (km)				
	Cormorant Alpha 36" Oil Pipeline Cormorant A Sullom Voe PL4	36	153.300				
5.2	 Options under consideration Three options were evaluated for this group: Full Removal Option 2A – Cut and Lift with De-burial Leave <i>In Situ</i> with Minor Intervention Option 4A – Rock Placement over Spans Option 4C – Remove Spans 	Info					
5.3	Evaluation						
5.3.1	Safety						
5.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised. It was clarified that this was only the first of four Safety sub-criteria that will be considered for each group.						
5.3.1.2	Other Users – The assessment conducted was presented with no challenge raised. David Holland, TAQA HSE Manager, queried whether Legacy Risk is covered elsewhere, clarification was provided that yes, Legacy Risk is covered separately.						
	High Consequence Events (HCE) – The assessment conducted was presented with no challenge raised. HCE were addressed via a HAZID process. Steve Sapp, TAQA, clarified that the HAZID used TAQA's corporate risk matrix to inform outcomes.						
5.3.1.3	challenge raised. HCE were addressed via a HAZID process. Steve Sapp, TAQA,)					
5.3.1.3	challenge raised. HCE were addressed via a HAZID process. Steve Sapp, TAQA,						
	challenge raised. HCE were addressed via a HAZID process. Steve Sapp, TAQA, clarified that the HAZID used TAQA's corporate risk matrix to inform outcomes. Legacy Risk – The assessment conducted was presented. A challenge was raised regards the preference to minimise further rock installation. Option 4A was changed from Weaker to Much Weaker against Option 4C. A query was raised by Andrew Third, SFF, regarding the potential height of rock berms over mid-line spans associated within Option 4A. This could be in the region	Info					



ITEM	COMMENT	ACTION
	Details of the spans on PL4 were requested by OPRED – this will be provided following the workshop.	TAQA
5.3.2	Environment	
5.3.2.1	Operational Marine Impacts – The assessment conducted was presented with no challenge raised. Gareth Jones, Xodus, noted that operations within the near shore area may impact on	Info
	seal haul out and that this should be considered within the assessment.	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. Clarification was requested by David Holland, TAQA, as to whether the CO ₂ associated with quarrying rock is included here. It is not, the boundaries stated are rock and CO ₂ associated with returned or replaced material.	Info
5.3.2.4	Seabed Disturbance – The assessment conducted was presented with no challenge raised. For Options 4A and 4C the quantity of rock associated with the East Coast Mainland SPA were provided.	Info
5.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no challenge raised.	Info
5.3.3	Technical	
5.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised.	Info
5.3.4	Societal	
5.3.4.1	Fishing – The assessment conducted was presented. In line with the Legacy Safety challenge regards the preference to minimise further rock installation. Option 4A was changed from Weaker to Much Weaker against Option 4C.	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. A query was raised by David Holland, TAQA, regarding how long the operator retains liability for infrastructure left <i>in situ</i> . It was clarified that this is in perpetuity. However, for the purposes of the CA a 30 year time horizon has been considered.	Info
5.3.6	Results	
5.3.6.1	Option 4A was identified as the emerging recommendation. It has received positive contributions from 1.1 – Operational Personnel, 1.2 – Other Users and 1.3 – HCE, 2.1 – Operational Marine Impact, 2.2 – Atmospheric Emissions and Fuel Consumption, 3.1 – Technical Risk, 4.2 – Other Users and 5.1 – Short Term	Info



ACTION

ITEM COMMENT

	Costs and is diminished by 1.4 – Legacy Risk, 2.3 – Other Consumptions, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts, 4.1 – Fishing and 5.2 – Long Term Costs. Steve Sapp, TAQA, stated that consideration will be given to taking a different approach for the near shore section given the difference from the offshore deeper section of the pipeline. John Foreman, Xodus, agreed that this result is only the emerging recommendation, and that further assessment will likely take place.	
5.3.6.2	A request was made by Ruth Ledingham, OPRED, for a copy of the Screening Report.	TAQA
5.3.6.3	The PL4 trunk line has been identified as having potential for re-use. The expectation is that the CA Report will fully document the consideration given to re-use options for PL4.	TAQA

6.0 Group 1: Trunk Pipe in Pipe Hybrids

6.1	Infrastructure details									
	Field / Platform	Description	From	То	Pipeline No.	Pipeline NB / OD (inches)	Length (km)			
	Central Cormorant UMC	26" Oil Pipe-in-Pipe Hybrid - East [1]	UMC	Cormorant A	PL167 (N1208)	26" (8")	3.345			
	Central Cormorant UMC	26" Oil Pipe-in-Pipe Hybrid - East [2]	UMC	Cormorant A	PL167 (N1208)	26" (8")	3.345			
	Central Cormorant UMC	26" Oil Pipe-in-Pipe Hybrid - West [1]	UMC	Cormorant A	PL210 (N1209)	26" (8")	3.343			
	Central Cormorant UMC	26" Oil Pipe-in-Pipe Hybrid - West [2]	UMC	Cormorant A	PL210 (N1209)	26" (8")	3.343			
	Central Cormorant UMC	24" Oil Pipe-in-Pipe Hybrid [1]	UMC	Cormorant A	PL168 (N1207)	24" (2 x 3")	3.345			
	Central Cormorant UMC	24" Oil Pipe-in-Pipe Hybrid [2]	UMC	Cormorant A	PL168 (N1207)	24" (2 x 3")	3.345			
	 Four options were evaluated for this group: Full Removal Option 2A – Cut and Lift with De-burial Leave <i>In Situ</i> with Major Intervention Option 3B – Trench and Bury Entire Line Leave <i>In Situ</i> with Minor Intervention Option 4A – Rock Placement over Spans Option 4C – Remove Spans 									
6.3	Evaluation									
6.3.1	Safety									
6.3.1.1	Operational Person raised.	nel – The assessment	conducted	was presented	l with no chal	lenge Info				
	A requirement was	identified to account	for remova	l of venting app	ourtenances	TAQA	4			
6.3.1.2	Other Users – The a	assessment conducted	d was prese	Other Users – The assessment conducted was presented with no challenge raised.						
6.3.1.3										



ITEM	COMMENT	ACTION
6.3.1.4	Legacy Risk – The assessment conducted was presented. In line with the challenge raised for Group 2 the preference for Option 3B over 4A and 4C was increased from Stronger to Much Stronger and for Option 4A against Option 4C from Neutral to Much Weaker.	Info
6.3.2	Environment	
6.3.2.1	Operational Marine Impacts – The assessment conducted was presented with no challenge raised.	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. The challenges associated with trenching large diameter lines was raised. It was clarified that this would be factored into the assessment under 3.1 Technical Risk.	Info
6.3.2.4	Seabed Disturbance – The assessment conducted was presented with no challenge raised.	Info
6.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no challenge raised.	Info
6.3.3	Technical	
6.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised. Further discussion regarding the challenges of trenching both large diameter lines and in this area where the soils have a significant clay content. A query was raised by David Holland, TAQA, regarding the feasibility of using hydraulic shears for cutting the lines. Steve Sapp, TAQA, responded that	Info
	consideration had been given to the technology available and that suitably large shears are available from a number of suppliers. A query was raised regarding the integrity of the carrier pipe to retain the inner pipes even with crimping of the ends by shear cutting. Ruth Ledingham, OPRED, highlighted that the expected base case is for a clear	Info Info
	seabed to be left. The discussion would be taken off-line where more detail can be provided. An action was taken to set up a meeting with OPRED to discuss further.	Info TAQA
6.3.4	Societal	
6.3.4.1	Fishing – The assessment conducted was presented. In line with the challenge raised for Group 2 the preference for Option 3B over 4A and 4C was increased from Stronger to Much Stronger and for Option 4A against Option 4C from Neutral to	
	Much Weaker. Andrew Third, SFF, advised that venting appurtenances as exist on the pipe in pipe	Info
	hybrids were shown not to be over-trawlable via trials performed on a bundle. Hywel Williams, HSE, highlighted that 'structures' would expect to be looked at	Info
	closely. Ruth Ledingham, OPRED, requested more information on such structures if they are	Info
	not being left for pipeline stabilisation purposes.	Info
	Hywel Williams, HSE, noted that TAQA has some very large structures.	Info



ITEM	COMMENT	ACTION
	An action was taken to update the method statements incorporating removal of the venting appurtenances for Options 4A and 4C.	TAQA
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 4A was identified as the emerging recommendation. It has received positive contributions from 1.1 – Operational Personnel, 1.3 – Other Users, 3.1 – Technical Risk and 5.1 – Short-Term Costs and is diminished by 1.4 – Legacy Risk, 2.3 – Other Consumptions, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts and 4.2 – Other Users. It is equally preferred for 1.2 – Other Users, 2.1 – Operational Marine Impact, 2.2 – Atmospheric Emissions and Fuel Consumption and 5.2 – Long Term Costs.	Info
7.0	Group 3: Flexibles and Umbilicals, Trenched and Buried	
7.1	Infrastructure details	

Central Cormorant UMC3" Oil 2 - TFLWell P1Cormorant APL118 (N0701)35.6Central Cormorant UMC3" Oil 1 - TFLWell P1Cormorant APL11835.6Central Cormorant UMC3" Oil 1 - TFLWell P1Cormorant APL11835.6UMC6" Water InjectionUMCWell W4PL155863.537UMCPipeline(N0927)(N0927)77Central Cormorant3" Umbilical - EastCormorant AUMCPL16937.669UMC03" Umbilical - WestCormorant AUMCPL16937.962UMC03" Umbilical - WestCormorant AUMCPL16937.962UMC000993.331.962UMC0000093.33UMC000093.33UMC0000037.69UMC00000037.69UMC00000037.69UMC00000037.69UMC00000000Central Cormorant0000000PelicanControl UmbilicalCormorant APelicanPL1083/89/90 <t< th=""><th></th><th>Field / Platform</th><th>Description</th><th>From</th><th>То</th><th>Pipeline No.</th><th>Pipeline NB / OD (inches)</th><th>Length (km)</th></t<>		Field / Platform	Description	From	То	Pipeline No.	Pipeline NB / OD (inches)	Length (km)
$\begin{array}{c c c c c c } UMC & UMC & UMC & Well W4 & PL1558 & 6 & 3.537 \\ UMC & Pipeline & UMC & Well W4 & PL1558 & 6 & 3.537 \\ (N0927) & (N0927) & (N0927) & (N0927) & (N0927) & (N0927) & (N0803) & (N0804) & (N0804) & (N0804) & (N0805) & (N080$	(3" Oil 2 - TFL	Well P1	Cormorant A	PL118 (N0701)		. ,
UMCPipeline(N0927)Central Cormorant3" Umbilical - EastCormorant AUMCPL16937.669UMC3" Umbilical - WestCormorant AUMCPL16937.962UMC0000000Central Cormorant3" UmbilicalUMCWell P5PL1308/PL3094.93.3UMC0000000Central Cormorant0000000UMC00000000Central Cormorant00000000UMC0000000000Central Cormorant000 <td>(</td> <td></td> <td>3" Oil 1 - TFL</td> <td>Well P1</td> <td>Cormorant A</td> <td></td> <td>3</td> <td>5.6</td>	(3" Oil 1 - TFL	Well P1	Cormorant A		3	5.6
UMC(N0803)Central Cormorant3" Umbilical - WestCormorant AUMCPL16937.962UMCCentral CormorantUmbilicalUMCWell P5PL308/PL3094.93.3UMCUMCWell V4PLU62274.93.845Central CormorantUmbilicalUMCWell W4PLU62274.93.845UMCUMCUmbilicalUMCPL11654.47.2UMCUmbilicalCormorant AUMCPL11654.47.2UMCUmbilicalCormorant APelicanPL1088/89/905.48.542NorthControl UmbilicalCormorant APelicanPL1088/89/905.48.542North CormorantPower CableNorthEiderPL13815413.11CormorantPower CableNorthEiderPL18706.421OtterControl UmbilicalEiderOtterPL44382.221.6Cortrol UmbilicalEiderOtterPL44392.221.6OtterPower Cable 2 (MPPEiderOtterPL44402.221.6Supply)OtterPower Cable 3EiderOtterPL44402.221.6	(5	UMC	Well W4		6	3.537
UMC Central Cormorant UMCUmbilicalUMCWell P5PL308/PL309 PL308/PL309 (N0805)4.93.3Central Cormorant UMCUmbilicalUMCWell W4PLU6227 (N0806)4.93.845Central Cormorant 	(3" Umbilical - East	Cormorant A	UMC		3	7.669
UMCUmbilicalUMCWell W4PLU6227 (N0806)4.93.845 (N0806)Central Cormorant UMCReplacement UmbilicalCormorant AUMCPL11654.47.2 (N0874)PelicanControl UmbilicalCormorant APelicanPL088/89/905.48.542 (N0843)PelicanControl UmbilicalCormorant APelicanPL0194448.434 (N1862)Pelican4" Replacement Control UmbilicalCormorant APelicanPLU194448.434Control UmbilicalCormorant APelicanPLU194448.434Control UmbilicalCormorant APelicanPLU194448.434Control UmbilicalCormorant APelicanPLU194448.434Control UmbilicalCormorant APelicanPLU194448.434CormorantPower CableNorthEiderPLU18706.421OtterPower Cable 1 (MPPEiderOtterPLU18706.421OtterPower Cable 2 (MPPEiderOtterPL4332.221.6CourderPower Cable 2 (MPPEiderOtterPL44002.221.6CotterPower Cable 3EiderOtterPL44402.221.6	(3" Umbilical - West	Cormorant A	UMC		3	7.962
UMC(N0806)Central CormorantReplacement UmbilicalCormorant AUMCPL11654.47.2UMCUmbilicalCormorant APelicanPL1088/89/905.48.542PelicanControl UmbilicalCormorant APelicanPL101088/89/905.48.542Pelican4" Replacement Control UmbilicalCormorant APelicanPL101088/89/905.48.542North CormorantPower CableNorthEiderPL10194448.434Control UmbilicalCormorant APelicanPL101945413.11CormorantPower CableNorthEiderPL3815413.11CormorantControl UmbilicalEiderOtterPL018706.421OtterControl UmbilicalEiderOtterPL44382.221.6Supply)TotrePower Cable 2 (MPPEiderOtterPL44392.221.6Supply)TotrePower Cable 3EiderOtterPL44402.221.6	(Umbilical	UMC	Well P5	,	4.9	3.3
Central Cormorant UMCReplacement UmbilicalCormorant AUMC UMCPL1165 (N0874)4.47.2PelicanControl UmbilicalCormorant APelicanPL1088/89/905.48.542Pelican4" Replacement Control UmbilicalCormorant APelicanPL1088/89/905.48.542North Cormorant4" Replacement Control UmbilicalCormorant APelicanPLU194448.434Control UmbilicalCormorant APelicanPLU1945413.11CormorantPower CableNorthEiderPL3815413.11CormorantControl UmbilicalEiderOtterPLU18706.421OtterPower Cable 1 (MPPEiderOtterPL44382.221.6Supply)OtterPower Cable 2 (MPPEiderOtterPL44392.221.6OtterPower Cable 3EiderOtterPL44402.221.6	(Umbilical	UMC	Well W4		4.9	3.845
PelicanControl UmbilicalCormorant APelicanPL1088/89/905.48.542Pelican4" ReplacementCormorant APelicanPL1088/89/905.48.542Pelican4" ReplacementCormorant APelicanPL1088/89/905.48.434Control UmbilicalControl Umbilical(N1862)13.11North CormorantPower CableNorthEiderPL3815413.11CormorantControl UmbilicalEiderOtterPLU18706.421OtterControl UmbilicalEiderOtterPL44382.221.6Control UmbilicalEiderOtterPL44392.221.6OtterPower Cable 1 (MPPEiderOtterPL44392.221.6Supply)OtterPower Cable 2 (MPPEiderOtterPL44402.221.6OtterPower Cable 3EiderOtterPL44402.221.6	(Cormorant A	UMC	PL1165	4.4	7.2
Pelican 4" Replacement Control Umbilical Cormorant A Control Umbilical Pelican PLU1944 (N1862) 4 8.434 North Cormorant Power Cable North Eider PL3815 4 13.11 Cormorant Power Cable North Eider PL3815 4 13.11 Otter Control Umbilical Eider Otter PLU1870 6.4 21 Otter Control Umbilical Eider Otter PLU1870 6.4 21 Otter Power Cable 1 (MPP Eider Otter PL4438 2.2 21.6 Supply) Otter Power Cable 2 (MPP Eider Otter PL4439 2.2 21.6 Supply) Otter Power Cable 3 Eider Otter PL4440 2.2 21.6		Pelican	Control Umbilical	Cormorant A	Pelican	PL1088/89/90	5.4	8.542
North Cormorant Power Cable North Eider PL3815 4 13.11 Cormorant Cormorant (N0809) 13.11 13.11 13.11 Otter Control Umbilical Eider Otter PLU1870 6.4 21 Total Cormorant Cormorant Cormorant 0000000 13.11 Otter Control Umbilical Eider Otter PLU1870 6.4 21 Cormorant Cormorant Cormorant Cormorant Cormorant Cormorant Cormorant Otter Power Cable 1 (MPP Eider Otter PL4438 2.2 21.6 Supply) Cotter Power Cable 2 (MPP Eider Otter PL4439 2.2 21.6 Supply) Cotter Power Cable 3 Eider Otter PL4440 2.2 21.6		Pelican		Cormorant A	Pelican	PLU1944	4	8.434
OtterControl UmbilicalEiderOtterPLU18706.421OtterPower Cable 1 (MPPEiderOtterPL44382.221.6Supply)Control Cable 2 (MPPEiderOtterPL44392.221.6OtterPower Cable 2 (MPPEiderOtterPL44392.221.6Supply)EiderOtterPL44392.221.6OtterPower Cable 3EiderOtterPL44402.221.6		North Cormorant			Eider	PL3815	4	13.11
OtterPower Cable 1 (MPPEiderOtterPL44382.221.6Supply)(T0126)(T0126)2.221.6OtterPower Cable 2 (MPPEiderOtterPL44392.221.6Supply)Supply)EiderOtterPL44392.221.6OtterPower Cable 3EiderOtterPL44402.221.6		Otter	Control Umbilical	Eider	Otter	PLU1870	6.4	21
Otter Power Cable 2 (MPP Eider Otter PL4439 2.2 21.6 Supply) Otter Power Cable 3 Eider Otter PL4440 2.2 21.6		Otter	(Eider	Otter	PL4438	2.2	21.6
Otter Power Cable 3 Eider Otter PL4440 2.2 21.6		Otter	Power Cable 2 (MPP	Eider	Otter	· · · · ·	2.2	21.6
		Otter	Power Cable 3	Eider	Otter	PL4440	2.2	21.6

TAQA Subsea Decommissioning Support



ITEM	COMMENT					ACTI	ON	
	Cladhan	Control Umbilical	Tern	Cladhan	PLU3575	5.7	16.6	
	Kestrel	8.5" Oil Flexible Pipeline	Kestrel P1	SSIV	(N1869) PL1851 (N0791)	8.5	7.796	
	Kestrel	4" Gas Lift Flexible Pipeline	Tern	Kestrel	PL1852 (N1128)	4	7.737	
	Kestrel	8.5" Umbilical	Tern	Kestrel P2	PLU1854 (N1827)	8.5	7.9	
	Hudson	Hudson Main Umbilical	Tern Alpha	Hudson Manifold	PL1023	5.8	11	
7.2	 Full Removal Optio Leave In Situ v Optio Optio Optio Leave In Situ v 	sideration evaluated for this gro n 2B – Reverse Instal vith Minor Interventio n 4A – Rock Placeme n 4B – Trench and Bu n 4C – Remove Spar vith Minimal Intervent n 5 – Remove Line Eu	lation without on ent over Spans ury Spans / Ex ns / Exposures tion	; / Exposures , posures / Sha / Shallow Bur	llow Burial ial	Info		
7.3	Evaluation							
7.3.1	Safety							
7.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised.							
7.3.1.2	Other Users – The assessment conducted was presented with no challenge raised.							
7.3.1.3	High Consequence Events – The assessment conducted was presented with no challenge raised.							
7.3.1.4	Legacy Risk – The assessment conducted was presented. The Neutral preference between Option 4C and 5 was changed to a Stronger preference for Option 4C. Steve Sapp, TAQA, noted that spans in flexibles are not equivalent to spans in rigid pipelines. Andrew Third, SFF, responded that remediation of trenched spans where the rock is flush with the seabed is less of an issue than with surface laid lines and also clarified the preference for free rock placement over use of rock bags.					e		
7.3.2	Environment							
7.3.2.1	Operational Marine challenge raised.	e Impacts – The asses	ssment condu	cted was pres	ented with no	Info		
7.3.2.2	Atmospheric Emissions and Fuel Consumption – The assessment conducted was presented with no challenge raised.							
7.3.2.3	Other Consumptions – The assessment conducted was presented with no challenge raised.							
7.3.2.4	Seabed Disturband raised.	e – The assessment o	conducted wa	s presented w	ith no challenge	e Info		



ITEM	COMMENT	ACTI	NC					
	The preference was for less rock, i.e. larger but temporary seabed disturbance caused by line removal or trenching operations was preferred to a permanent change in habitat associated with rock placement. JNCC concurred with that sentiment.							
7.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no Ir challenge raised.							
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 Info raised.							
7.3.6	Results							
7.3.6.1	Option 2B was identified as the emerging recommendation.InfoIt has received positive contributions from 1.3 – High Consequence Events, 1.4 –Legacy Risk, 2.5 – Legacy Marine Impacts, 4.1 – Fishing, 4.2 – Other Users and 5.2 –Long-term Costs, and is diminished by 1.1 – Operations Personnel, 2.4 – SeabedDisturbance. It is equally preferred for 1.2 – Other Users, 2.1 – Operational MarineImpacts, 2.2 – Atmospheric Emissions and Fuel Consumption, 2.3 – OtherConsumptions, 3.1 – Technical Risk and 5.1 – Short-term Costs.							
7.3.6.2	· · · · · · · · · · · · · · · · · · ·							
8.0	Group 16: Blocked Rigid Pipeline, Trenched and Buried							
8.1	Infrastructure details		1					
	Heid / Platform Description From To Pipeline No. OD (i Hudson L1 Production/Test Well L1 Hudson PL1024/A	ne NB / nches) 6	Length (km) 1.631					
	Pipeline Manifold Steve Sapp, TAQA, provided the background on the L1 pipeline blockage issue. The we a test well which was subsequently tied back. Potentially hydrates formed following a s there have been ongoing problems with the line throughout operation. Robin Ritchie, noted issues associated with the well's tree valves.	cale squ	ueeze,					



ITEM	COMMENT	ACTION
8.2	 Options under consideration Five options were evaluated for this group: Full Removal Option 2A – Cut and Lift Leave <i>In Situ</i> with Minimal Intervention Option 5 – Remove Line Ends and Remediate Snag Hazards 	Info
8.3	Evaluation	
8.3.1	Safety	
8.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised.	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. An enquiry was made as to whether the contents of this blocked line were already permitted for release. Gareth Jones, Xodus, confirmed that this was the case.	Info
8.3.2.2	Atmospheric Emissions and Fuel Consumption – The assessment conducted was presented with no challenge raised.	Info
8.3.2.3	Other Consumptions – The assessment conducted was presented with no challenge raised.	Info
8.3.2.4	Seabed Disturbance – The assessment conducted was presented with no challenge raised.	Info
8.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no challenge raised.	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. The equal preference for Option 2A and Option 5 was initially amended to a Stronger preference for full removal, however, given the burial status of this line Andrew Third, SFF, advised that the Neutral assessment was valid.	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



ITEM	COMMENT	ACTION
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 5 was identified as the emerging recommendation; however, the result was close. From a safety perspective, positive contributions from 1.1 – Operations Personnel and 1.3 – High Consequence Events were enough to counter the negative contribution from 1.4 – Legacy Risk. Similarly, positive contributions for 2.1 – Operational Marine Impact and 2.4 – Seabed Disturbance countered the negative contribution from 2.5 – Legacy Marine Impacts. All other assessments were equally preferred.	Info

9.0 Group 18: Uncertain Integrity or Concrete Coated Rigid Pipelines, Trenched and Buried

9.1 Infrastructure details...

Field / Platform	Description	From	То	Pipeline No.	Pipeline NB / OD (inches)	Lengt (km)
Central Cormorant UMC	8" Water Injection Pipeline - New	Cormorant A	UMC	PL184 (N0901)	8"	7.200
Central Cormorant UMC	8" Water Injection Pipeline - Old	Cormorant A	UMC	PL184 (N0930)	8"	7.500
Central Cormorant UMC	2 x 3" Well Injection Flowlines	UMC	Well W4	PL304 (N0902)	3"	3.52
Central Cormorant UMC	2 x 3" Well Injection Flowlines	UMC	Well W4	PL305 (N0903)	3"	3.52
Central Cormorant UMC	3" Oil - TFL	Well P5	UMC	PL306 (N0707)	3"	3.14
Central Cormorant UMC	3" Oil - TFL	Well P5	UMC	PL307 (N0708)	3"	3.10
Eider	12" Oil Pipeline	Eider (Oil Production Tee)	North Cormorant	PL475 (N0506)	12"	13.14
Eider	12" Water Injection Pipeline - Disused	Tern	Eider	PL476 (N1001)	12"	16.40
Otter	10" Water Injection Pipeline	Eider (Water Injection Tee)	Otter	PL3132 (T0129)	10"	21.10
Otter	10" Water Injection Pipeline - Disused	Eider	Otter	PL1869 (T0124)	10"	21.10
Otter	10" Multiphase Pipeline	Otter	Eider	PL1868 (T0123)	10"	21.20
Otter	10" Multiphase Pipeline - Replacement	Otter	Eider (Oil Production Tee)	PL1868a (T0123a)	10"	6.00
Tern	8" Gas Pipeline	North Cormorant	Tern	PL478 (N0604)	8"	13.00
Hudson	2" L1 Gas Lift Pipeline	Hudson Manifold	Well L1	PL1022.1	2"	1.64
Hudson	2" L2 Gas Lift Pipeline	Hudson Manifold	Well L2	PL1022.2	2"	1.76
Hudson	10" Production Pipeline (disused)	Hudson Manifold	Tern Alpha	PL1018	10"	10.41
Hudson	10" Production Pipeline (disused)	Hudson Manifold	Tern Alpha	PL1019	10"	10.41
Hudson	8" Production/Test Pipeline (disused)	Hudson Manifold	Tern Alpha	PL1020	8"	10.41

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ITEM	COMMENT					AC	ΓΙΟΝ
	Hudson	8" L1 Production/Test	Well L1	Hudson	PL1024	8"	1.761
	Hudson	Pipeline (disused) 8" L2 Production/Test	Well L2	Manifold Hudson Manifold	PL1025	8"	1.761
	Hudson	Pipeline (disused) 8" Water Injection Pipeline (disused)	Tern Alpha	Hudson Manifold	PL1021	8"	10.410
9.2	 Full Removal Opt Leave <i>In Situ</i> Opt Opt Opt Leave In Situ 	e evaluated for this gro	ith De-burial n nt over Spans ıry Spans / Ex s / Exposures ion	posures / Sha / Shallow Bur	llow Burial ial	Infc)
9.3	Evaluation						
9.3.1	Safety						
9.3.1.1	raised. Hywel Williams, H <i>pipeline shall ensu</i> (1) <i>is performed s</i> Ruth Ledingham, does not preclud that that was unc because reverse	onnel – The assessmen ISE, highlighted the PS <i>ure that work done in d</i> <i>afely"</i> OPRED, noted that pla e the need to decomm lerstood. The reason the nstallation is not applic que due to uncertaintie	R Regulation <i>lischarge of th</i> acing lines inte hission the line hese lines we cable for these	14, Para 2, " <i>Th</i> e duty contain the Interim F es. Steve Sapp e placed into e lines, remova	ne operator of a ned in paragrap Pipeline Regime D, TAQA, explai this group is al will require th	n bh e ined)
9.3.1.2	Other Users – Th	e assessment conducte	ed was preser	ted with no ch	nallenge raised	. Info)
).3.1.3	High Consequent challenge raised.	ce Events – The assessr	ment conduct	ed was preser	nted with no	Info)
9.3.1.4	Ruth Ledingham,	e assessment conducte OPRED, requested ado this information to OP	ditional chara		0	Info	
9.3.2	Environment					1730	~/ `
9.3.2.1		ne Impacts – The asses	sment condu	cted was pres	ented with no	Infc)
9.3.2.2	1	ssions and Fuel Consur o challenge raised.	mption – The	assessment co	onducted was	Info)
9.3.2.3	Other Consumpt	ons – The assessment	conducted w	as presented v	vith no challen	ge Infc)

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ITEM	COMMENT	ACTION
9.3.2.4	Seabed Disturbance – The assessment conducted was presented with no challenge raised.	Info
9.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no challenge raised.	Info
9.3.3	Technical	
9.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised.	Info
9.3.4	Societal	
9.3.4.1	Fishing – The assessment conducted was presented with no challenge raised.	Info
9.3.4.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
9.3.5	Economic	
9.3.5.1	Short Term Costs – The assessment conducted was presented with no challenge raised.	Info
9.3.5.2	Long Term Costs – The assessment conducted was presented with no challenge raised.	Info
9.3.6	Results	
9.3.6.1	Option 4B was identified as the emerging recommendation. The option did not receive any particular positive contributions; however, it was equally favourable across a number of sub-criteria; 1.2 – Other Users, 1.3 – High Consequence Events, 2.1 – Operational Marine Impact and 2.2 – Atmospheric Emissions and Fuel Consumption. It received negative contributions from 1.1 – Operations Personnel, 1.4 – Legacy Risk, 2.3 – Other Consumption, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts, 3.1 – Technical Risk, 4.1 - Fishing, 4.2 – Other Users, 5.1 – Short-term Costs and 5.2 – Long-term Costs, however these were not sufficient to prevent it becoming the emerging recommendation. Andrew Third, SFF, stated that from a fishing perspective Option 4B is preferable to the second place option, Option 5.	Info
10.0	Closing Statement	
10.1	TAQA thanked all stakeholders for attending and participating and invited any further comments to be submitted to <u>Katie.Lilford@taqaglobal.com</u> .	Info



APPENDIX C GROUP 1 – DETAILED EVALUATION RESULTS

C.1 Group 1 Attributes Table

O2A - Full Removal - Cut and Lift



Group 1: Pipe-in-Pipe Hybrids

	PL167 (N1208) - 26" Oil Pipe-in-Pipe Hybrid - East [1] - 3.345 km	PL167 (N1208) - 26" Oil Pipe-in-Pipe Hybrid - East [2] - 3.345 ki	m
F	L210 (N1209) - 26" Oil Pipe-in-Pipe Hybrid - West [1] - 3.343 km	PL210 (N1209) - 26" Oil Pipe-in-Pipe Hybrid - West [2] - 3.343 k	m
	PL168 (N1207) - 24" Oil Pipe-in-Pipe Hybrid [1] - 3.345 km	PL168 (N1207) - 24" Oil Pipe-in-Pipe Hybrid [2] - 3.345 km	
	O3B - Leave (Major) - Trench & Bury Entire Line	O4A - Leave (Minor) - Rock Placement Over Areas of Spans /	С
	OSB - Leave (Major) - Trench & Bury Entire Line	Exposure / Shallow Burial	
	- Pipelines are disconnected	- Pipeline is disconnected	- Pip

							Expo <u>sure / Sr</u>	nallow Burial	
	- Pipelines are d	isconnected		- Pipelines are discon	nected		- Pipeline is disconnected		- Pipeline
	- Surface laid lin	es are fully recove	ered by cut and lift	- Trim chains are rem	oved by divers		- Trim chains are removed by dive	ers	- Trim cha
	- Shear cutting t	echnique emplo	yed in order to crimp pipe ends	- Vent appurtenances	s are removed by divers		- Vent appurtenances are remove	d by divers	- Vent ap
				- Lines are trenched a	and backfilled to 0.6m E	OoC	- Rock placement over areas of sp	ans	- Areas of
									- Shear cu
									- Rock pla
	Vessel Type: PoE	/Days/Hours/P	PLL	Vessel Type: PoB / Day	ys/Hours/PLL		Vessel Type: PoB / Days / Hours / P	LL	Vessel Ty
	CSV: 76/159.4/1	45,382/1.09E-02		CSV: 76/12.7/11,573/8	8.68E-04		CSV: 76/12.7/11,573/8.68E-04		CSV: 76/2
				Trenching Vessel: 55/	15.1/9,940/7.45E-04		Rockdump Vessel: 20 / 6.4 / 1,543 /	1.16E-04	
	Total offshore ho	ours: 145,382 hrs							Total offsł
	Total offshore PL	L: 1.09E-02		Total offshore hours: 2	21,513 hrs		Total offshore hours: 13,116 hrs		Total offsł
				Total offshore PLL: 1.6	1E-03		Total offshore PLL: 9.84E-04		
þ	Resource Type: D	Days/Hours/PLL							Resource
5	Engineering & N	lanagement: 1,97	76.5/15,812/6.32E-05	Resource Type: Days /	'Hours/PLL		Resource Type: Days/Hours/PLL		Engineer
;	Project Manager	ment: 1,798.0 / 14,	384/5.75E-05	Engineering & Manag	gement: 663.2/5,306/2.	12E-05	Engineering & Management: 216.	2/1,729/6.92E-06	Project M
Σ Λ	Onshore Operat	ions (includes Cle	eaning & Disposal): 222.0 / 14,208	/ Project Management	:: 616.0 / 4,928 / 1.97E-05		Project Management: 206.0 / 1,648	8/6.59E-06	Onshore
	1.75E-03			Onshore Operations (includes Cleaning & Dis	sposal): 2.0 / 128 / 1.57E-			6.30E-05
				05			Total onshore hours: 3,377 hrs		
	Total onshore ho	ours: 44,404 hrs					Total onshore PLL: 1.35E-05		Total onsl
) :	Total onshore PL	L: 1.87E-03		Total onshore hours: 1	0,362 hrs				Total ons
				Total onshore PLL: 5.6	57E-05		Total operational hours: 16,494 hrs	5	
	Total operationa	il hours: 189,786 h	irs				Total operational PLL: 9.97E-04		Total ope
	Total operationa	I PLL: 1.28E-02		Total operational hou	ırs: 31,875 hrs				Total ope
				Total operational PLL	:1.67E-03				
	MW	MW	MW	W	N	r	S		· · ·
	7.66467	12.8385	6.18357	1.67502508	0.80676329		0.481642512		

Option 2A is assessed as being Much Weaker than Option 3B, Option 4A and Option 4C due to the risk exposure being higher in Option 2A due to the extended offshore scope for full removal and the onshore handling of the entirety of the lines. Option 3B is assessed as being Weaker than Option 4A due to the longer durations to trench and bury the entirety of the lines. Option 3B is assessed as being Neutral to Option 4C as the offshore and onshore scope and hence the risk exposure is similar. Option 4A is assessed as being Stornger than Option 4C as the offshore scope to rock cover problem areas is the smallest of all the options and hence has the lowest risk exposure.

Overall, Option 4A is preferred from a risk to Operations Personnel perspective.



O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

lines are disconnected

chains are removed by divers

appurtenances are removed by divers

s of spans are removed by cut and lift

r cutting technique employed in order to crimp pipe ends placement over cut ends to mitigate snag risk

| Type: PoB / Days / Hours / PLL 76 / 29.1 / 26,512 / 1.99E-03

offshore hours: 26,512 hrs offshore PLL: 1.99E-03

irce Type: Days/Hours/PLL ieering & Management: 345.6/2,765/1.11E-05 ct Management: 325.0/2,600/1.04E-05 ore Operations (includes Cleaning & Disposal): 8.0/512/ -05

onshore hours: 5,877 hrs onshore PLL: 8.44E-05

operational hours: 32,389 hrs operational PLL: 2.07E-03 Comparative Assessment Report – Consultation Draft

			O2A - Full Remo	oval - Cut and I	Lift		e (Major) - Trench & Bı	ury Entire Line		Placement Over Areas of Spans / Shallow Burial	040
ıfety	Users	Vessel Days: CSV: 159.4				Vessel Days: CSV: 12.7 Trenching Vessel: 15	1		Vessel Days: CSV: 12.7 Rockdump Vessel: 6.4		Vessel CSV: 29
l. Safe	1.2 Other	Total vessel da Transits: 18	ys: 159.4 days			Total vessel days: 27. Transits: 4			Total vessel days: 19.1 days Transits: 4		Total ve Transit
		W	W	W	ľ.	N	N		Ν		r.
S	ummary	Option 2A is as All other option Overall, Optio	ns are assessed as n 3B, Option 4A a	/eaker than all o being Neutral t and Option 4C	other options due to each other as, w are equally prefe	hile there are differend rred from a risk to O	ces in the vessel days ar other Users perspective	id transits, these are ins e.	ufficient to express a preference f		
1. Safety	1.3 High Consequence Events	through the w lifting to transf	Id lift operations. H ater column to rec fer pipeline section ons to deploy and r	cover line sectio ns to quayside.	ns. Additional Low number of	operations (125) thro	nching operations. Hig ough the water column nt and cutting equipme	to deploy and recover	Routine, low risk rock placemer lifting operations (119) through t recover cutting equipment (to r		High n to reco transfe operat chains
		W	W	W	ľ.	N	S		S	l i i i i i i i i i i i i i i i i i i i	
S	ummary	Option 4A is as It is noted that	the lifts are likely	to be challengi	ng due to stability				sections although the expectatic	on is that the use of hydraulic shear	rs should
1. Safety	1.4 Legacy Risk	No legacy risk	from this full remo	oval option.		be fully trenched an The survey & monito that the potential sr continues to be mar Vessel Type: PoB / D	ain in-situ with this opti nd buried under this opti pring programme is con nag hazard from left in-s naged & mitigated as a ays / Hours / PLL cy): 44 / 29.0 / 15,323 / 1.15	ion. nmitted to ensuring situ infrastructure opropriate.	The line would remain in-situ w its length remaining surface lai placement to mitigate potentia The survey & monitoring progra that the potential snag hazard continues to be managed & mi Vessel Type: PoB / Days / Hours, Survey Vessel (Legacy): 44 / 29.0	al snag hazard. Imme is committed to ensuring from left in-situ infrastructure tigated as appropriate. / PLL	f The lin its leng with ro The sui that th contine Vessel Survey
s	ummary	Option 2A is as no legacy risk t Option 3B is as with large rock Option 4A is as	from the full remo sessed as being M c berms or remove	tronger than Op val option versu luch Stronger th d, presenting li luch Weaker th	otion 3B as while b us the lines remain nan Option 4A and nes remaining sur an Option 4C as w	ing in-situ with proble d Option 4C as while th face laid with areas of	em areas rock covered, p ne lines remain in-situ, t spot rock cover.	presenting surface laid hey are fully trenched a	lines with large rock berms or ren and buried thus presenting a clea	r legacy risk. Option 2A is assessed noved, presenting lines remaining ar seabed versus lines remaining in reater legacy snag risk than the pro	surface l n-situ with



C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

| Days: 29.1

vessel days: 29.1 days ts: 4

er users of the sea.

number of lifting operations (259) through the water column over line ends and to place rock bags. Additional lifting to er pipeline sections to quayside. Additional lifting tions to deploy and recover cutting equipment (to remove s & appurtenances).

other options.

e are around double the offshore lifting operations in Option

assist by 'crimping' of the lines at cut locations.

ne would remain in-situ with this option with the majority of ogth remaining surface laid. Areas of spans will be removed ock cover to mitigate potential snag hazard from cut ends. urvey & monitoring programme is committed to ensuring ne potential snag hazard from left in-situ infrastructure nues to be managed & mitigated as appropriate.

l Type: PoB / Days / Hours / PLL y Vessel (Legacy): 44 / 29.0 / 15,323 / 1.15E-03

g Much Stronger than Option 4A and Option 4C as there is laid with areas of spot rock cover. th problem areas rock covered, presenting surface laid lines

reas being removed in Option 4C.

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		O2A - Full Remo	oval - Cut and	Lift	O3B - Leave	(Major) - Trench & Bu	ry Entire Line		Placement Over Areas of Spans / ' Shallow Burial	04C - I
	Vessel Noise (d	ays on-site): 131.4 d	days		Vessel Noise (days on	-site): 19.7 days		Vessel Noise (days on-site): 11.1 d		Vessel No
	Tooling Noise (I	Hydraulic Shears)	= 125.5 days		Tooling Noise (Trench	ning) = 17.7 days		Tooling Noise = none		Tooling N
	Operation relea	ises:			Operation releases:			Operation releases:		Operation
	Line cleaning a	nd flushing opera	ations will use [Best	Line cleaning and flu	shing operations will u	se Best	Line cleaning and flushing ope	erations will use Best	Line clear
	Environmental	Practice (BEP) ar	nd the Best Ava	ilable Techniques	Environmental Practi	ice (BEP) and the Best A	Available Techniques	Environmental Practice (BEP) a	and the Best Available Techniques	Environm
	ដ្ឋ (BAT) to minim	ise as far as possik	ole both residua	al hydrocarbon and	(BAT) to minimise as	far as possible both resi	dual hydrocarbon and	(BAT) to minimise as far as poss	ible both residual hydrocarbon and	(BAT) to m
	other chemical	levels in line post	t flush and relea	ases to the marine	other chemical levels	in line post flush and re	eleases to the marine	other chemical levels in line po	st flush and releases to the marine	and other
	 (BAT) to minimise as far as possible both residual hydrocarbon at other chemical levels in line post flush and releases to the marin environment during flushing activities. There will be potential for the release of residual contents at cut locations, however, given the prior cleaning of the lines, the concentration and quantity of release should still be low overall Therefore, the related impact is also anticipated to be low. There 				environment during	flushing activities.		environment during flushing a	ctivities.	marine ei
				l contents at cut	As line is being trencl	ned there is negligible ı	release from the lines.	As line is being rock covered in	areas of spans there is negligible	Cutting o
				he lines, the	_			release from the lines.		from with
					Vessel releases:					the conce
	Therefore, the r	elated impact is a	also anticipated	l to be low. There	This includes Ballast,	Grey and Black Water,	this is driven by	Vessel releases:		overall. T
	will also be potential for release of small amounts of line			ts of line insulation	duration of vessel ope	erations and therefore a	at 19.7 days is not	This includes Ballast, Grey and	Black Water, this is driven by	There will
	o material at cut locations.			considered significan	t. The environmental in	mpact is considered to	duration of vessel operations a	nd therefore at 11.1 days is the lowest	insulatior	
	~				be negligible.			of the options. The environmer	ntal impact is considered to be	
	Vessel releases:							negligible.		Vessel rel
	This includes B	This includes Ballast, Grey and Black Water, this is driven by							This inclu	
	duration of ves	duration of vessel operations and therefore at 131.4 days is the							duration	
	highest of all th	highest of all the options. The environmental impact is								considere
	considered to b	e negligible.								to be neg
	W	W	W		N	N	r	N	ľ	•
umr	The assessmen Option 2A is ass mary impact is expect	t of the Operation ressed as being W rted to be low, the	I Marine Impa /eaker than all ere is enough cu	umulative impact to	o a combination of the o express a small prefe	rence for all options ove	er Option 2A.		releases of pipeline contents and ir tting operations, these are consider	
Sumr	The assessmen Option 2A is ass impact is expect All other option Overall, Option	t of the Operation sessed as being W sted to be low, the s are assessed as a 3B, Option 4A a	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic	rence for all options ove es in the vessel duration onal Marine Impact pe	er Option 2A. ns, tooling operations ar	nd potential for releases from cu		ed insuffici
_	The assessmen Option 2A is ass impact is expect All other option Overall, Option	t of the Operation sessed as being W sted to be low, the s are assessed as a 3B, Option 4A a	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t	rence for all options ove es in the vessel duration onal Marine Impact pe	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes):		ed insuffici Vessel En
_	The assessmen Option 2A is ass impact is expect All other option Overall, Option	t of the Operation sessed as being W sted to be low, the s are assessed as a 3B, Option 4A a	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t Fuel: 1,385	rence for all options ove es in the vessel duration onal Marine Impact pe	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236		ed insuffici Vessel En Fuel: 1,620
_	The assessmen Option 2A is ass impact is expect All other option Overall, Option	t of the Operation sessed as being W sted to be low, the s are assessed as a 3B, Option 4A a	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t Fuel: 1,385 CO2: 4,390	rence for all options ove es in the vessel duration onal Marine Impact pe	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919		Vessel En Fuel: 1,620 CO2: 5,135
_	The assessmen Option 2A is ass impact is expect All other option Overall, Option	t of the Operation sessed as being W sted to be low, the s are assessed as a 3B, Option 4A a	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOX: 82.27	rence for all options ove es in the vessel duration onal Marine Impact pe	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43		Vessel En Fuel: 1,620 CO2: 5,135 NOx: 96.2
Atmospheric	The assessmen Option 2A is ass impact is expect All other option Overall, Option Fuel: 4,421 CO2: 14,016 NOx: 262.64 SO2: 17.69	t of the Operation sessed as being W sted to be low, the s are assessed as a 3B, Option 4A a	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t Fuel: 1,385 CO2: 4,390	rence for all options ove es in the vessel duration onal Marine Impact pe	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919		Vessel En Fuel: 1,620 CO2: 5,135
Atmospheric	The assessmen Option 2A is ass impact is expect All other option Overall, Option	t of the Operation sessed as being W sted to be low, the is are assessed as n 3B, Option 4A a ns (in tonnes):	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOX: 82.27	rence for all options ove es in the vessel duration onal Marine Impact pe onnes):	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43		Vessel En Fuel: 1,620 CO2: 5,135 NOx: 96.2
Atmospheric	The assessmen Option 2A is ass impact is expect All other option Overall, Option Vessel Emission Fuel: 4,421 CO2: 14,016 NOX: 262.64 SO2: 17.69	t of the Operation sessed as being W sted to be low, the is are assessed as n 3B, Option 4A a ns (in tonnes):	al Marine Impa /eaker than all ere is enough cu being Neutral	other options due to umulative impact to to each other as, wh	ve a combination of the o express a small prefe ile there are difference red from an Operation Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOx: 82.27 SO2: 5.54	rence for all options ove es in the vessel duration onal Marine Impact pe onnes):	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43 SO2: 4.94		ed insuffici Vessel En Fuel: 1,62(CO2: 5,135 NOx: 96.2 SO2: 6.48
Atmospheric	The assessmen Option 2A is ass impact is expect All other option Overall, Option Fuel: 4,421 CO2: 14,016 NOX: 262.64 SO2: 17.69 Vessel Energy U	t of the Operation sessed as being W sted to be low, the sare assessed as a 3B, Option 4A a ns (in tonnes): Use: 190,124 GJ	And Marine Impa leaker than all ere is enough cu being Neutral and Option 4C	other options due to umulative impact to to each other as, wh are equally prefer	o a combination of the o express a small prefe ile there are difference red from an Operatic Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOx: 82.27 SO2: 5.54 Vessel Energy Use: 59	rence for all options over es in the vessel duration onal Marine Impact per onnes): ,555 GJ	er Option 2A. ns, tooling operations ar	nd potential for releases from cu Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43 SO2: 4.94 Vessel Energy Use: 53,154 GJ		ed insuffici Vessel En Fuel: 1,62(CO2: 5,135 NOx: 96.2 SO2: 6.48
2.2	The assessmen Option 2A is ass impact is expect All other option Overall, Option Fuel: 4,421 CO2: 14,016 NOX: 262.64 SO2: 17.69 Vessel Energy I Vessel Energy I The assessmen Option 2A is ass	t of the Operation sessed as being W tted to be low, the sare assessed as a 3B, Option 4A a as (in tonnes): Use: 190,124 GJ	And Marine Impa leaker than all ere is enough cu being Neutral and Option 4C	other options due to umulative impact to to each other as, wh are equally prefer	o a combination of the o express a small prefe ile there are difference red from an Operation Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOX: 82.27 SO2: 5.54 Vessel Energy Use: 59 No-criterion is as follows:	rence for all options ove es in the vessel duration onal Marine Impact pe onnes): ,555 GJ	er Option 2A. is, tooling operations ar rspective.	Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43 SO2: 4.94 Vessel Energy Use: 53,154 GJ N		ed insuffici Vessel En Fuel: 1,620 CO2: 5,135 NOx: 96.2 SO2: 6.48 Vessel En
Atmospheric	The assessmen Option 2A is ass impact is expect All other option Overall, Option Vessel Emission Fuel: 4,421 CO2: 14,016 NOX: 262.64 SO2: 17.69 Vessel Energy U Vessel Energy U The assessmen Option 2A is ass All remaining C	t of the Operation sessed as being W sted to be low, the sare assessed as a 3B, Option 4A a as (in tonnes): Use: 190,124 GJ W t of the Atmosphe sessed as being W options are assessed	Anal Marine Impa leaker than all ere is enough co being Neutral and Option 4C eric Emissions & leaker than all ed as being Ne	other options due to umulative impact to to each other as, wh are equally prefer consumptions sub other options as the utral to each other a	o a combination of the o express a small prefe ile there are difference red from an Operation Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOX: 82.27 SO2: 5.54 Vessel Energy Use: 59 NOS: 554 Vessel Energy Use: 59 NOS: 554 Vessel Energy Use: 59 NOS: 554 NOS: 554 NOS: 554 NOS: 554 NOS: 554 NOS: 554 NOS: 555 NOS: 555 N	rence for all options over the vessel duration onal Marine Impact per onnes): ,555 GJ N e are around 3 to 4 time Il differences in the em	er Option 2A. is, tooling operations an rspective. es greater for Option 2A issions and fuel consum	Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43 SO2: 4.94 Vessel Energy Use: 53,154 GJ N	tting operations, these are consider	ed insuffici Vessel En Fuel: 1,620 CO2: 5,135 NOx: 96.2 SO2: 6.48 Vessel En
2.2 Atmospheric	The assessmen Option 2A is ass impact is expect All other option Overall, Option Vessel Emission Fuel: 4,421 CO2: 14,016 NOX: 262.64 SO2: 17.69 Vessel Energy U Vessel Energy U The assessmen Option 2A is ass All remaining C	t of the Operation sessed as being W sted to be low, the sare assessed as a 3B, Option 4A a as (in tonnes): Use: 190,124 GJ W t of the Atmosphe sessed as being W options are assessed	Anal Marine Impa leaker than all ere is enough co being Neutral and Option 4C eric Emissions & leaker than all ed as being Ne	other options due to umulative impact to to each other as, wh are equally prefer consumptions sub other options as the utral to each other a	o a combination of the o express a small prefe ile there are difference red from an Operation Vessel Emissions (in t Fuel: 1,385 CO2: 4,390 NOX: 82.27 SO2: 5.54 Vessel Energy Use: 59 NOS: 554 Vessel Energy Use: 59 NOS: 554 Vessel Energy Use: 59 NOS: 554 NOS: 554 NOS: 554 NOS: 554 NOS: 554 NOS: 554 NOS: 555 NOS: 555 N	rence for all options over es in the vessel duration onal Marine Impact per onnes): ,555 GJ N e are around 3 to 4 time	er Option 2A. is, tooling operations an rspective. es greater for Option 2A issions and fuel consum	Vessel Emissions (in tonnes): Fuel: 1,236 CO2: 3,919 NOx: 73.43 SO2: 4.94 Vessel Energy Use: 53,154 GJ N	tting operations, these are consider	ed insuffici Vessel En Fuel: 1,62/ CO2: 5,135 NOx: 96.2 SO2: 6.48 Vessel En



: - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

Noise (days on-site): 21.1 days g Noise (Hydraulic Shears) = 9.4 days

tion releases:

leaning and flushing operations will use Best

onmental Practice (BEP) and the Best Available Techniques to minimise as far as possible both residual hydrocarbon ther chemical levels in line post flush and releases to the e environment during flushing activities.

g of line ends would lead to an elevated release of fluids within the line. However, given the prior cleaning of the line, ncentration and quantity of release should still be low I. Therefore, the related impact is also anticipated to be low. will also be potential for release of small amounts of line tion material at cut locations.

releases:

ncludes Ballast, Grey and Black Water, this is driven by on of vessel operations and therefore at 21.1 days is not dered significant. The environmental impact is considered negligible.

n material at all cut locations. Whilst the environmental

fficient to express a preference.

l Emissions (in tonnes): ,620 ,135 96.22 ,48

Energy Use: 69,654 GJ

the other options.

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Environmental			O2A - Full Remo	val - Cut and Lif	t	O3B - Leave	(Major) - Trench & Bur	y Entire Line		Placement Over Areas of Spans / Shallow Burial	040
	s		ons (CO2 in tonne	s):		Material Emissions (C	,		Material Emissions (CO2 in tonn		Materia
Je	tion	Recovered Mate				Recovered Material: 5			Recovered Material:		Recove
uuc	Other Imptions	Remaining Mat	erial:			Remaining Material: 1	1,748		Remaining Material: 11,854		Remain
wire	2.3 (nsu	Total: 6,335				Total: 11,805			Total: 11,854		Total: 1
2. Er	Co	Rock: N/A tonne	es			Rock: N/A tonnes			Rock: 7,000 tonnes		Rock: 2
		Ν	S	N		N	N	F	N		
Sur	mmary	Option 2A is ass combination of Option 4C as, w Option 3B is ass Option 4A is ass	the lower impact hile there is a grea sessed as being Ne	eutral to Option 3 from processing ater impact from eutral to both Op eutral to Option	B as, while there the returned ma replacing mater tion 4A and Option &C with the different	is a greater impact from terial and there being r ial left in-situ and the s on 4C as the impact as ence in rock resource re	no rock resource require small amount of rock res	ed versus the greater in source required in Opt esource consumption	mpact from generating replacen ion 4C, this difference is conside is considered minimal and insuff	fficient to express a preference. Op nent material and the rock resource red insufficient to express a preferen ficient to express a preference.	e require
=		Seabed Disturb	ance (m2):			Seabed Disturbance (m2).		Seabed Disturbance (m2):		Seabed
inta	ed nce	Seabed Distarb	ance (mz).			Trenching: 202,460	111 <i>2j</i> .		Rock Cover: 7,000		Rock C
	Seabed	No rock cover in	n this option.			J J J			,		
2 iror	4 Se stur					No rock cover in this c	ption.		Habitat Loss / Change (m2):		Habita
2. Environmental	2.4 Dist								Rock Cover: 7,000		Rock B
		S	S	S	×	S	N	×	W		•
		The assessment	t of the Seabed Dis	sturbance sub-cr	iterion is as follov	VS:					
Sur	mmary	being Neutral to Option 4A is ass	o Option 4C with 1	the larger area of /eaker than Optic	temporary impa on 4C due to the g	ct versus the small area greater area of perman	ger area of impact in O a of permanent habitat ent habitat change in C	change being largely		bitat change associated with the sn	naller ar
r		No legacy marij									
a		···· · · · · · · · · · · · · · · · · ·	ne impact from th	nis full removal or	otion.	Line cleaning and flue	shing operations will us	se Best	Line cleaning and flushing ope	rations will use Best	Line cl
	ć		ne impact from th	nis full removal op	otion.	-	shing operations will us ce (BEP) and the Best A		Line cleaning and flushing oper Environmental Practice (BEP) a	rations will use Best nd the Best Available Techniques	Line clo Enviror
en	arin		ne impact from th	nis full removal op	ption.	Environmental Practi		vailable Techniques	Environmental Practice (BEP) a		Enviror
nmen	y Marin acts		ne impact from th	iis full removal op	otion.	Environmental Practi	ce (BEP) and the Best A ar as possible both resid	vailable Techniques	Environmental Practice (BEP) a	nd the Best Available Techniques ble both residual hydrocarbon and	Enviror
2. Environmental	2.5 Legacy Marine Impacts		ne impact from th	iis full removal op	otion.	Environmental Practi (BAT) to minimise as f other chemical levels The legacy marine im	ce (BEP) and the Best A ar as possible both resid	wailable Techniques dual hydrocarbon and ase of these low	Environmental Practice (BEP) a (BAT) to minimise as far as possi other chemical levels in line pos The legacy marine impact from	nd the Best Available Techniques ble both residual hydrocarbon and st flush.	Enviror (BAT) to
ED	5 Le	S	ne impact from th	nis full removal op	otion.	Environmental Practi (BAT) to minimise as f other chemical levels The legacy marine im concentration / quant	ce (BEP) and the Best A ar as possible both resic in line post flush. pact from the slow relea	wailable Techniques dual hydrocarbon and ase of these low	Environmental Practice (BEP) a (BAT) to minimise as far as possi other chemical levels in line pos The legacy marine impact from concentration / quantity release	nd the Best Available Techniques ble both residual hydrocarbon and st flush. the slow release of these low	Enviror (BAT) to and oth The leg concer
ED	5 Le	The assessment	MS t of the Legacy Ma	MS rine Impacts sub	-criterion is as fol	Environmental Practi (BAT) to minimise as f other chemical levels The legacy marine im concentration / quant overall. S lows:	ce (BEP) and the Best A ar as possible both resid in line post flush. pact from the slow relea ity releases is therefore	wailable Techniques dual hydrocarbon and ase of these low expected to be low	Environmental Practice (BEP) a (BAT) to minimise as far as possi other chemical levels in line pos The legacy marine impact from concentration / quantity release overall.	nd the Best Available Techniques ble both residual hydrocarbon and st flush. the slow release of these low	Enviror (BAT) to and oth The leg concer overall



C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

ial Emissions (CO2 in tonnes): ered Material: 209 ining Material: 11,463 11,672

224 tonnes

is assessed as being Stronger than Option 4A due to a ed in Option 4A. Option 2A is assessed as being Neutral to

ed Disturbance (m2): Cover: 350

at Loss / Change (m2): Bags: 350

ing of the lines, although the judgement is reduced as the all amount of rock cover in these options. rea of rock cover in option 4A. Option 3B is assessed as

eleaning and flushing operations will use Best conmental Practice (BEP) and the Best Available Techniques to minimise as far as possible both residual hydrocarbon ther chemical levels in line post flush.

gacy marine impact from the slow release of these low ntration / quantity releases is therefore expected to be low l.

me period with Option 3B although this is reduced as the acts associated with the full removal option whereas there

expected to lower as a result. In have been removed resulting in potentially greater legacy

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			D2A - Full Remov	val - Cut and Lift		O3B - Leave	(Major) - Trench & Bu	ry Entire Line		Placement Over Areas of Spans / / Shallow Burial	04C -
3. Technical	3.1 Technical Risk	multiple options Technical Risks: 1	available on the	th this option are as		limited track record (Technical Risks: A co	enching of large diame Score 1) mparatively large scope uired to confirm if it is f	e. Geotechncial	Concept Maturity: Rock place 3)	ment is a well proven process. (Score	ore Concept Technica (Score 3)
		N	MW	W		MW	MW		S		F
Su	ımmary	Option 2A is asse the pipe-in-pipe diameter of the I as both options h Option 3B is asse Option 4A is asse	ssed as being Ne hybrids with stat ines. Option 2A is nave similar chall essed as being Mu essed as being Str	bility issues due to p s assessed as being enges to cut and lif uch Weaker than bo	s while both e ootential for loo Much Weaker t sections, how oth Option 4A a 4C due the ro	ose equipment (loss of than Option 4A due t ever the scale of the c and Option 4C due to utine nature of the ro	f spider / centraliser sup o the challenges of cut perations and hence so the significant challen	port) within cut sectic ing and lifting the pip cope for challenges is r ges trenching and bur	n during lift. The challenges as be-in-pipe hybrids versus the rou nuch greater for Option 2A. ying lines of this type and diam	enges associated with Option 2A rela sociated with Option 3B relate to the itine nature of rock covering spans ir eter in the geotechnical conditions p er in scope as it relates to line ends or	geotechnic Option 4A present.
4. Societal	4.1 Fishing		ucture is remove	with the removal o d long term, benefi		, and the second s	operation, localised an vould be clear for fishin		Short operation, small area of would not be the fishing indu	disturbance, however, rock berms try's preference (Score 2)	Short ope cut ends
		S	MS	MS		MS	MS		N		-
Su	Immary	Option 2A is asse as the lines rema Option 3B is asse Option 4A is asse	ssed as being Str in in these option issed as being Mu issed as being Ne	ns (with rock cover c uch Stronger than b	3B as, while bo over spans / spa oth Option 4A as the lines wil	oth options present a d ans removed) which p and Option 4C as it p I remain on the seabe	resents an obstruction resents a clear seabed	to fishing operations v versus the lines remain	ersus the lines being removed i ning on the seabed in Option 4/		
_	Users	Significant amou	unt of recyclable r	material returned. (Score 3)	Minimal societal ber	efits/impacts with this	option. (Score 3)	Minimal societal benefits/im	pacts with this option. (Score 3)	Minimal
4. Societal	4.2 Other Us	Materials Return Steel: 6,275 tonne Polymer: 381 tonn	es (recyclable)			Materials Returned: Steel: 57 tonnes (recy Polymer: 4 tonnes (la			Materials Returned: None.		Materials Steel: 208 Polymer:
		S	S	S		N	N	r.	N		
Su	ımmary	Option 2A is asse other options. In All other options It is noted that th	ssed as being Str addition, there is are assessed as b ae extraction of th	s the job creation / r being Neutral to eac be insulation materi	r options as the etention assoc h other as the al internal to t	ere is a significant qua iated with the large o positive and negative	ffshore and onshore sco societal impacts are co	ope in Option 2A. This onsidered largely simil	is deemed to present a small so ar for those options.	on of material returned (polymer) tha cietal benefit over the other options. chieved and that the useful recyclab	



C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

ept Maturity: Cut and lift has a good track record (Score 3) ical Risks: Limited technical risks associated with option 2 3)

tting (with shears to provide 'crimping' effect) and lifting of nnical conditions of clays and 'shelly deposits' and the 9 4A. Option 2A is assessed as being Weaker than Option 4C

operation, small area of disturbance. Rock bags will profile nds to mitigate snag hazard for fishing gear. (Score 2)

being Much Stronger than both Option 4A and Option 4C

nal societal benefits/impacts with this option. (Score 3)

ials Returned: 208 tonnes (recyclable) ner: 13 tonnes (landfill)

end up in landfill versus limited / no material returned in the

could be obtained.

			O2A - Full Remo	val - Cut and Lift		O3B - Leave	(Major) - Trench & Bu	ry Entire Line	O4A - Leave (Minor) - Rock Pla Exposure / Sl		04C
5. Economic	5.1 Short- term Costs	£17.73 Million				£6.2 Million			£2.268 Million		£3.428 N
		W	MW	MW		w	w		N	*	
		11.53 million more	15.462 million more	14.302 million more		3.932 million more	2.772 million more		1.16 million less		
		186.0% higher	681.7% higher	417.2% higher		173.4% higher	80.9% higher		33.8% lower		
Su	mmary	Option 3B is ass Option 4A is ass	essed as being W essed as being N	eaker than Option eutral to Option 40	4A due to the c Cas, while there	osts being around 2.5 t	imes higher (£3.9 milli costs to deliver these o	on more). Option 3B	gher (£14.3 million more). is assessed as being Weaker than Op s are considered insufficient to expre	•	round dou
nic	erm	Surveys: N/A FLTC: N/A				Surveys: £0.87 Million FLTC: N/A			Surveys: £0.87 Million FLTC: £0.06 Million		Surveys FLTC: £0
5. Economic	5.2 Long-term Costs	Total Legacy Co	st: £0 Million			Total Legacy Cost: £0.8	37 Million		Total Legacy Cost: £0.931 Million		Total Le
		N	N	N		N	N		N	r	
Su	mmary	All options are a express a prefer	ence.	Costs sub-criterior Neutral to each oth preferred from a l	ner as, while the	-	s associated with the f	ull removal option ve	rsus long-term costs for survey and n	nonitoring with the other options	s, these lor



 E- Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial Million



C.2 Group 1 Pairwise Comparison Matrices – Safety

02A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
N	мw	мw	мw	9.9%
MS	N	w	N	26.9%
MS	s	N	s	36.4%
MS	N	w	N	26.9%
Lift	8 S	< / su	ve /	
	N MS MS	N MW MS N MS S NS N	NMWMWMSNWMSNW	N MW MW MS N W N MS S N S MS N W N

1.3 High Consequence Events	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.0%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	s	29.9%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	s	N	N	s	29.9 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	w	w	N	22.1%

1.2 Other Users	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	N	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	s	N	N	N	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%
1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	MS	MS	41.0%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	MS	MS	33.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	мw	мw	N	мw	9.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MW	мw	MS	N	16.2%



C.3 Group 1 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	N	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	s	N	N	N	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%

2.3 Other Consumptions	02A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
	02A - Ful	03B - L ₁	O4A - Placeme Expo	04C - L Areas	
O2A - Full Removal - Cut and Lift	N	N	s	N	27.6%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	N	24.9 %
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	w	N	N	N	22.5%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	24.9 %

2.5 Legacy Marine Impacts	02A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	MS	MS	43.5%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	s	25.1%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	MW	w	N	s	17.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	мw	w	w	N	14.1%

2.2 Atmospheric Emissions & Fuel Consumption	02A - Full Removal - Cut and Lift	03B - Leave (Najor) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	N	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	s	N	N	N	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	33.1%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	z	24.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	w	w	N	w	18.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	S	N	24.4%



C.4 Group 1 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	N	мw	٤	15.3%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	мw	мw	12.8%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	MS	MS	N	s	42.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	MS	w	N	29.3%

C.5 Group 1 Pairwise Comparison Matrices – Societal

4.1 Fishing	02A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04.C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	MS	MS	41.3%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	MS	MS	33.8%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	MW	MW	N	и	12.5%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	мw	мw	N	N	12.5%

4.2 Other Users	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	33.3%
O3B - Leave (Major) - Trench & Bury Entire Line	×	N	N	z	22.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	w	N	N	N	22.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	22.2%



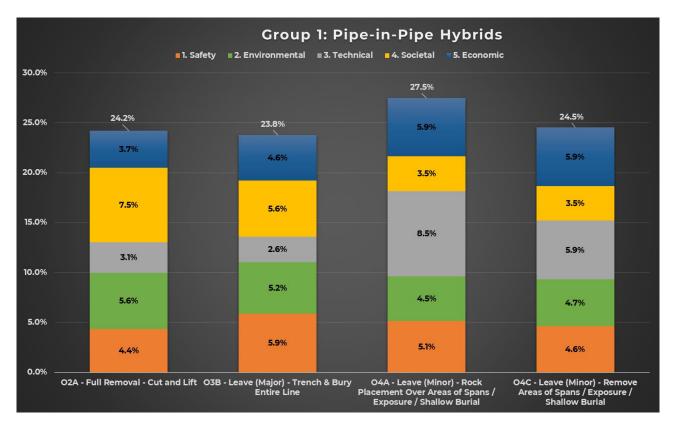
C.6 Group 1 Pairwise Comparison Matrices – Economic

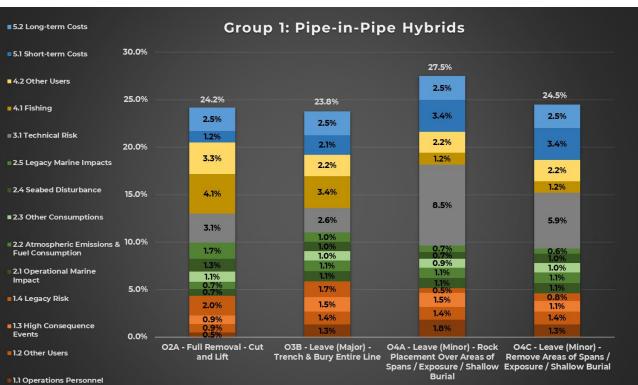
5.1 Short-term Costs	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	мw	мw	12.0%
O3B - Leave (Major) - Trench & Bury Entire Line	S	N	w	×	20.8%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	MS	s	N	N	33.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	S	N	N	33.6%

5.2 Long-term Costs	02A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	N	N	N	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	N	25.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%



C.7 Group 1 Results Charts







APPENDIX D GROUP 2 – DETAILED EVALUATION RESULTS



D.1 Group 2 Attributes Table

Group 2: Trunk Lines (Trenched and Buried)

PL4 (N0101) - 36" Oil Pipeline from Cormorant Alpha to Sullom Voe - 153.3 km

	02/	A - Full Removal - Cut a	and Lift	O4A - Leave (Minor) - Rock Placeme Shallov	ent Over Areas of Spans / Exposure / w Burial	O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial
	- Pipeline is disconnected			- Pipeline is disconnected		- Pipeline is disconnected
	 Line is de-buried using M Line is fully recovered by 		2 passes)	- Rock placement over areas of spans		 Areas of spans are removed by cut and lift Rock placed over cut ends to mitigate snag risk
	- Concrete spalling debris		% of cuts)			
	Vessel Type: PoB / Days / H	lours / DL I		Vessel Type: PoB / Days / Hours / PLL		Vessel Type: PoB / Days / Hours / PLL
	DSV: 110 / 81.0 / 106,973 / 8.0			Rockdump Vessel: 20 / 32.1 / 7,694 / 5.77	'E-04	DSV: 110 / 8.2 / 10,811 / 8.11E-04
	Divers: 18 / 81.0 / 35,009 / 3.4					Divers: 18 / 8.2 / 3,538 / 3.43E-03
	CSV: 76/1,296.7/1,182,554/	/8.87E-02		Total offshore hours: 7,694 hrs Total offshore PLL: 5.77E-04		CSV: 76 / 133.2 / 121,451 / 9.11E-03
	Total offshore hours: 1,324,5	536 hrs		Total offshore PLL: 5.77E-04		Rockdump Vessel: 20 / 29.7 / 7,121 / 5.34E-04
la	Total offshore PLL: 1.31E-01			Resource Type: Days/Hours/PLL		Total offshore hours: 142,921 hrs
ersonnel				Engineering & Management: 232.4 / 1,8		Total offshore PLL: 1.39E-02
	Resource Type: Days/Hou Engineering & Manageme			Project Management: 375.0 / 3,000 / 1.20	0E-05	Resource Type: Days/Hours/PLL
suo	Project Management: 17,4			Total onshore hours: 4,859 hrs		Resource Type: Days/Hours/PLL Engineering & Management: 2,010.3/16,082/6.43E-05
Operations				Total onshore PLL: 1.94E-05		Project Management: 1,940.0 / 15,520 / 6.21E-05
Ope						Onshore Operations (includes Cleaning & Disposal): 248.0 / 15,872 / 1.95E-03
ŝ	Total onshore hours: 582,69 Total onshore PLL: 3.85E-0			Total operational hours: 12,553 hrs Total operational PLL: 5.97E-04		Total onshore hours: 47,474 hrs
	TOLAI UNSTIDIE PEL. 3.03E-0	2				Total onshore PLL: 2.08E-03
	Total operational hours: 1,9	907,231 hrs				
	Total operational PLL: 1.69	E-01				Total operational hours: 190,395 hrs
						Total operational PLL: 1.60E-02
	VMW			MS		
		MW				
	283.0820771	10.5625		0.0373125		
	The assessment of the Ope				the stin Option 24. This is due to the mu	
						uch greater offshore scope associated with the full removal of this 153 km trunk exposure from the onshore handling and processing of the full length of the
						eing around 10 times higher in Option 2A. This is due to the greater scope both
	offshore and onshore to re	move the full 153 km tru	ink line in Option 2A versus the	smaller offshore and onshore scope ass	sociated with removing problem areas or	nly in Option 4C.
				-	-	be to provide rock placement over the problem areas of the line (which are also
			handling/processing in Option Operations Personnel perspec		hore scopes associated with removing pr	oblem areas in Option 4C.
		leffed from a risk to a	perations resonance perspec	live.		
	N/-cool Dovice			Versal Davier		
ş	Vessel Days: DSV: 81.0			Vessel Days: Rockdump Vessel: 32.1		Vessel Days: DSV: 8.2
Jsers	-			-		
her Users	DSV: 81.0 CSV: 1,296.7			Rockdump Vessel: 32.1 Total vessel days: 32.1 days		DSV: 8.2
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da	зус		Rockdump Vessel: 32.1		DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7
1.2 Other Users	DSV: 81.0 CSV: 1,296.7	ays		Rockdump Vessel: 32.1 Total vessel days: 32.1 days		DSV: 8.2 CSV: 133.2
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da	ays		Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8		DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da	ays MW		Rockdump Vessel: 32.1 Total vessel days: 32.1 days		DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth	MW ner Users sub-criterion is	as follows:	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S		DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be	MW her Users sub-criterion is eing Very Much Weaker	as follows: r than Option 4A due to the tho	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t		DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk	as follows: r than Option 4A due to the tho	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t		DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C.	: as follows: than Option 4A due to the thou k to other users of the sea. Option	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t	er than Option 4C as, again there are thou	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti	as follows: Than Option 4A due to the thou k to other users of the sea. Option ion 4C due to there being less v	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake	er than Option 4C as, again there are thou	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is
Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti	as follows: Than Option 4A due to the thou k to other users of the sea. Option ion 4C due to there being less v	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake	er than Option 4C as, again there are thou	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is
1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operat	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number	s as follows: than Option 4A due to the thou k to other users of the sea. Option ion 4C due to there being less v Other Users perspective. r of lifts (15527) through the	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake	er than Option 4C as, again there are thou	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of High number of lifting operations (924) through the water column to recover
1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as b considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operativ water column to recover li	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional	as follows: than Option 4A due to the thou k to other users of the sea. Option ion 4C due to there being less v Other Users perspective. r of lifts (15527) through the lifting to transfer pipeline	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 usands of vessel days and hundreds of t on 2A is assessed as being Much Weake ressel days and transits to execute Optic	er than Option 4C as, again there are thou	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of High number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside.
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1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as b considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operativ water column to recover li	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number in e sections. Additional n number of lifting opera	as follows: than Option 4A due to the thou k to other users of the sea. Option ion 4C due to there being less v Other Users perspective. r of lifts (15527) through the lifting to transfer pipeline	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 usands of vessel days and hundreds of t on 2A is assessed as being Much Weake ressel days and transits to execute Optic	er than Option 4C as, again there are thou	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of High number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside.
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1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as be to perform the cutting of the compared to no lifting operation.	MW er Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW th Consequence Events - eing Very Much Weaker he line and the recovery erations associated with	sas follows: r than Option 4A due to the though k to other users of the sea. Option ion 4C due to there being less work Dither Users perspective. r of lifts (15527) through the lifting to transfer pipeline ations to deploy and recover sub-criterion is as follows: r than Option 4A due to the very y of the cut sections of line through a rock placement operations in 0	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake vessel days and transits to execute Optic Routine, low risk rock placement opera MS y high number of offshore lifting operati ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as bei	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of High number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
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1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as be to perform the cutting of the compared to no lifting operater smaller than Option 2A.	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW h Consequence Events eing Very Much Weaker he line and the recovery erations associated with shore lifting operations a	as follows: Than Option 4A due to the thouse to other users of the sea. Option to other users of the sea. Option to other Users perspective. Ther Users perspective. Ther Users perspective. The Users perspective. Th	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake vessel days and transits to execute Optic Routine, low risk rock placement operation MS y high number of offshore lifting operation ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as being playment / retrieval and line section recommenders	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again overy associated with Option 4C, howeve	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 High number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as be Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as be to perform the cutting of the compared to no lifting oper are almost a thousand offs smaller than Option 2A. Option 4A is assessed as be	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW h Consequence Events : eing Very Much Weaker he line and the recovery he line and the recovery erations associated with shore lifting operations a eing Much Stronger tha	as follows: Than Option 4A due to the thouse to other users of the sea. Option to other users of the sea. Option to other Users perspective. Ther Users perspective. Ther Users perspective. The Users perspective. Th	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake vessel days and transits to execute Optic Routine, low risk rock placement opera MS y high number of offshore lifting operati ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as bei ployment / retrieval and line section reco	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 High number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as be Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as be to perform the cutting of the compared to no lifting oper are almost a thousand offs smaller than Option 2A. Option 4A is assessed as be	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW h Consequence Events : eing Very Much Weaker he line and the recovery he line and the recovery erations associated with shore lifting operations a eing Much Stronger tha	as follows: Than Option 4A due to the thouse than Option 4A due to the thouse to other users of the sea. Option ion 4C due to there being less we Define Users perspective. The of lifts (15527) through the lifting to transfer pipeline ations to deploy and recover sub-criterion is as follows: Than Option 4A due to the very of the cut sections of line througe to rock placement operations in G associated with equipment deploy an Option 4C due to there being	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake vessel days and transits to execute Optic Routine, low risk rock placement opera MS y high number of offshore lifting operati ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as bei ployment / retrieval and line section reco	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again overy associated with Option 4C, howeve	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 High number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as b to perform the cutting of the compared to no lifting operater are almost a thousand offs smaller than Option 2A. Option 4A is assessed as b Overall, Option 4A is pre	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW h Consequence Events eing Very Much Weaker he line and the recovery erations associated with shore lifting operations a eing Much Stronger tha ferred from a High Con	as follows: Than Option 4A due to the thouse than Option 4A due to the thouse to other users of the sea. Option ion 4C due to there being less we Define Users perspective. The option 4C due to the very of the cut sections of line throuse to rock placement operations in Consecutive associated with equipment deping an Option 4C due to there being	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake ressel days and transits to execute Optic Routine, low risk rock placement operation MS y high number of offshore lifting operation ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as being play high operations versus almost at the re.	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again overy associated with Option 4C, however housand offshore lifting operations with 0	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 High number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of usands of days and hundreds of transits in Option 2A versus a lower number of areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
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1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as b to perform the cutting of the compared to no lifting operater are almost a thousand offs smaller than Option 2A. Option 4A is assessed as b Overall, Option 4A is pre	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW h Consequence Events eing Very Much Weaker he line and the recovery erations associated with shore lifting operations a eing Much Stronger tha ferred from a High Con	as follows: r than Option 4A due to the though k to other users of the sea. Option ion 4C due to there being less we other Users perspective. r of lifts (15527) through the lifting to transfer pipeline ations to deploy and recover sub-criterion is as follows: r than Option 4A due to the very y of the cut sections of line through the cut sections of line through r ock placement operations in 0 associated with equipment deploy an Option 4C due to there being nsequence Events perspectiv	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake vessel days and transits to execute Optic Routine, low risk rock placement opera MS y high number of offshore lifting operation ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as being option 4A. Option 2A is assessed as being option 4A. Option 2A is assessed as being placement / retrieval and line section record on o lifting operations versus almost at the re. The line would remain in-situ with this length is already trenched and buried. mitigate potential snag hazard.	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again overy associated with Option 4C, however housand offshore lifting operations with o coption although the majority of its Areas of spans will be rock covered to	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of High number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
1.2 Other	DSV: 81.0 CSV: 1,296.7 Total vessel days: 1,377.7 da Transits: 382 VMW The assessment of the Oth Option 2A is assessed as be considered to present an i vessel days and transits in Option 4A is assessed as b Overall, Option 4A is pre Routine cut and lift operat water column to recover li sections to quayside. High deburial (MFE) and cutting VMW The assessment of the Hig Option 2A is assessed as b to perform the cutting of the compared to no lifting operater are almost a thousand offs smaller than Option 2A. Option 4A is assessed as b Overall, Option 4A is pre	MW her Users sub-criterion is eing Very Much Weaker ncrease in the safety risk Option 4C. eing Stronger than Opti ferred from a risk to O tions. Very high number ne sections. Additional n number of lifting opera g equipment. MW h Consequence Events eing Very Much Weaker he line and the recovery erations associated with shore lifting operations a eing Much Stronger tha ferred from a High Con	as follows: r than Option 4A due to the thork k to other users of the sea. Option ion 4C due to there being less work other Users perspective. r of lifts (15527) through the lifting to transfer pipeline ations to deploy and recover sub-criterion is as follows: r than Option 4A due to the very y of the cut sections of line through nock placement operations in 0 associated with equipment deploy an Option 4C due to there being nsequence Events perspective	Rockdump Vessel: 32.1 Total vessel days: 32.1 days Transits: 8 S usands of vessel days and hundreds of t on 2A is assessed as being Much Weake vessel days and transits to execute Optic Routine, low risk rock placement operation g high number of offshore lifting operation ugh the water column in Option 2A. The Option 4A. Option 2A is assessed as being logment / retrieval and line section record g no lifting operations versus almost a the rec. The line would remain in-situ with this length is already trenched and buried. mitigate potential snag hazard. The survey & monitoring programme is	er than Option 4C as, again there are thou on 4A. ations. No offshore lifting. ions (which have the potential for a High ere are also lifting operations associated v ing Much Weaker than Option 4C, again overy associated with Option 4C, however housand offshore lifting operations with o coption although the majority of its Areas of spans will be rock covered to	DSV: 8.2 CSV: 133.2 Rockdump Vessel: 29.7 Total vessel days: 171.0 days Transits: 26 rsus the low number of vessel days and transits to deliver Option 4A which is usands of days and hundreds of transits in Option 2A versus a lower number of High number of lifting operations (924) through the water column to recover areas of spans. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.

÷			& mitigated as appropriate.	
gao				Vessel Type: PoB / Days / Hours / PLL
			Vessel Type: PoB / Days / Hours / PLL	Survey Vessel (Legacy): 44 / 60.9 / 32,171 / 2.41E-03
ţ			Survey Vessel (Legacy): 44 / 60.9 / 32,171 / 2.41E-03	
				Total offshore hours: 32,171 hrs
			Total offshore hours: 32,171 hrs	Total offshore PLL: 2.41E-03
			Total offshore PLL: 2.41E-03	
	MS	MS	MW	
Th	e assessment of the Leg	gacy Risk sub-criterion is as follows:		
Op	otion 2A is assessed as b	eing Much Stronger than both Opt	ion 4A and Option 4C as the line is fully removed and as such there is no legac	y risk versus the line remaining with rock cover over areas of spans or the areas of spans removed in
th	e other options, where t	he potential for snag hazard remai	ns although this is mitigated by the survey and monitoring programme.	
Op	otion 4A is assessed as b	eing Much Weaker than Option 40	Cas while the majority of the trunk line is trenched and partially buried in both	options, the rock cover over areas of spans in Option 4A would present a greater legacy risk from
sn	agging potential than i	f the areas of spans were removed i	n Option 4C, hence the preference for Option 4C.	

Overall, Option 2A is preferred from a Legacy Risk perspective.

Comparative Assessment Report – Consultation Draft



				O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure					
		A - Full Removal - Cu	t and Lift	Shallow Burial	O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial				
l l	Vessel Noise (days on-site)	-		Vessel Noise (days on-site): 19.1 days	Vessel Noise (days on-site): 116.2 days				
	Tooling Noise (MFE and D	WC) = 405.5 days		Tooling Noise = None	Tooling Noise (DWC) = 54.6 days				
	Operation releases:			Operation releases:	Operation releases:				
ಕ	Line cleaning and flushing operations will use Best Environmental Practice			Line cleaning and flushing operations will use Best Environmental Practice					
Operational Marine Impact	(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			(BEP) and the Best Available Techniques (BAT) to minimise as far as possible					
e L	releases to the marine env			both residual hydrocarbon and other chemical levels in line post flush and releases to the marine environment during flushing activities.	both residual hydrocarbon and other chemical levels in line post flush and releases to the marine environment during flushing activities.				
arin	releases to the mainle env	nonment during hus	ning activities.	releases to the marrie environment during hushing activities.	releases to the manne environment during indsining activities.				
Σ	There will be potential for	the release of residua	l contents during cutting	As line is being rock covered there is negligible release from the line.	Cutting and removal of problem areas of line would lead to a release of fluids				
iona			of the lines, the concentration		from within the line. However, given the prior cleaning of the line, the				
erati	and quantity of release sho is also anticipated to be lo		all. Therefore, the related impact		concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low.				
Ope	is also anticipated to be for	N.		This includes Ballast, Grey and Black Water, this is driven by duration of vess operations and therefore at 19.1 days is the lowest of all options. The	related impact is also anticipated to be low.				
5.1	Vessel releases:			environmental impact is considered to be negligible.	Vessel releases:				
			s is driven by duration of vessel		This includes Ballast, Grey and Black Water, this is driven by duration of vessel				
			s the highest of all options and		operations and therefore at 116.2 days not considered significant. The				
	notable. The environment	ai impact is consider	ad to be low.		environmental impact is considered to be negligible.				
					· · · · · · · · · · · · · · · · · · ·				
	MW	W	act sub-criterien is as follows:	S					
			act sub-criterion is as follows: an Option 4A due to the environ	mental impact associated with the much larger number of days of vessel op	erations and deburial (MFE) / cutting (DWC) operations. In addition, the impact				
		0			C again, due to the larger number of vessel days, cutting operations and releases at				
	cut locations.								
				t from the lower number of vessel days and there being no cutting operation	s and hence no releases in Option 4A.				
			it area in near shore location don rational Marine Impact perspec						
	overall, option 4A is pre-	lefted from an oper	ational Marine Impact perspec	uve.					
-	l								
	Vessel Emissions (in tonne Fuel: 37,823	s):		Vessel Emissions (in tonnes):	Vessel Emissions (in tonnes):				
2.2 Atmospheric Emissions & Fuel Consumation	CO2: 119,898			Fuel: 2,394 CO2: 7,589	Fuel: 6,177 CO2: 19,582				
& Fi	NOx: 2,246.67			NOx: 142.21	NOx: 366.93				
lsoc	SO2: 151.29			SO2: 9.58	SO2: 24.71				
Atm issic									
5 2 2 E 2 2	Vessel Energy Use: 1,626,37	'9 GJ		Vessel Energy Use: 102,943 GJ	Vessel Energy Use: 265,622 GJ				
	N/N//	N 43 4 /							
	MW	MW		S					
			& Consumptions sub-criterion is a an both Option 4A and Option 4		th the greater scopes in Option 2A				
	Option 2A is assessed as being Much Weaker than both Option 4A and Option 4C as there is much greater atmospheric emissions and fuel use associated with the greater scopes in Option 2A. Option 4A is assessed as being Stronger than Option 4C as the emissions and fuel use for Option 4A is less than half that associated with Option 4C.								
	Overall, Option 4A is pre	ferred from an Atmo	ospheric Emissions & Consump	otions perspective.					
Υ Υ	Material Emissions (CO2 in	tonnes):		Material Emissions (CO2 in tonnes):	Material Emissions (CO2 in tonnes):				
tion	Recovered Material: 146,23 Remaining Material: 189								
un pi	Remaining Material, 10-2	8		Recovered Material:	Recovered Material: 7,630				
2.3 Consu	Total: 146 427	8		Remaining Material: 200,420	Remaining Material: 189,973				
	Total: 146 427	8							
Ŭ	Total: 146 427	8		Remaining Material: 200,420	Remaining Material: 189,973				
Ŭ	Total: 146,427	⁵⁸		Remaining Material: 200,420 Total: 200,420	Remaining Material: 189,973 Total: 197,603				
Ŭ	Total: 146,427 Rock: 32 tonnes	S	-criterion is as follows:	Remaining Material: 200,420 Total: 200,420 Rock: 77,050 tonnes	Remaining Material: 189,973 Total: 197,603				
Ŭ	Total: 146,427 Rock: 32 tonnes MS The assessment of the Oth Option 2A is assessed as be	S er Consumptions sub eing Much Stronger th	han Option 4A due to the large q	Remaining Material: 200,420 Total: 200,420 Rock: 77,050 tonnes W quantity of rock resource required in Option 4A coupled with the greater impart	Remaining Material: 189,973 Total: 197,603 Rock: 15,600 tonnes act associated with producing replacement material for the infrastructure left in-				
Ŭ	Total: 146,427 Rock: 32 tonnes MS The assessment of the Oth Option 2A is assessed as be situ. Option 2A is assessed	S er Consumptions sub eing Much Stronger th as being Stronger th	han Option 4A due to the large q an Option 4C due to the greater	Remaining Material: 200,420 Total: 200,420 Rock: 77,050 tonnes W quantity of rock resource required in Option 4A coupled with the greater impact quantity of rock resource and greater impact associated with producing repl	Remaining Material: 189,973 Total: 197,603 Rock: 15,600 tonnes act associated with producing replacement material for the infrastructure left in-				
ð	Total: 146,427 Rock: 32 tonnes MS The assessment of the Oth Option 2A is assessed as be situ. Option 2A is assessed Option 4A is assessed as be	S er Consumptions sub eing Much Stronger th as being Stronger than Op eing Weaker than Op	han Option 4A due to the large q an Option 4C due to the greater ption 4C due to the greater quant	Remaining Material: 200,420 Total: 200,420 Rock: 77,050 tonnes W quantity of rock resource required in Option 4A coupled with the greater impart	Remaining Material: 189,973 Total: 197,603 Rock: 15,600 tonnes act associated with producing replacement material for the infrastructure left in-				
ŏ	Total: 146,427 Rock: 32 tonnes MS The assessment of the Oth Option 2A is assessed as be situ. Option 2A is assessed Option 4A is assessed as be	S er Consumptions sub eing Much Stronger th as being Stronger than Op eing Weaker than Op	han Option 4A due to the large q an Option 4C due to the greater	Remaining Material: 200,420 Total: 200,420 Rock: 77,050 tonnes W quantity of rock resource required in Option 4A coupled with the greater impact quantity of rock resource and greater impact associated with producing repl	Remaining Material: 189,973 Total: 197,603 Rock: 15,600 tonnes act associated with producing replacement material for the infrastructure left in-				
Ŭ	Total: 146,427 Rock: 32 tonnes MS The assessment of the Oth Option 2A is assessed as be situ. Option 2A is assessed Option 4A is assessed as be	S er Consumptions sub eing Much Stronger th as being Stronger than Op eing Weaker than Op ferred from an Other	han Option 4A due to the large q an Option 4C due to the greater ption 4C due to the greater quant	Remaining Material: 200,420 Total: 200,420 Rock: 77,050 tonnes W quantity of rock resource required in Option 4A coupled with the greater impact quantity of rock resource and greater impact associated with producing repl	Remaining Material: 189,973 Total: 197,603 Rock: 15,600 tonnes act associated with producing replacement material for the infrastructure left in-				
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The assessment of the Legacy Marine Impacts sub-criterion is as follows:										
Option 2A is assessed as b	eing Much Stronger than (Option 4A and Option 4C as t	here are no legacy environmental impa	acts associated with the full removal option versus the impact associated with the slow degradation of the line and slow						
release of residual conten	ts in Option 4A and Optior	1 4C.								
Option 4A is assessed as b	eing Neutral to Option 4C	as the legacy impact from th	nese options are considered largely simi	lar.						
Overall, Option 2A is pre	ferred from a Legacy Ma	rine Impacts perspective.								

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TAQA Subsea Decommissioning Support Comparative Assessment Report – Consultation Draft



	02	A - Full Removal - Cut a	and Lift	O4A - Leave (Minor) - Rock Placem		O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial
-			proven with multiple options		w Burial ma fall pipe vessel is a well proven	Concept Maturity: Cut and lift has a good track record (Score 3)
3.1 Technical Risk	available on the market. (technique. (Score 3)	in a lan pipe vedenba wen proven	Technical Risks: Technical risk with this option is related to scale, i.e managing
echi		l risks with this option ar	e associated with the scale of	Technical Risks: Limited technical risks	s associated with option (Score 3)	logistics. (Score 3)
112	the operation. (Score 1)					
	N434/	14/		N		
	MW The assessment of the Teo	W	is as follows	N		
				ft operations associated with Option 2A	are relatively routine, as are the rock plac	ement operations associated with Option 4A, the scale of the cut and lift
						er than Option 4C as, again, the operations are largely routine but the much
				d hence a preference for Option 4C.		
					e differences in scale being insufficient to	o express a preference. to be considered. This adds to the challenges associated with the full removal
	option.					
	Overall, Option 4A is pre	eferred from a Technic	al Risk perspective.			
	Large scale disruption ass	ociated with the remov	al operation, however,	Short operation, small area of disturba	nce during operation. However, rock	Significant operation, spread over a large area. Rock cover intended to be
4.1 Fishing	infrastructure is removed	long term, beneficial for	the fishing industry. (Score 2)	berms are not preferred option from th	e fishing industry's perspective. (Score 1)	installed flush with seabed to a void impact on fishing operations. (Score 2)
1.4						
	140	140	r			
	MS The assessment of the Soc	MS	sub-criterion is as follows:	MW		
				the line is removed in Option 2A. Altho	ugh there would be significant disruptio	n in removing the line, a clear seabed is the preferred outcome from a
	commercial fishing opera					
			on 4C due to the large rock be impact on Fishing perspecti		preferred than the section removal and	spot rock cover associated with Option 4C.
	overall, option 2A is pre	erred from a Sociecal	impact on Fishing perspect	ve.		
	Circuit constants of constants		d (Cas = 7)	Minima langiatal langa fita (inanasta wit	h this actions (Oceano 7)	Minimal and the fat line and with this action (Gauss 7)
Users	Significant amount of rec	yciable material returne	a. (Score 3)	Minimal societal benefits/impacts wit	n this option. (Score 3)	Minimal societal benefits / impacts with this option. (Score 3)
) L	Materials Returned:			Materials Returned:		Materials Returned:
Other	Steel: 74,122 tonnes (recyc	,		None.		Steel: 3,868 ton nes (recyclable)
420	Concrete: 68,428 tonnes (I	andfill)				Concrete: 3,571 tonnes (landfill)
	W	w	ľ	N	(
			sers sub-criterion is as follows:	N	Y	
	The assessment of the Soc Option 2A is assessed as b	cietal impact on Other U eing Weaker than Optic	on 4A and Option 4C as while t	here is good job creation / retention in t		fit in the large quantity of steel returned in Option 2A, this is offset by the large
	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur	cietal impact on Other U eing Weaker than Optic ned which is likely to en	on 4A and Option 4C as while t d up in landfill. Both the steel	there is good job creation / retention in t and the concrete will present processin		ft in the large quantity of steel returned in Option 2A, this is offset by the large the use of coal tar layer between the steel and the concrete and the age / design
	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th	cietal impact on Other U eing Weaker than Optic ned which is likely to en iis line being of the 'chic	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design.	g/waste segregation challenges due to	
	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design
	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design.	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design
	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design
. 1	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design
hort- Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 pact on Other Users perspective.	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are
s.i Short- srm Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 pact on Other Users perspective.	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are
5.1 Short- term Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 pact on Other Users perspective.	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are
5.1 Short- term Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C	cietal impact on Other U eing Weaker than Option ned which is likely to en his line being of the 'chic being Neutral to Option reference.	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 pact on Other Users perspective.	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are
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5.1 Short- term Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a p Overall, Option 4A and C £169.957 Million	ietal impact on Other U eing Weaker than Option ned which is likely to en is line being of the 'chic being Neutral to Option reference. Option 4C are equally p VMW	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc oreferred from a Societal imp	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. E4 291 Million MS 15.27 million more	g/waste segregation challenges due to	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are
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5.1 Short- term Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a p Overall, Option 4A and C £169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sho	vMW void of the sub-criter void of the sub-criter	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc preferred from a Societal imp	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. £4.291 Million MS 15.27 million more 355.8% higher	g / waste segregation challenges due to •C returning a moderate quantity of stee	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are £19.557 Million
5.1 Short- term Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a p Overall, Option 4A and C £169.957 Million E 169.957 Million E 165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b	ietal impact on Other U eing Weaker than Option ned which is likely to en is line being of the 'chic being Neutral to Option reference. Option 4C are equally p VMW 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weaker	on 4A and Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are differenc preferred from a Societal imp	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. £4.291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4	g / waste segregation challenges due to •C returning a moderate quantity of stee	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are
5.1 Short- term Costs	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C E169.957 Million E165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b due to the costs being mo	ietal impact on Other U eing Weaker than Optio ned which is likely to en is line being of the 'chic being Neutral to Option reference. Dption 4C are equally p UNU 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weakel ore than 8 times higher (being Much Stronger that	e ion is as follows: than Option 4A due the to cor £150 million more) than Option than Option 4A due to the costs b	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. £4.291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4	g / waste segregation challenges due to C returning a moderate quantity of stee 0 times higher (£165 million more) than	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are £19.557 Million
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5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C £163.957 Million VMW 165.66 million more 3860.6% higher The assessment of the She Option 2A is assessed as b due to the costs being mo Option 4A is assessed as b	ietal impact on Other U eing Weaker than Optio ned which is likely to en is line being of the 'chic being Neutral to Option reference. Dption 4C are equally p UNU 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weakel ore than 8 times higher (being Much Stronger that	e ion is as follows: than Option 4A due the to cor £150 million more) than Option than Option 4A due to the costs b	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. £4.291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4 n 4C. being almost five times higher (£15 million	g / waste segregation challenges due to C returning a moderate quantity of stee 0 times higher (£165 million more) than	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are [£19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C
5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C E169.957 Million E169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b Option 4A is assessed as b Overall, Option 4A is pre Surveys: N/A	ietal impact on Other U eing Weaker than Optio ned which is likely to en is line being of the 'chic being Neutral to Option reference. Dption 4C are equally p UNU 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weakel ore than 8 times higher (being Much Stronger that	e ion is as follows: than Option 4A due the to cor £150 million more) than Option than Option 4A due to the costs b	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. £4.291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4 n 4C.	g / waste segregation challenges due to C returning a moderate quantity of stee 0 times higher (£165 million more) than	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are £19.557 Million
5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pi Overall, Option 4A and C £169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b due to the costs being mc Option 4A is assessed as b Overall, Option 4A is pre Surveys: N/A FLTC: N/A	ietal impact on Other U eing Weaker than Optic ned which is likely to en is line being of the 'chic being Neutral to Option reference. Dotion 4C are equally p Option 4C are e	e ion is as follows: than Option 4A due the to cor £150 million more) than Option than Option 4A due to the costs b	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. E4-291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4 n 4C. being almost five times higher (£15 million Surveys: £1.828 Million FLTC: £0.443 Million	g / waste segregation challenges due to C returning a moderate quantity of stee 0 times higher (£165 million more) than	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are £19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C Surveys: £1.828 Million FLTC: £0.443 Million
5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C E169.957 Million E169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b Option 4A is assessed as b Overall, Option 4A is pre Surveys: N/A	ietal impact on Other U eing Weaker than Optic ned which is likely to en is line being of the 'chic being Neutral to Option reference. Dotion 4C are equally p Option 4C are e	e ion is as follows: than Option 4A due the to cor £150 million more) than Option than Option 4A due to the costs b	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. £4.291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4 n 4C. being almost five times higher (£15 million Surveys: £1.828 Million	g / waste segregation challenges due to C returning a moderate quantity of stee 0 times higher (£165 million more) than	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are £19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C
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5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pr Overall, Option 4A and C £169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sh Option 2A is assessed as b Overall, Option 4A is pre Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Milli S The assessment of the Lor	ietal impact on Other U eing Weaker than Option ned which is likely to en- is line being of the 'chic being Neutral to Option- reference. Diption 4C are equally p VMW 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weaker per than 8 times higher (being Much Stronger the efferred from a Short-te	e ion is as follows: rm Cost perspective. bion is as follows: rm a Societal imp contained from a Societal imp containe	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. E4-291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4 n 4C. seing almost five times higher (£15 million Surveys: £1.828 Million FLTC: £0.443 Million Total Legacy Cost: £2.271 Million	g / waste segregation challenges due to -C returning a moderate quantity of stee 0 times higher (£165 million more) than on more) for Option 4C.	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are E19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C Surveys: £1.828 Million FLTC: £0.443 Million Total Legacy Cost £2.271 Million
5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pi Overall, Option 4A and C £169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Shk Option 2A is assessed as b due to the costs being mc Option 4A is assessed as b Overall, Option 4A is pre Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Milli S The assessment of the Lor Option 2A is assessed as b	ietal impact on Other U eing Weaker than Option ned which is likely to en- is line being of the 'chic being Neutral to Option- reference. Diption 4C are equally p VMW 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weaker per than 8 times higher (being Much Stronger the efferred from a Short-te	e ion is as follows: rm Cost perspective. bion is as follows: rm a Societal imp contained from a Societal imp containe	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective. E4-291 Million MS 15.27 million more 355.8% higher sts to deliver this option being around 4 n 4C. seing almost five times higher (£15 million Surveys: £1.828 Million FLTC: £0.443 Million Total Legacy Cost: £2.271 Million	g / waste segregation challenges due to -C returning a moderate quantity of stee 0 times higher (£165 million more) than on more) for Option 4C.	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are £19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C Surveys: £1.828 Million FLTC: £0.443 Million
5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pi Overall, Option 4A and C £169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b Overall, Option 4A is pre Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Milli S The assessment of the Lor Option 2A is assessed as b and Option 4C.	ietal impact on Other U eing Weaker than Option ned which is likely to en- is line being of the 'chic being Neutral to Option reference. Diption 4C are equally p option 4C are equallo 4C are equally	e ion is as follows: rm Cost perspective. bion is as follows: rm a Societal imp contained from a Societal imp containe	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective.	g / waste segregation challenges due to -C returning a moderate quantity of stee 0 times higher (£165 million more) than on more) for Option 4C.	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are E19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C Surveys: £1.828 Million FLTC: £0.443 Million Total Legacy Cost £2.271 Million
5.1 Sho term Co	The assessment of the Soc Option 2A is assessed as b quantity of concrete retur of the concrete layer on th Option 4A is assessed as b insufficient to express a pi Overall, Option 4A and C £169.957 Million VMW 165.66 million more 3860.6% higher The assessment of the Sho Option 2A is assessed as b Overall, Option 4A is pre Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Milli S The assessment of the Lor Option 2A is assessed as b and Option 4C.	VMW VMW 150.4 million more ing Very Much Stronger than is line being of the 'chic being Neutral to Option reference. Deption 4C are equally p VMW 150.4 million more 769.0% higher ort-term Costs sub-criter eing Very Much Weaker ore than 8 times higher (being Much Stronger tha offerred from a Short-tee on S ng-term Costs sub-criter eing Stronger than Opt being Neutral to Option	e ion is as follows: than Option 4C as while t d up in landfill. Both the steel ken wire' type rather than the 4C as while there are difference oreferred from a Societal imp ion is as follows: than Option 4C due the to cor EISO million more) than Option an Option 4C due to the costs b rm Cost perspective. ion is as follows: ion is as follows: ion 4A and Option 4C due to the 4C as the long-term costs are t	there is good job creation / retention in t and the concrete will present processin more recent 'rebar' type design. es in the societal impacts, with Option 4 bact on Other Users perspective.	g / waste segregation challenges due to -C returning a moderate quantity of stee 0 times higher (£165 million more) than on more) for Option 4C.	the use of coal tar layer between the steel and the concrete and the age / design I which is offset by the concrete returned going to landfill, these differences are E19.557 Million Option 4A. Option 2A is assessed as being Very Much Weaker than Option 4C Surveys: £1.828 Million FLTC: £0.443 Million Total Legacy Cost £2.271 Million



Group 2 Pairwise Comparison Matrices – Safety **D.2**

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	 O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow 	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	vмw	мw	7.7%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	N	MS	69.2 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	MW	N	23.1%
1.3 High Consequence Events	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	vмw	мw	7.7%
O4A - Leave (Minor) - Rock Placement Over				69.2%
Areas of Spans / Exposure / Shallow O4C - Leave (Minor) -	VMS	N	MS	05.2%

/ Exposure / Shallow Burial

1.2 Other Users	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	vмw	мw	8.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	N	s	59.9%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	w	N	31.7%
1.4 Legacy Risk	02A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
	02A - F	O4A - Rock I Are Expo	04C - Remove Expo	>
O2A - Full Removal - Cut and Lift	z 02A - F	04A - G G Are Expo	04C - M Remove Expo	≥ 58.4%



D.3 Group 2 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	мw	w	18.6%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow O4C - Leave (Minor) -	MS	N	s	50.7%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	w	N	30.7%
2.3 Other Consumptions	02A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	MS	s	50.7%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	мw	N	w	18.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	30.7%
2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	MS	MS	60.0%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	мw	MW	14.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	s	48.7%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	w	N	37.1%
2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s mw		22.8%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow O4C - Leave (Minor) -	w	N	мw	17.4%

мw

мw

Ν

Ν

Ν

Ν

20.0%

20.0%

O4A - Leave (Minor) -Rock Placement Over

Areas of Spans / Exposure / Shallow O4C - Leave (Minor) -Remove Areas of Spans

/ Exposure / Shallow Burial



D.4 Group 2 Pairwise Comparison Matrices – Technical



D.5 Group 2 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	MS	MS	58.4%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MW	N	мw	13.5%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MW	MS	N	28.1%

4.2 Other Users	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	25.0%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	S	N	N	37.5%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	37.5%



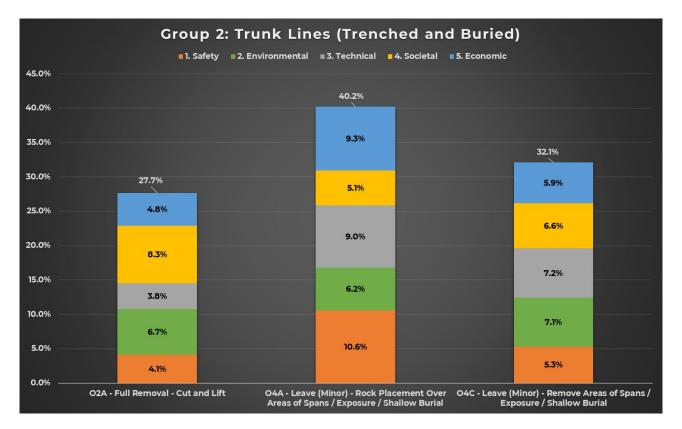
O2A - Full Removal - Cut and Lift 04A - Leave (Minor) -Rock Placement Over Exposure / Shallow O4C - Leave (Minor) temove Areas of Spa Exposure / Shallow Areas of Spans Weighting 5.1 Short-term Burial Costs O2A - Full Removal - Cut N vмw vмw **4.9**% and Lift O4A - Leave (Minor) -Rock Placement Over N VMS MS **64.2**% Areas of Spans / Exposure / Shallow O4C - Leave (Minor) -Remove Areas of Spans **30.9**% VMS мw Ν / Exposure / Shallow Burial

5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	42.9 %
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	28.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	28.6%

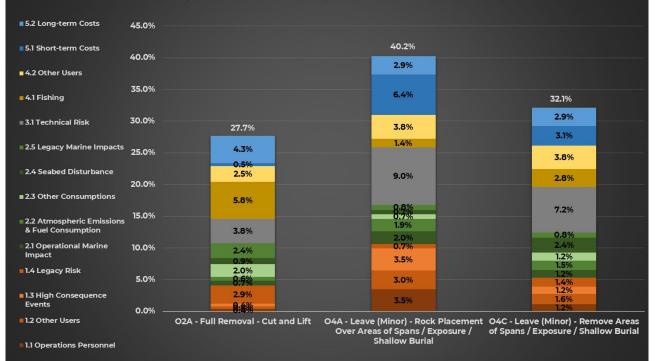
D.6 Group 2 Pairwise Comparison Matrices – Economic



D.7 Group 2 Results Charts



Group 2: Trunk Lines (Trenched and Buried)





APPENDIX E GROUP 3 – DETAILED EVALUATION RESULTS

E.1 Group 3 Attributes Table



Group 3: Flexible Pipelines & Umbilicals (Trenched & Buried)

PL118 (N0701) 3" Oil 2 - TFL 5.6 km | PL18 (N0702) 3" Oil 1 - TFL 5.6 km | PL558 (N0927) 6" Water Injection Pipeline 3.537 km | PL169 (N0803) 3" Umbilical - East 7.669 km | PL169 (N0804) 3" Umbilical - West 7.962 km | PL308 (N0805) Umbilical 3.3 km | PL309 (N0806) Umbilical 3.845 km | PL165 (N0874) Replacement Umbilical 7.2 km | PL1088/89/90 (N0843) Control Umbilical 8.542 km | PL1944 (N1862) 4" Replacement Control Umbilical 8.434 km | PL3815 (N0809) Power Cable 13.11 km | PLU1870 (T0127) Control Umbilical 21 km | PL4438 (T0126) Power Cable 1 (MPP Supply) 21.6 km | PL4439 Power Cable 2 (MPP Supply) 21.6 km | PL3815 (N0791) 8.5" Oil Flexible Pipeline 7.796 km | PL1852 (N1128) 4" Cas Lift Flexible Pipeline 7.737 km | PL1085 (N1867) S.5" Umbilical 7.9 km | PL1023 Hudson Main Umbilical 11 km

		O2A - Full Ren	noval - Cut and Lif	t		r) - Rock Placement O Exposure / Shallow Bur			& Bury Areas of Spans / Exposure low Burial	O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial		
	- Flowlines/um - De-burial of li	nbilicals are disco nes by MFE	onnected		- Flowlines/umbilica			- Flowlines/umbilicals are disc		- Flowlines / umbilicals are disconnected - Flowlines / umbilicals end transitions cut and recovered in 10m		
	- Lines are fully recovered by cut and lift sections						sections		sections			
					- Rock placement ove	- Rock placement over areas of spans / exposures / shallow burial			pans/exposures/shallow burial	- Remove areas of spans / exposures / shallow burial by cut and lif - Remediate cut ends with rock		
Í		B/Days/Hours/			Vessel Type: PoB / Da	-		Vessel Type: PoB / Days / Hours	/PLL	Vessel Type: PoB / Days / Hours / PLL		
	CSV: 76/1,241.8	/1,132,522/8.49E	-02		CSV: 76/55.8/50,908		-	CSV: 76 / 55.0 / 50,151 / 3.76E-03		CSV: 76/152.7/139,217/1.04E-02		
	Total offebora b	ours: 1,132,522 hrs			Rockdump Vessel: 20	0/59.9/14,369/1.08E-03	5	Trenching Vessel: 55/61.0/40,2	27373.02E-03	Rockdump Vessel: 20/9.7/2,323/1.74E-04		
	Total offshore P				Total offshore hours: 6	65 277 hrs		Total offshore hours: 90,424 hrs		Total offshore hours: 141,540 hrs		
	rotar onorior or	22.0.192.02			Total offshore PLL: 4.9			Total offshore PLL: 6.78E-03		Total offshore PLL: 1.06E-02		
le le	Resource Type:	Days/Hours/PL	L									
ty Personnel	Engineering &	Management: 15	485.3/123,882/4.96	6E-04	Resource Type: Days,	/Hours/PLL		Resource Type: Days/Hours/P	LL	Resource Type: Days / Hours / PLL Engineering & Management: 1,985.3 / 15,882 / 6.35E-05		
Sers			115,216/4.61E-04			gement: 1,722.1 / 13,776 /		Engineering & Management: 2				
		tions (includes C	leaning & Disposal):	: 178.0 / 11,392 /	5 0 1 1 1			Project Management: 2,224.0 / 17,792 / 7.12E-05		Project Management: 1,920.0 / 15,360 / 6.14E-05		
l. Safety ations Pe	1.40E-03							- Onshore Operations (includes Cleaning & Disposal): 4.0 / 256 / 3.15E				
1. Safe Operations	Total onchoro h	ours: 250,490 hrs			05			05		1.65E-04		
ő	Total onshore P				Total onshore hours: 26,600 hrs			Total onshore hours: 37,307 hrs		Total onshore hours: 32,586 hrs		
2	fotal offshore i	EE. 2.30E 03						Total onshore PLL: 1.80E-04		Total onshore PLL: 2.90E-04		
	Total operation	al hours: 1,383,012	2 hrs									
	Total operation	al PLL: 8.73E-02						Total operational hours: 127,731 hrs Total operational PLL: 6.96E-03		Total operational hours: 174,126 hrs		
										Total operational PLL: 1.09E-02		
		_										
	VMW	MW	MW	VMW	N	S	N	N	W	w		
	17.3559	12.5431	8.009174	26.0597	0.72270115	0.46146789	1.50149254	0.63853211	2.07761194	3.253731343		
			ns Personnel sub-cri						·	·		
										ntly greater offshore and onshore scope associated with the full rem		
				-			-		hore scope associated with the full r	-		
Summa		-	the problem areas			inces in the risk exposur	re due to differences in	offshore scope, these are consid	ered insufficient to express a prefere	ence. Option 4A is assessed as being Stronger than Option 4C as the		
Summa						sk exposure due to diffe	rences in offshore scop	e. these are considered insufficie	ent to express a preference. Option	4B is assessed as being Weaker than Option 5 as the risk exposure is		
		-	as of the lines in Opt									
		0				higher in Option 4C du	ie to the greater scope	associated with removing the pr	oblem areas of the lines in Option 4	.C.		
	Overall, Option	n 5 is preferred f	rom a risk to Oper	rations Personn	el perspective.							

		T I .	(.) O.)	1 1 1 1	6.11						
		MW	MW	MW	MW	N	N	w	N	W	W
1. Safe	12 Other	Total vessel days Transits: 120	s: 1,241.8 days			Total vessel days: 115.7 days			Total vessel days: 116.0 days Transits: 6		Total vessel days: 162.3 days Transits: 8
afety	Use	CSV: 1,241.8							CSV: 55.0 Trenching Vessel: 61.0		CSV: 152.7 Rockdump Vessel: 9.7
	s	Vessel Days:				-			Vessel Days:		Vessel Days:

he assessment of the Other Users sub-criterion is as follows:

Option 2A is assessed as being Much Weaker than all other options due to the much higher number of vessel transits requiured to execute this option compared to the others. There a a much higher number of vessel days at the various offshore locations although this is a users of the sea.

option 4A is assessed as being Neutral to Option 4B and Option 4C as, while there are differences in the vessel days and transits, these are considered insufficient to express a preference. Option 4A is assessed as being Weaker than Option 5 as there are fewer vessel days and transits in Option 4B is assessed as being Weaker than Option 5 as there are fewer vessel days and transits in Option 4C is assessed as being Weaker than Option 5 as there are fewer vessel days and transits in Option 4C is assessed as being Weaker than Option 5 as there are fewer vessel days and transits in Option 4C is assessed as being Weaker than Option 5 as there are fewer vessel days and transits in Option 5.

Overall, Option 5 is preferred from a risk to Other Users perspective.



/	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
n lift	- Flowlines/umbilicals are disconnected - Remove flowlines/umbilicals ends by cut and lift - Remediate cut ends with rock
	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 47.8 / 43,630 / 3.27E-03
	Total offshore hours: 43,630 hrs Total offshore PLL: 3.27E-03
/	Resource Type: Days / Hours / PLL Engineering & Management: 795.6 / 6,365 / 2.55E-05 Project Management: 738.0 / 5,904 / 2.36E-05 Onshore Operations (includes Cleaning & Disposal): 4.0 / 256 / 3.15E-05
	Total onshore hours: 12,525 hrs Total onshore PLL: 8.06E-05
	Total operational hours: 56,155 hrs Total operational PLL: 3.35E-03
emo	val of the lines by cut and lift. Option 2A is assessed as being Much
theı	isk exposure is around double in Option 4C due to the greater
e is a	around double in Option 4C due to the greater scope associated
	Vessel Days:
	CSV: 47.8
	Total vessel days: 47.8 days Transits: 4
a les	s significant contributer to the potential safety impact to other
	l transits in Option 5. ion 5.

Comparative Assessment Report – Consultation Draft

V (a var a la la al					<u> </u>	posure / Shallow Bu	urial	/ Shallow I	Burial	Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Sn	
Very high number of lifting operations (20445) to recover the lines.			Routine, low risk rock placement operations. High number of			Routine, low risk trenching operatio	ons. High number of lifting	Very high number of lifting operations (4020) to recover the line	High number of lifting operations (640) to recover the line			
Small number of lifting operations through the water column to deploy and recover cutting equipment. In addition there is the							nds. Small number of n to deploy and recover			ends and areas of spans / exposure / shallow burial. Small numbe of lifting operations through the water column to deploy and	er and to place rock bags. Small number of lifting operation through the water column to deploy and recover cutting	
a	deploy and recover cutting equipment. In addition there is the potential for dropped object associated with the offloading of the cut								recover cutting equipment. In addition there is the potential for	equipment. In addition there is the potential for dropped		
line secti	line sections to the quayside.			object associated with the offloading of the cut line sections to the quayside.			potential for dropped object associa cut line sections to the quayside.	ated with the offloading of the	dropped object associated with the offloading of the cut line sections to the quayside.	associated with the offloading of the cut line sections to t quayside.		
MV		MW	W	MW ub-criterion is as f	N	S	N	S	Ν	w		
Option 4 Option 4 Option 4	∔A is assesse ∔B is assesse ∔C is assesse	ed as being Ne ed as being Stu ed as being We	eutral to Option 4 ronger than Optio eaker than Optior	B and Option 5 as on 4C as there are n 5 as there are a r	, while there are differen	ces in the number of of lifts associated with lifts associated with C	lifts across these option h Option 4C. Option 4E Option 4C.	n, the differences are deemed insuffici	ient to express a preference. Op	d as being Weaker than Option 4C as there are around 20,000 lifts a tion 4A is assessed as being Stronger than Option 4C as there are a ces in the number of lifts across these option, the differences are de	much higher number of lifts associated with Option 4C.	
No legacy risk from this full removal option although crossings will remain.			gh the under	The lines would remain majority of their length placement over areas o	h would be trenched	and buried with rock	The lines would remain in-situ with fully trenched and buried. The survey & monitoring programm		The lines would remain in-situ with this option although would be fully trenched and buried as areas of exposures/shallow burial ar removed.			
					The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure			that the potential snag hazard from continues to be managed & mitigat		The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure	potential snag hazard from cut ends. Spans and exposu remain.	
					continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL			Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 76.9 / 40		continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL	The survey & monitoring programme is committed to en- that the potential snag hazard from left in-situ infrastruct continues to be managed & mitigated as appropriate.	
					Survey Vessel (Legacy)	: 44 / 76.9 / 40,608 / 3.	.05E-03			Survey Vessel (Legacy): 44 / 76.9 / 40,608 / 3.05E-03	Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 76.9 / 40,608 / 3.05E-03	
S	;	S	S	MS	w	W	S	N	S	S		
Option 4 lines rem Option 4 Option 4	h this is miti 4A is assesse nain in both 4B is assesse 4C is assesse	gated by the d as being We options, prob d as being Ne d as being Str	survey and monit eaker than Optior olem areas are roc eutral to Option 4 ronger than Optic	toring programme n 4B and Option 4 ck covered in Opti C as both options on 5 as while the li	e. Option 2A is assessed a C as, while the lines rem on 4A whereas the probl present a clear seabed.	as being Much Strong nain in all three option em areas would rema Option 4B is assessed	ger than Option 5 as the ns, Option 4B and Opti ain in Option 5. d as being Stronger tha	ere is no legacy risk as the lines are ren on 4C present more of a clear seabed	moved versus the lines remainin due to the problem areas being n both options, problem areas a	th problem areas addressed by rock cover / trenching / removal in t ng, largely trenched and buried albeit with areas of spans remainir g trenched or removed versus being rock covered in Option 4A. Op are trenched in Option 4A whereas the problem areas would remai	ng in Option 5. tion 4A is assessed as being Stronger than Option 5 as whil	
Option 4 lines rem Option 4 Option 4	h this is miti 4A is assesse nain in both 4B is assesse 4C is assesse	gated by the d as being We options, prob d as being Ne d as being Str	survey and monit eaker than Optior blem areas are roc eutral to Option 4	toring programme n 4B and Option 4 ck covered in Opti C as both options on 5 as while the li	e. Option 2A is assessed a C as, while the lines rem on 4A whereas the probl present a clear seabed.	as being Much Strong nain in all three option em areas would rema Option 4B is assessed	ger than Option 5 as the ns, Option 4B and Opti ain in Option 5. d as being Stronger tha	ere is no legacy risk as the lines are ren on 4C present more of a clear seabed n Option 5 as while the lines remain ir	moved versus the lines remainin due to the problem areas being n both options, problem areas a	ng, largely trenched and buried albeit with areas of spans remainir g trenched or removed versus being rock covered in Option 4A. Op	ng in Option 5. tion 4A is assessed as being Stronger than Option 5 as whil	
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N follows: d Option 4C due to the leases from vessel	as being Much Strong main in all three option em areas would rema Option 4B is assessed ons, problem areas an site): 82.5 days lic Shears) = 19.2 days hing operations will u e (BEP) and the Best ar as possible both res in line post flush and ushing activities. bould lead to an elevat lowever, given the pri l quantity of release sl related impact is also Crey and Black Water rations and therefore N higher vessel and too el noise and potentia	ger than Option 5 as the ns, Option 4B and Opti ain in Option 5. d as being Stronger tha re removed in Option 4, s use Best Available Techniques sidual hydrocarbon and releases to the marine ted release of fluids ior cleaning of the line, hould still be low o anticipated to be low. r, this is driven by at 82.5 days is the bling noise, increased p ul releases are similar fo	ere is no legacy risk as the lines are ren on 4C present more of a clear seabed in Option 5 as while the lines remain in A whereas the problem areas would re Vessel Noise (days on-site): 103.8 day Tooling Noise (Hydraulic Shears) = 5 Operation releases: Line cleaning and flushing operatic Environmental Practice (BEP) and the other chemical levels in line post flue environment during flushing activit Cutting of line ends would lead to an from within the line. However, giver the concentration and quantity of re overall. Therefore, the related impact Vessel releases: This includes Ballast, Grey and Black duration of vessel operations and the considered significant. The environ to be negligible.	moved versus the lines remaining due to the problem areas being n both options, problem areas a emain in Option 5. ys 57.6 days both swill use Best the Best Available Techniques both residual hydrocarbon and ush and releases to the marine ties. In elevated release of fluids in the prior cleaning of the line, elease should still be low uct is also anticipated to be low. It W events and the set of the line, elease should still be low it is also anticipated to be low. It we have the set of	ng, largely trenched and buried albeit with areas of spans remaining g trenched or removed versus being rock covered in Option 4A. Op are trenched in Option 4A whereas the problem areas would remain Vessel Noise (days on-site): 146.3 days Tooling Noise (Hydraulic Shears) = 70.3 days Operation releases: 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 releases to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated release of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 146.3 days is the highest of the options. The environmental impact is considered to be negligible. W seed vessel releases associated with the greater scope for Option 2A.	ng in Option 5. tion 4A is assessed as being Stronger than Option 5 as whill n in Option 5. Vessel Noise (days on-site): 39.8 days Tooling Noise (Hydraulic Shears) = 18.3 days Operation releases: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Teo (BAT) to minimise as far as possible both residual hydroc and other chemical levels in line post flush and releases marine environment during flushing activities. Cutting of line ends would lead to an elevated release of from within the line. However, given the prior cleaning of the concentration and quantity of release should still be overall. Therefore, the related impact is also anticipated Vessel releases: This includes Ballast, Grey and Black Water, this is driver duration of vessel operations and therefore at 39.8 days is the options. The environmental impact is considered to negligible.	
 Option 4 lines rem Option 4 Option 4 Overall, 0 Vessel No Tooling N Tooling N Operatio Line clea Practice 1 as far as p levels in 1 during fil Cutting of fluids froi line, the 0 overall. T Vessel re This inclu accident and there The assess Option 2 are less v Option 4 	h this is miti A is assesse nain in both B is assesse Option 2A i oise (days or Noise (MFE) Noise (MFE) Noise (Hydra on releases: aning and fl (BEP) and tl possible bot line post flu lushing activ of line into s orm within th concentrati Therefore, th eleases: udes Ballast tal discharge refore at ove ssment of th A is assesse B is assesse	gated by the d as being We options, prob d as being Ne d as being Str is preferred f n-site): 1063 d = 169 days aulic Shears) = ushing opera- he Best Availa th residual hy ush and releas vities. the close to an d quant he related imp t, Grey and Bla es. It is driven r 1000 days is W ne Operationa d as being We associated wit d as being Ne ed as being Ne	survey and monit eaker than Option olem areas are roo eutral to Option 4 ronger than Option from a Legacy Ri ays = 426 days tions will use Best able Techniques (I drocarbon and ot res to the marine of d lead to an elevat rer, given the prion city of release show boact is also anticip ack Water and the by duration of ve the most significat w al Marine Impact s seaker than Option h Option 5. eutral to Option 4 eutral to Option 4	toring programme n 4B and Option 4 ck covered in Opti- Cas both options on 5 as while the li- isk perspective. t Environmental BAT) to minimise ther chemical environment ted release of r cleaning of the uld still be low bated to be low. e potential for essel operations ant of the options. MW sub-criterion is as n 4A, Option 4B ar B and Option 4C a C as the impacts f	e. Option 2A is assessed a G as, while the lines rem on 4A whereas the proble present a clear seabed. In eseremain in both optice Vessel Noise (days on- Tooling Noise (Hydrau Operation releases: Line cleaning and flus Environmental Practice (BAT) to minimise as fa other chemical levels i environment during fl Cutting of line ends wo from within the line. H the concentration and overall. Therefore, the Vessel releases: This includes Ballast, C duration of vessel oper lowest of the options. N follows: d Option 4C due to the leases from vessel	as being Much Strong main in all three option em areas would rema Option 4B is assessed ons, problem areas an site): 82.5 days lic Shears) = 19.2 days hing operations will u ex (BEP) and the Best ar as possible both res in line post flush and ushing activities. Duld lead to an elevat lowever, given the pri l quantity of release si related impact is also Grey and Black Water rations and therefore N higher vessel and too el noise and potentia tential releases are si	ger than Option 5 as the ns, Option 4B and Opti ain in Option 5. d as being Stronger tha re removed in Option 4, s use Best Available Techniques sidual hydrocarbon and releases to the marine ted release of fluids ior cleaning of the line, hould still be low o anticipated to be low. r, this is driven by at 82.5 days is the bling noise, increased p ul releases are similar fo	ere is no legacy risk as the lines are ren on 4C present more of a clear seabed in Option 5 as while the lines remain in A whereas the problem areas would re Vessel Noise (days on-site): 103.8 day Tooling Noise (Hydraulic Shears) = 5 Operation releases: Line cleaning and flushing operatic Environmental Practice (BEP) and the other chemical levels in line post flue environment during flushing activit Cutting of line ends would lead to an from within the line. However, giver the concentration and quantity of re overall. Therefore, the related impact Vessel releases: This includes Ballast, Grey and Black duration of vessel operations and the considered significant. The environ to be negligible.	moved versus the lines remaining due to the problem areas being n both options, problem areas a emain in Option 5. ys 57.6 days both swill use Best the Best Available Techniques both residual hydrocarbon and ush and releases to the marine ties. In elevated release of fluids in the prior cleaning of the line, elease should still be low uct is also anticipated to be low. It W events and the set of the line, elease should still be low it is also anticipated to be low. It we have the set of	ng, largely trenched and buried albeit with areas of spans remaining g trenched or removed versus being rock covered in Option 4A. Op are trenched in Option 4A whereas the problem areas would remain Vessel Noise (days on-site): 146.3 days Tooling Noise (Hydraulic Shears) = 70.3 days Operation releases: 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 releases to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated release of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 146.3 days is the highest of the options. The environmental impact is considered to be negligible.	ng in Option 5. tion 4A is assessed as being Stronger than Option 5 as whill n in Option 5. Vessel Noise (days on-site): 39.8 days Tooling Noise (Hydraulic Shears) = 18.3 days Operation releases: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Teo (BAT) to minimise as far as possible both residual hydroc and other chemical levels in line post flush and releases marine environment during flushing activities. Cutting of line ends would lead to an elevated release of from within the line. However, given the prior cleaning of the concentration and quantity of release should still be overall. Therefore, the related impact is also anticipated Vessel releases: This includes Ballast, Grey and Black Water, this is driver duration of vessel operations and therefore at 39.8 days is the options. The environmental impact is considered to negligible.	



ld be	The lines would remain in-situ with this option although the
al are	majority of their length would be trenched and buried. The line
	ends will be removed with small areas of rock cover to mitigate
g	potential snag hazard from cut ends. Spans and exposures 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
	Survey Vessel (Legacy): 44 / 76.9 / 40,608 / 3.05E-03
l in th	e other options, where the potential for snag hazard remains
ining	in Option 5.
Opti	on 4A is assessed as being Stronger than Option 5 as while the
main	in Option 5.

	Vessel Noise (days on-site): 39.8 days
	Tooling Noise (Hydraulic Shears) = 18.3 days
	Tooming Noise (Hydradiic Shears) – 10.5 days
ies	Operation releases: 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 releases to the marine environment during flushing activities.
d	Cutting of line ends would lead to an elevated release of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low.
d to	Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 39.8 days is lowest of the options. The environmental impact is considered to be negligible.
2A. C	Option 2A is assessed as being Much Weaker than Option 5 as there

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			O2A - Full Rem	ioval - Cut and Lif	ft						O4C - Leave (Minor) - Remove Areas of	f Spans / Exposure /				
		Vessel Emissio	as (in tonnes):			Ex Vessel Emissions (in to	posure / Shallow Bu	rial	/ Shallo Vessel Emissions (in tonnes):	ow Burial	Shallow Burial Vessel Emissions (in tonnes):					
		Fuel: 34,728	is (in connes).			Fuel: 4,910	nnes).		Fuel: 4,907		Fuel: 6,756					
nta eric	en Fue	CO2: 110,089				CO2: 15,565			CO2: 15,554		CO2: 21,415					
nei phe	S F	NOV: 2 062 87				NOX: 291.66			NOX: 291.46		NOX: 401.28					
osl	εŭ	SO2: 178 01				SO2: 19.64			SO2: 19.63		SO2: 27.02					
ti či	sio	NOX: 2,062.87 SO2: 138.91				302.19.04			302.15.03		502.27.02					
2. Environmental 2.2 Atmospheric	is Cor		lco:1/07721C1			Vessel Energy Use: 211,			Vessel Energy Use: 210,986 GJ		Vessel Energy Use: 290,488 GJ					
N N	Ъ	Vessel Energy Use: 1,493,321 GJ				Vessei Litergy Ose. 211,	135 03		Vessel Energy Use. 210,900 US		Vessel Energy Use. 290,400 03					
		MW	MW	MW	MW	N	Ν	N	N	N	W					
		The assessmen	t of the Atmosphe	ric Emissions & Co	nsumptions sub-	criterion is as follows:			•							
		Option 2A is assessed as being Much Weaker than all other options as the emissions and fuel use for Option 2A is significantly higher than all other options.														
		Option 4A is as	sessed as being N	eutral to Option 4/	A, Option 4B and	Option 5 as, while there a	are differences in the	emissions and fuel use	across these options, the difference	ces are considered insufficient to e	xpress a preference.					
Sum	mary	Option 4B is as	sessed as being N	leutral to Option 4	C and Option 5 as	, while there are differen	ces in the emissions a	and fuel use across thes	e options, the differences are cons	idered insufficient to express a pre	eference.					
	Option 4C is assessed as being Weaker than Option 5 as the fuel use and emissions are almost double for Option 4C.															
	Overall, Option 5 is preferred from an Atmospheric Emissions & Consumptions perspective.															
a			ions (CO2 in tonne	es):		Material Emissions (CC	02 in tonnes):		Material Emissions (CO2 in tonne	es):	Material Emissions (CO2 in tonnes):					
l ar	, ŭ	Recovered Material: 3,554				Recovered Material: 68	3		Recovered Material: 68		Recovered Material: 344					
ŭ eq		Remaining Material:				Remaining Material: 10	0,966		Remaining Material: 10,966		Remaining Material: 10,097					
5 đ	5 Ę	Total: 3,554				Total: 11,034			Total: 11,034		Total: 10,441					
nvir 2.3																
2. Environment: 2.3 Other	ပိ	Rock: 3,600 ton	nes			Rock: 165,697 tonnes			Rock: N/A tonnes		Rock: 44,250 tonnes					
				-					-							
		MS	N	S	N	MW	W	MW	S	N	W					
	The assessment of the Other Consumptions sub-criterion is as follows:															
	Option 2A is assessed as being Much Stronger than Option 4A due to the large quantity of rock resource required in Option 4A. Option 2A is assessed as being Neutral to Option 4B and Option 5 as there is no / minimal rock resource required in the guantity of rock resource required in the guantity of rock resource required in Option 4A.										no/minimal rock resource required in these c	options. Option 2A is as				
					a											
Sum	mary	-	-								ue to the larger quantity of rock resource used					
		Option 4B is assessed as being Stronger than Option 4C as there is no rock resource required in this option versus a notable quantity required in Option 4C. Option 4B is assessed as being Neutral to Option 5 as there is no/minimal rock resource required in these options. Option 4C is assessed as being Weaker than Option 5 due to the higher quantity of rock resource required in Option 4C.														
		-	-	-	-	from an Other Consur										
		Overall, Option	п 2А, Орноп 4В а	and Option 5 are e	equally preferred	a from an other consul	inputoris perspective	•								
		Seabed Disturb	ance (m2):			Seabed Disturbance (r	n2).		Seabed Disturbance (m2):		Seabed Disturbance (m2):					
uta 4		MFE: 1,022,160	unce (mz).			Rock Cover: 168,697	112].		Trenching: 184,697		Rock Cover: 177,000					
her	Disturbance	1.11 2. 1,022,100				100000000000000000000000000000000000000			inchenning. Io 1,007		Nock cover. 177,000					
uo.	g ĝ	Habitat Loss/C	hange (m2):			Habitat Loss / Change	(m2):		No rock cover in this option.		Habitat Loss / Change (m2):					
vii V	i si i	Rock Cover: 12,5	- · ·			Rock Cover: 165,697					Rock Cover: 177,000					
2. Environmental 2.4. Seabed	• •															
		S	N434/	S		N4\A/	Ν		MS	W	MW					
		-	MW	-	MW	MW	N	MW	IMIS	vv	MVV					
				isturbance sub-crit												
		-	-			-					ea impacted in Option 4A is significant and re					
		-	-					-			here is significant area of seabed disturbance					
								-			rock cover in Option 2A is considered to have					
Sum	mary	-	-				-	-		- ·	C as the area of permanent habitat change is the area impacted in Option 4C is significant					
		-	-	-	-	-					the area impacted in Option 4C is significan	it and represents a perio				
			-							lanent habitat change.						
		-	-		-		inchabitat change int	Option 5 as the large area of temporary seabed impact in Option 4B is considered to have a greater impact than the small area of rock cover despite this being a permanent habitat change. on 4C is assessed as being Much Weaker than Option 5 due to the large area of permanent habitat change introduced in this option.								
			n 5 is preterrea ti	rom a Seabed Dic	turbance nerene											
			n 5 is preferred fi	rom a Seabed Dis	turbance perspe	ctive.										



O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk Vessel Emissions (in tonnes): Fuel: 3,690 CO2: 11,697 NOx: 219.18 SO2: 14.76 Vessel Energy Use: 158,664 GJ

Material Emissions (CO2 in tonnes): Recovered Material: 68 Remaining Material: 10,966 Total: 11,034

Rock: 640 tonnes

assessed as being Stronger than Option 4C due to the notable

Seabed Disturbance (m2): Rock Cover: 1,000

Habitat Loss / Change (m2): Rock Bags: 1,000

ent habitat change. Option 2A is assessed as being Much Weaker than operations in Option 2A, this impact is temporary in nature whereas the nan the small area of rock cover in Option 5.

ermanent habitat change. Option 4B is assessed as being Weaker

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		O2A - Full Remo	oval - Cut and L	ift	O4A - Leave (Mir				ich & Bury Areas of Spans / Exposur	e O4C - Leave (Minor) - Remove Areas of Spans / Exposure /	
Environmental Legacy Marine Impacts	No legacy marin	e impact from thi			Environmental Pra (BAT) to minimise			Line cleaning and flushing Environmental Practice (BE	P) and the Best Available Techniques possible both residual hydrocarbon an	Shallow Burial Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques d (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush.	
2. Environme 2.5 Legacy Ma Impacts				The legacy marine impact from the slow release of these low concentration / quantity releases is therefore expected to be low overall.				rom the slow release of these low eases is therefore expected to be low	The legacy marine impact from the slow release of these low concentration / quantity releases is therefore expected to be lo overall.		
6	Option 2A is asse and buried with and releases ove Option 4A is asse	essed as being Stro rock cover trench r a long time perio essed as being Ne	onger than Opti ning / removal of od with Option !	f problem areas. As 5 where sections of	and Option 4C as the s such, the lines left in the lines remain exp	n-situ will be largely iso posed to the marine en	blated from the marine en vironment.	nvironment. Option 2A is asse	ssed as being Much Stronger than Op	S e lines and releases over a long time period with the other options a tion 5 as there is no legacy marine impacts associated with the full r an Option 5 as the legacy marine impact is expected to be margina	
Summar	Option 4B is asse environment. Option 4C is asse	essed as being Ne essed as being Stre	onger than Opti		marine impact is exp				as being Stronger than Option 5 as the	legacy marine impact is expected to be marginally greater for Opt	
3. Technical 3.1 Technical Risk	multiple options	y: Cut and lift tech savailable on the Technical risks wit operation. (Score 2	market. (Score 3 th this option are	5)	techniques. (Score	: 3)	rock placement are well proven risks associated with option Concept Maturity: Group is trenched and buired the trenching is assumed to be feasible. (Score 3) Technical Risks: Minimal technical risk assumed, ho appropriate geotechnical study should be performe assess feasibility. (Score 3)		feasible. (Score 3) chnical risk assumed, however, an	Concept Maturity: Cut and lift has a good track record (Score 3) Technical Risks: Technical risk with this option is related to scale, i.e managing logistics. (Score 1)	
	W	W	W	MW	S	S	N	N	W	W	
4. Societal 4.1 Fishing	are considered g Option 4C is asse Overall, Option Significant short	reater than the sr essed as being We	mall scale of rou eaker than Optic om a Technical e, however, infra	tine operations in (on 5 due to the pote Risk perspective. structure is	Option 5. etial challenges asso Medium operatior	ciated with the scale of n, some short term distu erms are not preferred	f the removal operations	in Option 4C versus the smalle Relatively short term operat	perations in Option 4C are considered er scale of opertaions in Option 5. cion, localised areas of disturbance. If be clear for fishing operations to be	similar. Option 4B is assessed as being Weaker than Option 5 as th Significant operation, spread over a large area. Rock bags intended to be installed flush with seabed to avoid impact on fishing operations. However, use of rock bags needs to be considerd whether fall pipe vessel would be more efficient but potentially more impactful to fishing operations. (Score 2)	
	S	S	S	MS	W	W	S	N	S	S	
Summar	Option 2A is assered the same series of the same se	essed as being Stro lines remaining la essed as being We poth options, prob essed as being Ne essed as being Stro	onger than Opti argely trenched eaker than Optic lem areas are ro outral to Option onger than Opti rom a Societal material returne	and buried with p on 4B and Option 4 ock covered in Opti 4C as both options ion 5 as while the li impact on Fishing ed, however, also	and Option 4C as the roblem areas remain 4C as, while the lines on 4A whereas the p present a clear seab nes remain in both o g perspective.	ning. remain in all three opt roblem areas would rei ed. Option 4B is assess options, problem areas penefits / impacts with t	tions, Option 4B and Opt main in Option 5. sed as being Stronger tha are removed in Option 4	ion 4C present more of a clear an Option 5 as while the lines r A whereas the problem areas	seabed due to the problem areas beir emain in both options, problem areas	ssed by rock cover / trenching or removal respectively. Option 2A is ng trenched or removed versus being rock covered in Option 4A. Op are trenched in Option 4A whereas the problem areas would rema Minimal societal benefits / impacts with this option. (Score 3) Materials Returned:	
4. Societal 4.2 Other Use	Materials Return Steel: 3,065 tonn Copper: 1 tonnes Polymer: 2,276 to	es (recyclable) (recyclable)			Materials Returned: Steel: 60 tonnes (recyclable) Copper: 14 tonnes (recyclable) Polymer: 45 tonnes (landfill)			Steel: 60 tonnes (recyclable) Copper: 14 tonnes (recyclab) Polymer: 45 tonnes (landfill)	le)	Steel: 307 tonnes (recyclable) Copper: 70 tonnes (recyclable) Polymer: 228 tonnes (landfill)	
	S	S	S	S	N	N	N	N	N	N	
Summar	Option 2A is asse y up in landfill. Ov All other options	essed as being Stro verall, Option 2A is are assessed as be	onger than all of deemed to pre eing Neutral to	sent a small societ each other as the p	o the significant quar al benefit over the ot	her options.	le material returned (stee onsidered largely similar		ation / retention associated with the la	rge offshore and onshore scope in Option 2A. This is offset somewha	



re /	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
ques n	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.
ow	The legacy marine impact from the slow release of these low concentration / quantity releases is therefore expected to be low overall.
	nough this is reduced as the lines will be fully/largely trenched noval option whereas there will be slow degradation of the lines
ginally	y greater for Option 5 where sections of the lines remain exposed to
Optio	n 5 where sections of the lines remain exposed to the marine
3)	Concept Maturity: Minimal operations, well proven techniques.
ale,	(Score 3) Technical Risks: Limited technical risks associated with option (Score 3)
on 5 as	the scope of operations in Option 5 is smaller than the other
	ature and similar sclae of operations with these options. challenges associated with the trenching operations in Option 4B
n ut	Short operation, small area of localised disturbance. Rock used to remediate cut ends should be profiled with seabed to avoid impacts for the fishing industry. (Score 2)
2A is as	sessed as being Much Stronger than Option 5 as the lines are
. Opti	on 4A is assessed as being Stronger than Option 5 as while the
emain	in Option 5.
	Minimal societal benefits / impacts with this option. (Score 3) Materials Returned:
	Steel: 60 tonnes (recyclable) Copper: 14 tonnes (recyclable)
	Polymer: 45 tonnes (landfill)
what k	by the significant quantity of material (polymer) that is likely to end

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	O2A - Full Removal - Cut and Lift) - Rock Placement O (posure / Shallow Bui			Bury Areas of Spans / Exposure w Burial	e O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risl	
5.1 Short- term Costs	£140.619 Million				£15.513 Million			£21.877 Million		£18.917 Million	£8.023 Million	
	MW	MW	MW	MW	S	N	W	N	MW	w		
	125.097 million more	118.733 million more	121.693 million more	132.587 million more	6.364 million less	3.404 million less	7.49 million more	2.96 million more	13.854 million more	10.894 million more		
	806.4% higher	542.7% higher	643.3% higher	1652.6% higher	29.1% lower	18.0% lower	93.4% higher	15.6% higher	172.7% higher	135.8% higher		
	Option 4B is assessed as being Neutral to Option 4C as, while there is Option 4C is assessed as being Weaker than Option 5 due to the costs Overall, Option 5 is preferred from a Short-term Cost perspective			-	ble (£10.9 million more) than Option 5.						
c	Surveys: N/A FLTC: N/A				Surveys: £2.31 Million FLTC: N/A			Surveys: £2.31 Million FLTC: N/A		Surveys: £2.31 Million FLTC: N/A	Surveys: £2.31 Million FLTC: £0.635 Million	
J-tern ts												
ng-terr osts	Total Legacy Cos	t: £0 Million			Total Legacy Cost: £2.3	51 Million		Total Legacy Cost: £2.31 Million		Total Legacy Cost: £2.31 Million	Total Legacy Cost: £2.94 Million	
ng-terr osts	Total Legacy Cos	t: £0 Million S	S	S	Total Legacy Cost: £2.3	រា Million N	N	Total Legacy Cost: £2.31 Million	N	Total Legacy Cost: £2.31 Million	Total Legacy Cost: £2.94 Million	



Surveys: £2.31 Million
FLTC: £0.635 Million



E.2 Group 3 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	 O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow 	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	vмw	мw	мw	vмw	4.5%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	N	N	s	N	28.1%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	и	N	N	w	19.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	w	N	N	w	17.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	VMS	N	s	s	N	30.5%
1.3 High Consequence Events	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	 O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial 	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	w	мw	8.9%
O4A - Leave (Minor) -						
Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	s	N	25.1%
Rock Placement Over Areas of Spans / Exposure / Shallow O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS MS	N	Z Z	s s	N	25.1% 25.1%
Rock Placement Over Areas of Spans / Exposure / Shallow O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure /						

1.2 Other Users	O2A - Full Removal - Cut and Lift	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	мw	мw	7.6%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	N	w	21.1%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	N	N	и	w	21.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	w	21.1%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	S	S	S	N	29.2%

1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	MS	30.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	s	16.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	S	N	N	s	20.7%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	N	s	20.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	w	w	N	12.0%

nediate Snag R



E.3 Group 3 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	мw	12.1%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	N	w	19.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	s	N	N	N	w	19.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	N	N	N	w	19.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	S	S	S	N	30.4%

2.3 Other Consumptions	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	 O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial 	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MS	N	S	N	25.1%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	мw	N	мw	w	мw	8.9%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	N	MS	N	s	И	25.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	w	N	w	15.8%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	MS	N	s	N	25.1%

2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	MS	30.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	N	s	19.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	N	S	19.2 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	s	19.2 %
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MW	w	w	w	N	12.1%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	мw	мw	7.7%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	и	z	N	23.0%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	N	23.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	w	21.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	N	S	N	25.0%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	мw	s	мw	13.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	мw	N	мw	10.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	MS	N	MS	w	30.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	мw	N	мw	10.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	MS	s	MS	N	36.0%



E.4 Group 3 Pairwise Comparison Matrices – Technical



E.5 Group 3 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	MS	30.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	s	16.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	S	N	N	s	20.7 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	N	s	20.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MW	w	w	w	z	12.0%

4.2 Other Users	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	s	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	и	N	18.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	N	N	N	18.2%



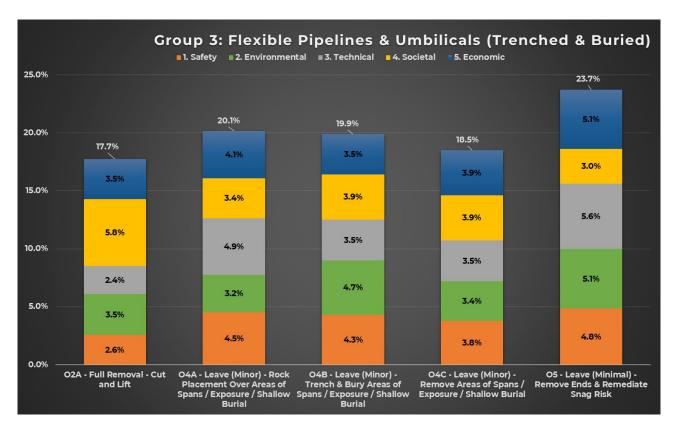
E.6 Group 3 Pairwise Comparison Matrices – Economic

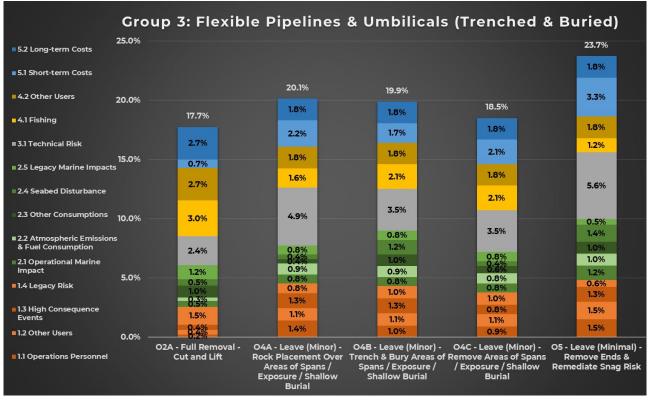
5.1 Short-term Costs	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	мw	мw	7.5%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	s	N	w	22.4%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	w	N	N	мw	16.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	w	20.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	s	MS	s	N	32.8 %

5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	S	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	z	z	N	18.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	z	N	18.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	N	N	N	18.2%



E.7 Group 3 Results Charts







APPENDIX F GROUP 4 – DETAILED EVALUATION RESULTS

Given the similarity between the equipment in Group 3, where the flexible flowlines and umbilicals are trenched and buried and Group 4 where the flexible flowlines are trenched and rock covered, the outcome of the evaluation for Group 4 is in line with the outcome obtained during the evaluation of Group 3 as described in Section 6.4. On this basis, the preferred decommissioning option for Group 4 is Option 5, Remove Ends and Remediate Snag Risk.



APPENDIX G GROUP 6 – DETAILED EVALUATION RESULTS

Group 6 Attributes Table G.1

Group 6: Rigid Pipelines (Surface Laid, Exposed and Non-concrete Coated)

PL1317 (N1002) - 16" Water Injection Pipeline from Tern to Eider (Water Injection Tee) - 16.104 km

	O2B - Full Rei	moval - Reverse	Installlation With	nout Deburial		(Major) - Trench & Bury Entire Lin	04A - Leave (Minor) - Rock Placement Over Areas of Span Exposure / Shallow Burial	ns / 04C -
	- Pipeline is disc	connected			- Pipeline is disconne	ected	- Pipeline is disconnected	- Pipeline
	- Diver initiatior	n preparation			- Entire line is trenche	ed and backfilled to 0.6m DoC	- Rock placement over free spans	- Remove
	- Section betwe	en Falcon/Kestrel	l crossing is remov	ed by cut and	- Remedial rock cove	r installed over trench transitions		
	lift							
	- Reverse reel re	maining pipeline	e					
	Vessel Type: PoB	B/Days/Hours/I	PLL		Vessel Type: PoB / Da	vs/Hours/PLL	Vessel Type: PoB / Days / Hours / PLL	Vessel Ty
	DSV: 110 / 7.9 / 10	-			Rockdump Vessel: 20	-	Rockdump Vessel: 20 / 6.5 / 1,558 / 1.17E-04	CSV: 76 /
		Divers: 18 / 7.9 / 3,391 / 3.29E-03				/12.4/8,171/6.13E-04		
	Reel Vessel: 76/	/12.3/11,208/8.41	E-04				Total offshore hours: 1,558 hrs	Total offsl
						9,196 hrs	Total offshore PLL: 1.17E-04	Total offs
	Total offshore ho	Total offshore hours: 24,962 hrs				00E-04		
au	Total offshore Pl	Total offshore PLL: 4.91E-03					Resource Type: Days/Hours/PLL	Resource
lannos						/Hours/PLL	Engineering & Management: 75.0 / 600 / 2.40E-06	Engineer
	Resource Type:	Resource Type: Days / Hours / PLL				gement: 333.8/2,671/1.07E-05	Project Management: 80.0 / 640 / 2.56E-06	Project M
l. Safety ations Pe	Engineering & N	Engineering & Management: 433.8/3,471/1.39E-05			Project Management	t: 319.0 / 2,552 / 1.02E-05		Onshore
Sal	Project Manage	ement: 507.0 / 4,0	56/1.62E-05				Total onshore hours: 1,240 hrs	7.08E-05
	Onshore Operat	tions (includes Cl	eaning & Disposal)): 124.0 / 7,936 /	Total onshore hours: 5	5,223 hrs	Total onshore PLL: 4.96E-06	
Oper	9.76E-04				Total onshore PLL: 2.0	09E-05		Total ons
							Total operational hours: 2,798 hrs	Total ons
	Total onshore he	ours: 15,463 hrs			Total operational hou	ırs: 14,418 hrs	Total operational PLL: 1.22E-04	
	Total onshore Pl	LL: 1.01E-03			Total operational PLL	.: 7.11E-04		Total ope
								Total ope
		al hours: 40,424 h	nrs					
	Total operationa	Total operational PLL: 5.91E-03						
	W	VMW	W		w	S	MS	
	8.31224	48.4426	4.37778		5.82786885	0.52666667	0.09037037	
	The assessment	, of the Operation	s Personnel sub-cr	iterion is as follo	ows:			

Option 2B is assessed as being Weaker than Option 3B due to the risk exposure being around 8 times higher in Option 2B. This is due to the greater offshore scope (with diver support) associated with the full removal of the line versus the smaller scope and lower risk activities to trench the entire line in Option 3B. Option 2B is assessed as being Very Much Weaker than Option 4A due to the risk exposure being around 48 times higher in Option 2B. This is due to the greater offshore scope (with diver support) associated with the full removal of the line versus the smaller scope and lower risk activities to perform rock placement over problem areas of the line in Option 4A. Option 2B is assessed as being Weaker than Option 4C due to the risk exposure being around 4 times higher in Option 2B. This is due to the greater offshore scope (with diver support) associated with the full removal of the line versus the smaller scope and lower risk activities to remove problem areas of the line in Option 4A.

Option 3B is assessed as being Weaker than Option 4A due to the risk exposure being around 6 times higher in Option 3B. This is due to the greater scope associated with trenching the entire line in Option 3B versus the smaller scope to provide rock placement over Summary problem areas of the line in Option 4A. Option 3B is assessed as being Stronger than Option 4C due to the risk exposure being around double in Option 4C. This is due to the smaller scope associated with trenching the entire line in Option 3B versus the greater scope to remove problem areas of the line in Option 4C.

Option 4A is assessed as being Much Stronger than Option 4C due to the risk exposure being around 11 times higher in Option 4C. This is due to the smaller scope associated with rock placement over problem areas of the line in Option 4A versus the greater scope to remove problem areas of the line in Option 4C.

Overall, Option 4A is preferred from a risk to Operations Personnel perspective.



- Leave (Minor) - Remove Areas of Spans / Exposure / **Shallow Burial** ine is disconnected ove pipeline at free span locations by cut and lift Type: PoB/Days/Hours/PLL 6/18.5/16,899/1.27E-03 ffshore hours: 16,899 hrs ffshore PLL: 1.27E-03 ce Type: Days/Hours/PLL eering & Management: 236.8/1,894/7.58E-06 t Management: 236.0 / 1,888 / 7.55E-06 re Operations (includes Cleaning & Disposal): 9.0 / 576 / 05 nshore hours: 4,358 hrs nshore PLL: 8.60E-05 perational hours: 21,257 hrs perational PLL: 1.35E-03

Comparative Assessment Report – Consultation Draft

		O2B - Full Rer	moval - Reverse I	Installlation W	ithout Deburial	O3B - Leave	(Major) - Trench & Bu	ry Entire Line		lacement Over Areas of Spans / Shallow Burial	04C
fety	r Users	Vessel Days: DSV: 7.9 Reel Vessel: 12.3				Vessel Days: Rockdump Vessel: 4.3 Trenching Vessel: 12.4			Vessel Days: Rockdump Vessel: 6.5		Vessel CSV:18
l. Safety	1.2 Other	Total vessel days Transits: 4	s: 20.1 days			Total vessel days: 16.7 Transits: 4	days		Total vessel days: 6.5 days Transits: 2		Total ve Transits
		N	N	Ν	ľ	N	N		N	×	
Sun	nmary	All options are a		Neutral to each	other as, while the	ere are small difference Jsers perspective.	es in the number of ves	sel days and transits, th	ne impact on the safety of other us	ers is expected to be similar (and l	low) acros
1. Safety	1.3 High Consequence Events	ends through th additional 4 lifts crossing and pla for dropped obje cut line sections	c reeling operation water column to associated recover acing rock bags. In ect associated with to the quayside. aploy and recover	o initiate reelin ering the cut se n addition ther h the offloading Small number	g. There are an ections around the e is the potential g of the reels and of lifting		ching operations. Sma h the water column to t.		Routine, low risk rock placemen operations.	, operations with no lifting	High n to reco transfe operati
Sun	nmary	consequence ev Option 3B is asso with the numero Option 4A is ass	vents is considered essed as being Ne ous offshore lifting essed as being Str	d similar from t eutral to Optior g operations in ronger than Op	he offloading oper 4 A as there is limi Option 4C. tion 4C due the po	rations in Option 2B and ited potential for high o	d the numerous offsho consequence events as ject associated with th	re lifting operations in there is limited / no of	Option 4C.	I line at the quayside. Option 2B is	
1. Safety	1.4 Legacy Risk	No legacy risk fr	om this full remov	val option.		be fully trenched and The survey & monitor that the potential sna continues to be mana Vessel Type: PoB / Day	n in-situ with this optic I buried under this opti ing programme is com ag hazard from left in-s aged & mitigated as ap ys/Hours/PLL y): 44/28.0/14,763/1.11	on. Imitted to ensuring itu infrastructure Ipropriate.	The line would remain in-situ wi its length remaining surface laid placement to mitigate potentia The survey & monitoring prograd that the potential snag hazard fi continues to be managed & mit Vessel Type: PoB / Days / Hours / Survey Vessel (Legacy): 44 / 28.0	snag hazard. mme is committed to ensuring om left in-situ infrastructure gated as appropriate. PLL	The line its leng with ro The sur that the continu Vessel
Sun	nmary	Option 2B is asso Option 4A and C Option 3B is asso leaving a potent Option 4A is ass	Dption 4C as there essed as being Mu tial snag risk. essed as being Ne	ronger than Op e is no legacy ris uch Stronger th eutral to Optior	tion 3B as there is sk with the full rem an Option 4A and	noval option versus the Option 4C as there is li naining surface laid wit	line remaining surface mited legacy risk with	e laid with problem are the line being fully tre	as rock covered or removed in the	senting a clear seabed, the line do other options leaving a potential rsus the line remaining surface lai	snag risk



- Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

Days: 3.5

ressel days: 18.5 days ts: 2

ss all options.

number of lifting operations (240) through the water column over line ends and to place rock bags. Additional lifting to er pipeline sections to quayside. Small number of lifting tions to deploy and recover cutting equipment.

ed as being Neutral to Option 4C as the potential for high

Option 4C due the potential for dropped object associated

ne would remain in-situ with this option with the majority of gth remaining surface laid. Areas of spans will be removed bock cover to mitigate potential snag hazard from cut ends. rvey & monitoring programme is committed to ensuring ne potential snag hazard from left in-situ infrastructure ues to be managed & mitigated as appropriate.

Type: PoB / Days / Hours / PLL / Vessel (Legacy): 44 / 28.0 / 14,763 / 1.11E-03

ain. Option 2B is assessed as being Much Stronger than k.

oroblem areas rock covered or removed in the other options

Comparative Assessment Report – Consultation Draft

Vessel Noise (days on-site): 6.8 days Loading Noise (Hays on-site): 6.8 days Vessel Noise (days on-site): 2.5 days Vessel Noise - none No Noise - none Noise -		O2B - Full Rer	moval - Reverse li	nstalllation W	ithout Deburial	O3B - Leave ((Major) - Trench & Bu	ry Entire Line		Rock Placement Over Areas of Span: osure / Shallow Burial	s / 04C - L		
Operation release: Operation		Vessel Noise (da	ys on-site): 6.1 days	S		Vessel Noise (days on-	site): 8.6 days			-	Vessel Noi		
Note the sensing and flukting operations will use Best Line cleaning and flukting operations will with mining with mining will with with will w		Tooling Noise (H	lydraulic Shears) =	1.2 days		Tooling Noise (Trenchi	ing) = 6.9 days		Tooling Noise = none		Tooling No		
The viscous of the section of the sectin of the sectin of the section of the section of the section of		Operation releas	ses:			Operation releases:			Operation releases:				
Normal control N		Line cleaning ar	nd flushing operat	ions will use B	est	Line cleaning and flus	shing operations will u	se Best	Line cleaning and flushi	ng operations will use Best	Line clean		
The subcode set of the during the reverse realing operations. Move everse realing operations. The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of dist from within the prior The subcode set of dist from within the prior The subcode set of dist from within the prior The subcode set of dist fro		Environmental	Practice (BEP) and	l the Best Avail	able Techniques	Environmental Practic	ce (BEP) and the Best /	Available Techniques	Environmental Practice	(BEP) and the Best Available Technique	es Environme		
The subcode set of the during the reverse realing operations. Move everse realing operations. The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of dist from within the prior The subcode set of dist from within the prior The subcode set of dist from within the prior The subcode set of dist fro	t	(BAT) to minimis	se as far as possible	e both residua	hydrocarbon and	(BAT) to minimise as fa	ar as possible both resi	dual hydrocarbon and	(BAT) to minimise as far a	as possible both residual hydrocarbon a	ind (BAT) to m		
The assessment of the Operational Marine Impact sub-criterion is as follows: N<	edu	other chemical l	levels in line post f	lush and relea	ses to the marine	other chemical levels	in line post flush and r	eleases to the marine	other chemical levels in l	line post flush and releases to the mari	ne and other		
The subcode set of the during the reverse realing operations. Move everse realing operations. The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of the dist from within the line. However, given the prior The subcode set of the dist from within the prior The subcode set of the dist from within the prior The subcode set of dist from within the prior The subcode set of dist from within the prior The subcode set of dist from within the prior The subcode set of dist fro	le In	environment du	uring flushing activ	vities.		environment during fl	lushing activities.		environment during flus	hing activities.	marine en		
The servers realing operations. Vessel releases Indecation at one time during the reverse realing operations. Vessel releases This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations and therefore at 0.1 days is not considered significant. The environmental impact is considered to be low. Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations and therefore at 0.1 days is not considered significant. The environmental impact is considered to be low. Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations and therefore at 0.1 days is not considered significant. The environmental impact is considered to be low. Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations and therefore at 0.1 days is not considered to be low. Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations and therefore at 0.1 days is not considered to be new; Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations and therefore at 0.1 days is not considered to the options. The environmental impact is considered to be new; Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations. The environmental impact is considered to be new; Vessel releases: This includes Ballast, Crey and Black Water, this is driven by duration of vessel operations. The environmental impact is considered to be new; Vessel to the option. Vessel to the option. </td <td>1arin</td> <td>There will be po</td> <td>tential for the relea</td> <td>ase of all residu</td> <td>ial contents in</td> <td>As line is being trench</td> <td>ed there is negligible</td> <td>release from the line.</td> <td>Cutting of line ends and</td> <td>midline cuts would lead to an elevated</td> <td>Cutting of</td>	1arin	There will be po	tential for the relea	ase of all residu	ial contents in	As line is being trench	ed there is negligible	release from the line.	Cutting of line ends and	midline cuts would lead to an elevated	Cutting of		
Proveyer, given the prior cleaning of the lines, the concentration and quantity of releases in and quantity of releases should still be low overall. Therefore, the related impact is also anticipated to be low. Cleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Incleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 25 days is not considered to be new. Incleaning of the inne, the option.	2					5	5.5		-		from withi		
and quantity of eleases should still be low overall. Therefore, the related impact is also anticipated to be low. This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 6.1 days is not considered significant. The environmental impact is considered in the environmental impact is considered significant. The environmental impact is considered to be negligible. N N	onã					Vessel releases:					the concer		
Normalize N	ati					This includes Ballast. (Grev and Black Water.	this is driven by			overall. Th		
Or Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 6.1 days is not considered significant. The environmental impact is considered to be negligible. Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 2.5 days is the lowest of the options. The environmental impact is considered to be negligible. Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 2.5 days is the lowest of the options. The environmental impact is considered to be negligible. Vessel releases: the options. The environmental impact is considered to be negligible. Vessel releases: this includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 2.5 days is the lowest of the options. The environmental impact is considered to be negligible. Vessel releases: the options. The environmental impact is considered to be negligible. Vessel releases: the options. The environmental impact is considered to be negligible. Vessel releases: the options. The environmental impact is considered to be negligible. Vessel releases: the options. It is noted that the impact from releases from the impact from releases from the impact from seese and releases is similar across all options. It is noted that the impact from releases from the impact from an Operational Marine Impact vessel noise, tooling noise and releases is similar across all options. It is noted that the impact from releases from the impact from the impact from the impact is considered to be fuel: 126 CO2 1579 Vessel Emissions (in tonnes): fuel: 126 CO2 1579 Vessel Emissions (in tonnes): SO2 1.199 Vessel Emings Use: 34,244 GJ	oer				,					, i			
N N N N N N Nessel Emissions (in tonnes): Fuel: 428 Vessel Emission (in tonnes): Fuel: 428								•	· ·		Vessel rele		
This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at £1 days is not considered significant. The environmental impact is considered to be negligible. This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at £2 days is the lowest of the options. The environmental impact is considered to be negligible. duration and therefore at 25 days is the lowest of the options. The environmental impact is considered to be negligible. duration of vessel operations and therefore at 25 days is the lowest of the options. The environmental impact is considered to be negligible. duration of vessel operations and therefore at 25 days is the lowest of the options. The environmental impact to considered to be negligible. duration of vessel operations and therefore at 25 days is the lowest environmental impact sub-criterion is as follows: All options are assessed as being Neutral to each other as the marine environmental impact from vessel noise, tooling noise and releases is similar across all options. It is noted that the impact from releases injection. Vessel Emissions (in tonnes): Vessel Emission	5.1	Vessel releases:						1			This includ		
duration of vessel operations and therefore at 6.1 days is not considered significant. The environmental impact is considered to be negligible. duration of vessel operations and therefore at 2.5 days is the lowest of the options. The environmental impact is considered to be negligible. highest. of the options. The environmental impact is considered to be negligible. highest. of the options. The environmental impact is considered to be negligible. highest. of the options. The environmental impact is considered to be negligible. highest. of the options. The environmental impact is considered to be negligible. highest. of the options. The environmental impact is considered to be negligible. highest. of the options. It is noted that the impact from releases from the injection. Vessel Emissions (in tonnes):		This includes Ballast, Grey and Black Water, this is driven by							This includes Ballast, Gre	ey and Black Water, this is driven by	duration o		
considered significant. The environmental impact is considered to be negligible. of the options. The environmental impact is considered to be negligible.										est highest of			
to be negligible. it to be negligible. negligible. negligible. negligible. negligible. it to be negligible. it to be negligible. negligible. negligible. negligible. it to be negligible. it to be negligible. it to be negligible. it to be negligible. it to be negligible. it to be negligible. it to be negligible. <td></td> <td colspan="3"></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>environme</td>										environme			
N N													
The assessment of the Operational Marine Impact sub-criterion is as follows: All options are assessed as being Neutral to each other as the marine environmental impact from vessel noise, tooling noise and releases is similar across all options. It is noted that the impact from releases from the injection. Overall, all options are equally preferred from an Operational Marine Impact perspective. Vessel Emissions (in tonnes): Vessel Emissions (in tonnes): </td <td></td>													
All options are assessed as being Neutral to each other as the marine environmental impact from vessel noise, tooling noise and releases is similar across all options. It is noted that the impact from releases from the injection. Overall, all options are equally preferred from an Operational Marine Impact perspective. Vessel Emissions (in tonnes): Vessel Emissions (in tonnes		Ν	N	N	ĺ.	N	N	r	N				
All options are assessed as being Neutral to each other as the marine environmental impact from vessel noise, tooling noise and releases is similar across all options. It is noted that the impact from releases from the injection. Overall, all options are equally preferred from an Operational Marine Impact perspective. Vessel Emissions (in tonnes): Fuel: 498 CO2: 1,579 NOX: 52,59 So2: 1,99 Vessel Energy Use: 21,417 GJ N N N N N N N N N N N N N N N N N N N													
injection. Overall, all options are equally preferred from an Operational Marine Impact perspective. Vessel Emissions (in tonnes): Fuel: 498 CO2: 1,579 NOX: 29,59 NOX: 29,59 SO2: 1,99 Vessel Energy Use: 21,417 GJ N N N N N N N N N N N N N			-	-			act from vessel noise, to	ooling noise and releas	es is similar across all opti	ons. It is noted that the impact from re	eases from the		
Vessel Emissions (in tonnes):	nmary							-					
Fuel: 498 Fuel: 1,029 Fuel: 890 Fuel: 890 Fuel: 1,22 Fuel: 1,22 Fuel: 2,22		Overall, all opti	ons are equally p	referred from	an Operational N	Aarine Impact perspec	tive.						
Fuel: 498 Fuel: 1,029 Fuel: 1,029 Fuel: 890 Fuel: 1,029 Fuel: 2,820 Fuel: 3,02: 4,00 Fuel: 3,02: 3,56 Fuel: 3,02: 3,02: 3,56													
CO2: 1,579 CO2: 2,579 CO2: 2,820 CO2: 2,820 CO2: 4,0 NOx: 29.59 NOx: 61.12 NOx: 52.85 NOx: 52.85 NOx: 52.85 NOx: 52.85 SO2: 3.56 NOx: 52.85 SO2: 5.16 SO2: 5.16 NOx: 52.85 SO2: 5.16 NOx: 52.85 NOx: 52.85 SO2: 5.16 NOx: 52.85 NOx: 52.8		Vessel Emission	s (in tonnes):		•	Vessel Emissions (in to	onnes):	•	Vessel Emissions (in tonr	nes):	Vessel Em		
Nox: 29.59 SO2: 1.99 Nox: 61.12 SO2: 4.12 Nox: 52.85 SO2: 3.56 Nox: 52.85 SO2: 3.56 Nox: 52.85 SO2: 3.56 Nox: 52.85 SO2: 516 Nox: 52.85 SO2: 516 Nox: 52.85 <		Fuel: 498				Fuel: 1,029			Fuel: 890		Fuel: 1,291		
SO2: 1.99 SO2: 3.56 SO2: 3.56 SO2: 5.16 Vessel Energy Use: 21,417 GJ Vessel Energy Use: 44,244 GJ Vessel Energy Use: 38,255 GJ Vessel Energy Use: 38,255 GJ N N N N N N N N N	ы Б. Т. j	CO2: 1,579				CO2: 3,262			CO2: 2,820		CO2: 4,091		
SO2: 1.99 SO2: 3.56 SO2: 3.56 Vessel Energy Use: 21,417 GJ Vessel Energy Use: 44,244 GJ Vessel Energy Use: 38,255 GJ N N N N		NOx: 29.59				NOx: 61.12			NOx: 52.85		NOx: 76.66		
Vessel Energy Use: 21,417 GJ Vessel Energy Use: 44,244 GJ Vessel Energy Use: 38,255 GJ Vessel Energy Use: 64,244 GJ N	s s par					SO2: 4.12			SO2: 3.56		SO2: 5.16		
	sions &	SO2: 1.99	Vessel Energy Use: 21,417 GJ				Vessel Energy Use: 44,244 GJ			Vessel Energy Use: 38,255 GJ			
The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows:	issio issio		se: 21,417 GJ										
	issio issio	Vessel Energy U		N			N	<u> </u>	N				



- Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

Noise (days on-site): 14.5 days g Noise (Hydraulic Shears) = 6.0 days

tion releases:

eaning and flushing operations will use Best

nmental Practice (BEP) and the Best Available Techniques o minimise as far as possible both residual hydrocarbon her chemical levels in line post flush and releases to the e environment during flushing activities.

g of line ends would lead to an elevated release of fluids vithin the line. However, given the prior cleaning of the line, ncentration and quantity of release should still be low . Therefore, the related impact is also anticipated to be low.

releases:

cludes Ballast, Grey and Black Water, this is driven by on of vessel operations and therefore at 14.5 days is the st of all options but not considered significant. The nmental impact is considered to be negligible.

the line are insignificant as this line was used for water

Emissions (in tonnes): 291 ,091 6.66 16

Energy Use: 55,494 GJ

nce from an environmental impact perspective.

Comparative Assessment Report – Consultation Draft

	O2B - Full Re	moval - Reverse	Installlation Wi	thout Deburial	O3B - Leave	e (Major) - Trench & Bur	ry Entire Line		lacement Over Areas of Spans / Shallow Burial	04C
2. Environmental 2.3 Other Consumptions	Recovered Mate Remaining Mat		25):		Material Emissions (Recovered Material: Remaining Material:	·		Material Emissions (CO2 in tonn Recovered Material: Remaining Material: 6,559 Total: 6,559	es):	Materia Recover Remain Total: 6,
2. Envira 2.3 C Consun	Total: 3,564 Rock: 256 tonne	s			Total: 6,559 Rock: 2,000 tonnes			Rock: 12,000 tonnes		Rock: 38
	N	N	N	í.	N	N	¥	N	í -	
Summary	All options are a	assessed as being	Neutral to each				al and rock consumpt	tion is similar across all options.		
ronmental Seabed urbance	Seabed Disturbance (m2): Rock Cover: 50				Seabed Disturbance Rock Cover: 2,000 Trenching: 156,950	(m2):		Seabed Disturbance (m2): Rock Cover: 12,000		Seabed Rock Co
 Environmental Seabed Disturbance 	Habitat Loss / Change (m2):				Habitat Loss/Chang Rock Cover: 2,000	ie (m2):		Habitat Loss/Change (m2): Rock Cover: 12,000		Habitat Rock Ba
Summary	Option 2B is ass area of perman Option 3B is ass being Neutral t Option 4A is ass	essed as being M ent habitat chang essed as being St o Option 4C as th sessed as being M	luch Stronger tha ge from the rock tronger than Opt e large area of te luch Weaker tha	an Option 4A due cover over the cut ion 4A as, while t mporary impact	to the limited disturba t locations in Option 4 here is a large area of i from trenching has sin to the larger area of pe	ance versus a significant C. mpact from the trenchir	area of permanent hang operations in Optio I area of permanent ha	abitat change from the introducti	f seabed disturbance from the tren on of rock cover in Option 4A. Opti e smaller area of permanent habita	on 2B is a
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 releases is therefore expected to be low overall.			(BAT) to minimise as far as possi other chemical levels in line pos The legacy marine impact from	nd the Best Available Techniques ble both residual hydrocarbon and st flush.	Line cle Environ (BAT) to and oth The lega concent overall.	
	S	MS	MS		S	S		N		
Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2B is assessed as being Stronger than Option 3B as there is no legacy marine impact from the full removal option versus the line remaining in Option 3B although, as the line is fully trenched and bur reducing its impact. Option 2B is assessed as being Much Stronger than Option 4A and Option 4A and Option 4C as the line is fully removed versus the line remaining exposed to the marine environment. Option 3B is assessed as being Stronger than Option 4A and Option 4C as the line remains but is isolated from marine environment as it is fully trenched and buried versus the line remaining and exposed to the marine and is exposed to the marine environment in both options. Note: it is recognised that the releases from this line over a long time period will negligible given its service as a water line. The line has a polymer liner which will be left in-situ and will introduce degradati occur slowly over a long time frame. Overall, Option 2B is preferred from a Legacy Marine Impacts perspective.									



- Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

al Emissions (CO2 in tonnes): ered Material: 250 ning Material: 6,092 5,342

84 tonnes

d Disturbance (m2): cover: 600

it Loss / Change (m2): Bags: 600

f the line, although this impact is temporary in nature. assessed as being Stronger than Option 4C due to small

e from the rock cover in Option 4A. Option 3B is assessed as

eaning and flushing operations will use Best nmental Practice (BEP) and the Best Available Techniques o minimise as far as possible both residual hydrocarbon her chemical levels in line post flush.

gacy marine impact from the slow release of these low ntration / quantity releases is therefore expected to be low .

n Option 3B so is isolated from the marine environment

marine environment.

oducts into the marine environment although this will

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		O2B - Full Rer	noval - Reverse	Installlation Wi	thout Deburial	O3B - Leave	(Major) - Trench & Bi	ury Entire Line		ock Placement Over Areas of Spans , sure / Shallow Burial	04C
3. Technical	3.1 Technical Risk	track record. (Sco Technical Risks:	y: Reverse reel of ore 2) Relatively small s with the scale / lo	cale scope, limi	ted technical	(Score 1)	echncial studies would	s has good track record	Concept Maturity: Rock pla (Score 3)	acement is a well proven technique. echnical risks associated with option	Concer Techni (Score 3
		W	MW	MW	ľ	W	W	ľ.	N	r i i i i i i i i i i i i i i i i i i i	
Sur	nmary	Option 2B is asse is expected to ca Option 3B is asse Option 4A is asse	arry less technical essed as being W essed as being Ne	eaker than Opti risk (Kestrel line eaker than Opti eutral to Option	on 3B as reverse r in area has been on 4A and Optior 4C as both optior	trenched). Option 2B	is assessed as being M nnical challenges in tre ne operations.	uch Weaker than Optio	n 4A and Option 4C due to	pability versus trenching of the line wh the limited track record versus largely r a capability the entire line versus largely	outine op
4. Societal	4.1 Fishing	Limited short term disturbance, infrastructure is removed, positive for fishing in the long term. (Score 2)					ssful, the area would b			ll amount of short term disturbance er, rock berms are not preferred option s perspective. (Score 1)	Rock b minim
		S	MS	MS		S	S	ľ.	N		
Sur	nmary	Option 2B is asse remaining in-sit Option 3B is asse / problem areas Option 4A is asse	essed as being Sta au (surface laid) w essed as being Sta removed in the o essed as being Na	ronger than Opt ith problem are ronger than Opt ther options. eutral to Option	as rock covered or ion 4A and Optio	is removed versus rem r removed in the other in 4C as the while the li nains surface laid with	options. ine remains in-situ in a		ched and buried thus prese	s assessed as being Much Stronger than enting a clear seabed in Option 3B versu	
al	Users				ed, however, also to limited land fill	Minimal societal ben Materials Returned:	efits/impacts with thi	s option. (Score 3)	Minimal societal benefits, Materials Returned:	/ impacts with this option. (Score 3)	Minima Materia
4. Societal	4.2 Other L	Materials Return Steel: 3,410 tonn Polymer: 295 tor	es (recyclable)			None.			None.		Steel: 2 Polyme
		N	N	N	ſ	N	N	í.	N		
Sur	nmary	All options are as benefit of this is	ssessed as Neutra offset by the large	al to each other a er quantity of po	lymer returned w		o in landfill.	rgely insignificant acros	s all options. It is noted tha	a greater quantity of useful, recyclable	e material



C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

pt Maturity: Cut and lift has a good track record (Score 3) ical Risks: No significant technical risk with this option. 3)

e still having challenges relating to geotechnical conditions perations in the other options. operations in the other options.

bags intended to be installed with a suitable gradient to hise impact on fishing operations. (Score 3)

A and Option 4C as the line is removed versus the line

e remaining surface laid with rock cover over problem areas

al societal benefits/impacts with this option. (Score 3)

als Returned: 247 tonnes (recyclable) .er: 22 tonnes (landfill)

I (steel) is returned in Option 2B, however the societal

	O2B - Full Removal - Reverse Installlation Without Deburial				hout Deburial	O3B - Leave	(Major) - Trench & Bu	ry Entire Line		c Placement Over Areas of Spans / e / Shallow Burial	04C
5. Economic	5.1 Short- term Costs	£5.138 Million				£3.306 Million			£1.019 Million		£2.539 I
		N	W	Ν	×	W	N	r	N		
		1.832 million more	4.119 million more	2.599 million more		2.287 million more	0.767 million more		1.52 million less		
		55.4% higher	404.2% higher	102.4% higher		224.4% higher	30.2% higher		59.9% lower		
Su	nmary	more than 5 tim Option 3B is asse £800k more, thi Option 4A is ass	es higher (around essed as being We s is considered ins	£4 million more eaker than Option ufficient to expre utral to Option 4) than Option 44 n 4A due to the c ess a preference. C as, while the c	A. Option 2B is assessed costs to deliver this option osts to deliver Option 4	as being Neutral to O on being more than 3	ption 4C as, while the times higher (around	costs to deliver Option 2B are £2	e. Option 2B is assessed as being We 2.6 million more, this is considered ir 4A. Option 3B is assessed as being N e.	nsufficient
	۶	Surveys: £0 Milli	on .			Surveys: £0.839 Millior	n n		Surveys: £0.839 Million		Surveys
5. Economic	Long-term Costs	FLTC: N/A				FLTC: N/A			FLTC: £0.048 Million		FLTC: £
5. Eco	5.2 Lor Co	Total Legacy Cos	st: £0 Million			Total Legacy Cost: £0.8	839 Million		Total Legacy Cost: £0.886 Mill	ion	Total Le
		N	N	Ν		N	N		N		
Su	nmary	All options are as preference.	of the Long-term ssessed as being N ons are equally p	leutral to each of	ther as, while the	_	osts associated with the	full removal option, t	he costs associated with the mo	onitoring and surveying of the lines re	emaining



A constraint of the costs to deliver this option being to express a preference. Option 4C as, while the costs to deliver Option 3B are A costs to deliver A costs to deliver Option 3B are A costs to deliver A

g in-situ are relatively minor and insufficient to express a



G.2 Group 6 Pairwise Comparison Matrices – Safety

Weig

13.4%

33.8%

33.8%

19.0%

1.1 Operations Personnel	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial		Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	w	VMW	w		9.7%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	×	s		22.8%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	S	N	MS	-	51.9%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	w	MW	N		15.6%
		1				
1.3 High Consequence	ill Removal - Installlation ut Deburial	ave (Major) - k Bury Entire Line	ave (Minor) - icement Over of Spans / re / Shallow	ave (Minor) - reas of Spans / re / Shallow Burial		ighting

02B - Ful Reverse I Without

Ν

MS

MS

Ν

Events

O2B - Full Removal -Reverse Installlation Without Deburial

O3B - Leave (Major) -Trench & Bury Entire

Line O4A - Leave (Minor) -Rock Placement Over Areas of Spans /

Exposure / Shallow O4C - Leave (Minor) -Remove Areas of Spans

/ Exposure / Shallow Burial 03B - Lea Trench &

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04A - Le Rock Pla

Area Expos 04C - L emove Expos

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1.2 Other Users	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	N	N	z	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	и	25.0%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	Ν	N	N	25.0%
				/	

1.4 Legacy Risk	02B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	S	MS	MS	41.3%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	MS	MS	33.8 %
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MW	MW	N	N	12.5%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MW	MW	N	N	12.5%



G.3 Group 6 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	N	N	г	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	и	25.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%

2.3 Other Consumptions	O2B - Full Removal - Reverse Installlation Without Deburial	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	N	N	N	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	z	25.0%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%

2.5 Legacy Marine Impacts	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	Z	s	MS	MS	43.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	s	25.2%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	мw	w	N	N	15.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	мw	w	N	N	15.6%

2.2 Atmospheric Emissions & Fuel Consumption	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	N	N	N	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	N	25.0%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%

2.4 Seabed Disturbance	O2B - Full Removal - Reverse Installlation Without Deburial	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	s	MS	s	37.3%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	N	23.1%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MW	w	N	мw	12.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	MS	N	27.5%

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G.4 Group 6 Pairwise Comparison Matrices – Technical



G.5 Group 6 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	s	MS	MS	43.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	s	25.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MW	w	N	N	15.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	мw	w	N	N	15.6%

4.2 Other Users	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	Z	N	N	z	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	z	25.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	z	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	Ν	N	N	25.0%



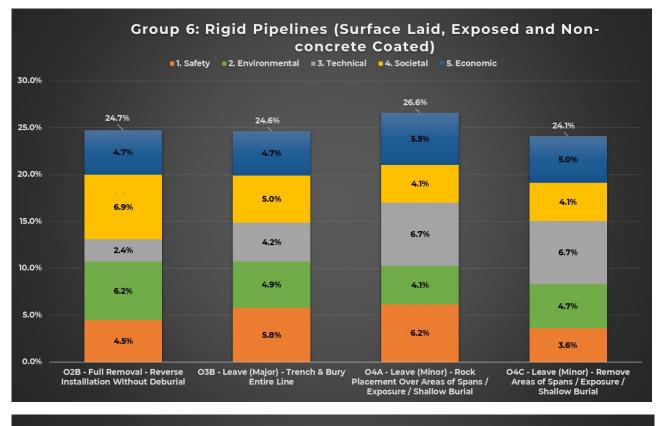
G.6 Group 6 Pairwise Comparison Matrices – Economic

5.1 Short-term Costs	O2B - Full Removal - Reverse Installlation Without Deburial	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	N	w	N	22.4%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	w	N	22.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	s	N	N	30.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	Ν	N	N	24.8%

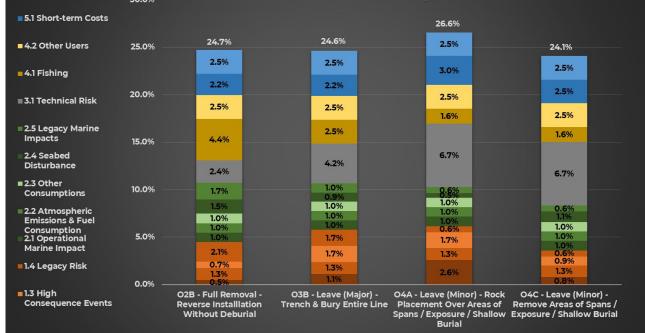
5.2 Long-term Costs	O2B - Full Removal - Reverse Installlation Without Deburial	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2B - Full Removal - Reverse Installlation Without Deburial	N	N	N	N	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	И	N	N	г	25.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%



G.7 Group 6 Results Charts



Group 6: Rigid Pipelines (Surface Laid, Exposed and Non-30.0% concrete Coated)



5.2 Long-term Costs



APPENDIX H GROUP 7 – DETAILED EVALUATION RESULTS

H.1 Group 7 Attributes Table



Group 7: Rigid Lines (Surface Laid, Exposed and Concrete Coated)

PL113 (N0305) - 20" Oil Pipeline from North Cormorant to Cormorant Alpha - 16.586 km | PL477 (N0505) - 16" Oil Pipeline from Tern to North Cormorant - 12.957 km

	O2A - Full Remo	val - Cut and Lift	:	O3B - Leave	(Major) - Trench & Bu	ry Entire Line		acement Over Areas of Spans / Shallow Burial	04C -	
- Pipelines are o	disconnected			- Pipelines are discon	nected		- Pipelines are disconnected		- Pipeline	
- Surface laid lir	nes are fully recove	ered by cut and li	ft	- Entirety of lines are t	renched and backfilled	d to 0.6m DoC	- Rock placement over areas of s	bans	- Areas of	
- Concrete spall	ing debris is recov	vered by DSV (25%	of cuts)	- Remedial rock cover	installed over trench t	ransitions				
Vessel Type: Po	B/Days/Hours/P	PLL		Vessel Type: PoB / Day	ys/Hours/PLL		Vessel Type: PoB / Days / Hours / I	PLL	Vessel Ty	
DSV: 110 / 19.5 / 2	25,674/1.93E-03			Rockdump Vessel: 20	/5.0/1,210/9.07E-05		Rockdump Vessel: 20 / 8.6 / 2,052	/1.54E-04	DSV: 110 /	
Divers: 18/19.5/	8,402/8.15E-03			Trenching Vessel: 55 /	19.0/12,566/9.42E-04				Divers: 18	
CSV: 76/154.7/	141,114/1.06E-02						Total offshore hours: 2,052 hrs		CSV: 76/2	
				Total offshore hours: 13	3,776 hrs		Total offshore PLL: 1.54E-04			
Total offshore h	ours: 175,190 hrs			Total offshore PLL: 1.03	3E-03				Total offsh	
Total offshore P	LL: 2.07E-02						Resource Type: Days/Hours/PLI	_	Total offsh	
				Resource Type: Days/	Hours/PLL		Engineering & Management: 61.	8/494/1.98E-06		
Resource Type:	Days/Hours/PLL			Engineering & Manag	gement: 504.4/4,035/ ⁻	1.61E-05	Project Management: 90.0 / 720	/2.88E-06	Resource	
Engineering &	Management: 2,36	56.2 / 18,929 / 7.57E	-05		: 486.0 / 3,888 / 1.56E-05			Engineer		
Project Manage	ement: 2,285.0 / 18,2	280/7.31E-05					Total onshore hours: 1,214 hrs			
Onshore Opera	tions (includes Cle	eaning & Disposal): 376.0 / 24,064	Total onshore hours: 7	7,923 hrs		Total onshore PLL: 4.86E-06			
/2.96E-03				Total onshore PLL: 3.17	7E-05					
							Total operational hours: 3,266 hrs			
Total onshore h	ours: 61,273 hrs			Total operational hou	rs: 21,699 hrs		Total operational PLL: 1.59E-04		Total onsl	
Total onshore P	LL: 3.11E-03			Total operational PLL:	: 1.06E-03				Total onsl	
Total operation	al hours: 236,464 h	nrs							Total ope	
Total operation	al PLL: 2.38E-02								Total ope	
MW	VMW	W	۲	w	S	r	MS			
22.4528	149.686	5		6.66666667	0.22268908		0.033403361			
	assessment of the Operations Personnel sub-criterion is									
	-		aker than Option 3B due to the risk exposure being around 22 times higher in Option 2A due to the greater offshore scope (with diver support) associated with the full rer							
-	-		Option 2A is assessed as being Very Much Weaker than Option 4A due to the risk exposure being around 150 times higher in Option 2B. This is due to the greater offshore s							
			-				n 2A is assessed as being Weaker th		sure being	
	1 (11 /					es to remove problem areas of the li			
Option 3B is ass	essed as being We	eaker than Optio	n 4A due to the r	isk exposure being aro	und 7 times higher in (Option 3B. This is due	e to the greater scope associated wit	th trenching the lines in Option 3E	3 versus the	

Option 3B is assessed as being Weaker than Option 4A due to the risk exposure being around 7 times higher in Option 3B. This is due to the greater scope associated with trenching the lines in Option 3B versus the smaller scope to provide rock placement over problem areas of the lines in Option 4A. Option 3B is assessed as being Stronger than Option 4C due to the risk exposure being around 5 times higher in Option 4C. This is due to the smaller scope associated with trenching the lines in Option 3B versus the entire line in Option 3B versus the greater scope to remove problem areas of the line in Option 4C.

Option 4A is assessed as being Much Stronger than Option 4C due to the risk exposure being around 30 times higher in Option 4C. This is due to the smaller scope associated with rock placement over problem areas of the line in Option 4A versus the greater scope to remove problem areas of the line in Option 4C due to the risk exposure being around 30 times higher in Option 4C. This is due to the smaller scope associated with rock placement over problem areas of the line in Option 4A versus the greater scope to

Overall, Option 4A is preferred from a risk to Operations Personnel perspective.



: - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial ines are disconnected s of spans are removed by cut and lift placement over cut ends to mitigate snag risk Type: PoB / Days / Hours / PLL 10/5.2/6,824/5.12E-04 :18/5.2/2,233/2.17E-03 6/27.3/24,861/1.86E-03 ffshore hours: 33,919 hrs offshore PLL: 4.54E-03 rce Type: Days/Hours/PLL eering & Management: 461.8/3,694/1.48E-05 Management: 440.0 / 3,520 / 1.41E-05 re Operations (includes Cleaning & Disposal): 24.0 / 1,536 /)4 onshore hours: 8,750 hrs nshore PLL: 2.18E-04 perational hours: 42,669 hrs perational PLL: 4.76E-03 oval of these lines versus the smaller scope to perform e (with diver support) associated with the full removal of the ng around 5 times higher in Option 2B. This is due to the

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			O2A - Full Remo	oval - Cut and Li	ift	O3B - Leave	(Major) - Trench & Bu	ry Entire Line	O4A - Leave (Minor) - Rock Placement Over A Exposure / Shallow Burial	reas of Spans / 040	
≅ty	_ ر	Vessel Days: DSV: 19.5 CSV: 154.7				Vessel Days: Rockdump Vessel: 5.0 Trenching Vessel: 19.0			Vessel Days: Rockdump Vessel: 8.6	Vessel DSV: 5. CSV: 27	
1. Safety	1.2 Other	Total vessel days Transits: 16	s: 174.2 days			Total vessel days: 24.1 Transits: 4	days		Total vessel days: 8.6 days Transits: 2		
		w	W	W	ľ	N	N	r	N		
Sum	nmary	The assessment Option 2A is asse All other options	of the Other Use essed as being W s are assessed as	ers sub-criterion is Veaker than all of being Neutral to	ther options due t each other as, wh	to the greater number of nile there are difference	of vessel days and trans	d transits, these are ins	her options presenting a small increase to the poten sufficient to express a preference from a safety perspe		
l. Safety 13 High	Consequence Events	through the wat lifting to transfe	ter column to rec r pipeline sectior	Very high numbe cover line section ns to quayside. L recover cutting e	s. Additional .ow number of		ching operations. Sma h the water column to t.		Routine, low risk rock placement operations with n operations.	no lifting High n to reco to tran operat	
		MW	MW	W		N	S		S	r.	
Sum	nmary	2A. Option 3B is ass Option 4A. Option 4A is ass	essed as being N ressed as being S	leutral to Option Stronger than Op	4A as there is mir	nimal / no lifting operat significant offshore lift	tions with these option:	s. Option 3B is assesse	e many more lifting operations and hence greater po d as being Stronger than Option 4C as there is signifi no lifting operations in Option 4A.		
l. Safety	1.4 Legacy Risk	No legacy risk fr	om this full remo	oval option.		be fully trenched and The survey & monitor that the potential sna continues to be man Vessel Type: PoB / Da	in in-situ with this optic d buried under this optic ing programme is com ag hazard from left in-s aged & mitigated as ap ys/Hours/PLL y): 44/31.4/16,574/1.24	on. mitted to ensuring itu infrastructure propriate.	The line would remain in-situ with this option with its length remaining surface laid. Areas of spans w placement to mitigate potential snag hazard. The survey & monitoring programme is committed that the potential snag hazard from left in-situ infr continues to be managed & mitigated as appropri Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 31.4 / 16,574 / 1.24E-03	ill have rock its leng with ro d to ensuring The sur astructure that th	
		S	MS	MS	ľ	MS	MS	r	W		
Sum	nmary	Option 2A is asse no legacy risk fro Option 3B is asse with large rock b Option 4A is ass	essed as being St om the full remo essed as being M berms or remove essed as being V	ival option versus fuch Stronger tha ed, presenting lin Veaker than Opti	tion 3B as while be the lines remain an Option 4A and es remaining surf	ing in-situ with probler Option 4C as while the face laid with areas of s e lines remain in both	m areas rock covered, p e lines remain in-situ, tl pot rock cover.	resenting surface laid ney are fully trenched	2A thus removing any potential for legacy risk. Optio lines with large rock berms or removed, presenting I and buried thus presenting a clear seabed versus lin as in Option 4A present a greater legacy snag risk tha	ines remaining surface l es remaining in-situ witl	



- Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

Days: .2 7.3

essel days: 32.4 days :s: 4

er users of the sea.

number of lifting operations (380) through the water column ver areas of spans and to place rock bags. Additional lifting sfer pipeline sections to quayside. Small number of lifting ions to deploy and recover cutting equipment.

otion 2A over minimal / no lifting operations with the other nence events from dropped object, associated with Option

pe associated with Option 4C versus limited lifting in

ne would remain in-situ with this option with the majority of gth remaining surface laid. Areas of spans will be removed bock cover to mitigate potential snag hazard from cut ends. rvey & monitoring programme is committed to ensuring ne potential snag hazard from left in-situ infrastructure ues to be managed & mitigated as appropriate.

Type: PoB/Days/Hours/PLL /Vessel (Legacy): 44/31.4/16,574/1.24E-03

9 Much Stronger than Option 4A and Option 4C as there is aid with areas of spot rock cover. h problem areas rock covered, presenting surface laid lines

ing removed in Option 4C.

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		O2A - Full Remov	val - Cut and Lift	: 	O3B - Leave	(Major) - Trench & Bui	ry Entire Line	O4A - Leave (Minor) - Rock F Exposure /	Shallow Burial	04C - I		
	Vessel Noise (da	ys on-site): 142.2 d	ays		Vessel Noise (days on-	-site): 16.1 days		Vessel Noise (days on-site): 4.6 c		Vessel No		
	Tooling Noise (D	WC) = 122.3 days			Tooling Noise (Trench	ing) = 12.4 days		Tooling Noise = none		Tooling N		
	Operation releas	ses:			Operation releases:			Operation releases:		Operation		
	Line cleaning ar	nd flushing operat	tions will use Bes	t	Line cleaning and flu	shing operations will us	se Best	Line cleaning and flushing ope	Line clear			
	Environmental I	Practice (BEP) and	d the Best Availab	ole Techniques	Environmental Practi	ce (BEP) and the Best A	vailable Techniques	Environmental Practice (BEP) and the Best Available Techniques				
Ś	(BAT) to minimis	se as far as possibl	e both residual h	ydrocarbon and	(BAT) to minimise as f	ar as possible both resi	dual hydrocarbon and					
e E		levels in line post f		s to the marine	other chemical levels	in line post flush and re	eleases to the marine	other chemical levels in line po	st flush and releases to the marine	and other		
b	environment du	uring flushing activ	vities.		environment during f	flushing activities.		environment during flushing a	ctivities.	marine er		
Operational Marine Impact	Cutting of line e	nds and midline o	cuts would lead to	o an elevated	As line is being trench	ned there is negligible r	elease from the line.	As line is being rock covered the	ere is negligible release from the	Cutting of		
la	release of fluids	from within the lir	ne. However, give	en the prior				line.		release of		
0	cleaning of the l	line, the concentra	ation and quantit	y of release	Vessel releases:					cleaning		
era		w overall. Therefo	ore, the related in	npact is also		Grey and Black Water, 1		Vessel releases:		should sti		
ð S	anticipated to b	e low.				erations and therefore a	3	This includes Ballast, Grey and I		anticipate		
Z.					•	t. The environmental in	mpact is considered to	· ·	•			
	/essel releases: This includes Ballast, Grey and Black Water, this is driven by				be negligible.				onmental impact is considered to	Vessel rel		
		s includes Ballast, Grey and Black Water, this is driven by						be negligible.		This inclu duration		
		s includes Ballast, Grey and Black Water, this is driven by ration of vessel operations and therefore at 142.2 days is the hest of all options. The environmental impact is considered								considere		
	be low.	dons. me environ	intental intpacts	s considered to						to be neg		
	14/	W	14/	*			F			V		
	W	VV	W		N	N		N	l i la companya da la			
	The assessment	of the Operationa	al Marine Impacts		s follows:							
	The assessment Option 2A is asse	of the Operationa essed as being We	al Marine Impacts eaker than all oth	er options due to	s follows: a combination of the	noise impact from the	longer vessel durations		releases of pipeline contents at all c	cut locatior		
nary	The assessment Option 2A is asse low, there is eno	of the Operationa essed as being We ough cumulative in	al Marine Impacts eaker than all oth mpact to express	er options due to a small preferen	s follows: a combination of the ce for all options over (noise impact from the l Option 2A.		s and tooling operations and the	releases of pipeline contents at all o			
ary	The assessment Option 2A is asse low, there is eno All other options	of the Operationa essed as being We ough cumulative in s are assessed as b	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (le there are difference	noise impact from the l Option 2A.	s, tooling operations a	s and tooling operations and the				
nary	The assessment Option 2A is asse low, there is eno All other options Overall, Option	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per	s, tooling operations a	s and tooling operations and the nd potential for releases from cut		ed insuffici		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per	s, tooling operations a	s and tooling operations and the nd potential for releases from cut Vessel Emissions (in tonnes):		ed insuffici Vessel Em		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission Fuel: 4,648	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per	s, tooling operations a	s and tooling operations and the nd potential for releases from cut Vessel Emissions (in tonnes): Fuel: 1,036		ed insuffici Vessel Em Fuel: 1,724		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission Fuel: 4,648 CO2: 14,733	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per	s, tooling operations a	s and tooling operations and the nd potential for releases from cut Vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284		ed insuffici Vessel Em Fuel: 1,724 CO2: 5,460		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission Fuel: 4,648 CO2: 14,733	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per	s, tooling operations a	s and tooling operations and the nd potential for releases from cut Vessel Emissions (in tonnes): Fuel: 1,036		ed insuffici Vessel Em Fuel: 1,724		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission Fuel: 4,648 CO2: 14,733 NOx: 276.07 SO2: 18.59	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar s (in tonnes):	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019 NOX: 75.30	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per Ionnes):	s, tooling operations a	s and tooling operations and the nd potential for releases from cut Vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284 NOX: 61.53		Vessel Em Fuel: 1,724 CO2: 5,460 NOx: 102.4		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission Fuel: 4,648 CO2: 14,733	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar s (in tonnes):	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019 NOX: 75.30 SO2: 5.07	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per Ionnes):	s, tooling operations a	vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284 NOx: 61.53 SO2: 4.14		ed insuffici Vessel Em Fuel: 1,724 CO2: 5,466 NOx: 102.4 SO2: 6,90		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission Fuel: 4,648 CO2: 14,733 NOx: 276.07 SO2: 18.59	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar s (in tonnes):	al Marine Impact eaker than all oth mpact to express peing Neutral to e	er options due to a small preferen ach other as, whi	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019 NOX: 75.30 SO2: 5.07 Vessel Energy Use: 54	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per Ionnes):	s, tooling operations a	vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284 NOx: 61.53 SO2: 4.14 Vessel Energy Use: 44,540 GJ		ed insuffici Vessel Em Fuel: 1,724 CO2: 5,466 NOx: 102.4 SO2: 6,90		
	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission: Fuel: 4,648 CO2: 14,733 NOx: 276.07 SO2: 18.59 Vessel Energy U	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar s (in tonnes): se: 199,852 GJ	Al Marine Impact seaker than all oth mpact to express being Neutral to e nd Option 4C ar	er options due to a small preferen each other as, wh e equally prefer	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019 NOX: 75.30 SO2: 5.07	noise impact from the l Option 2A. Is in the vessel duration mal Marine Impact per connes): ,511 GJ	s, tooling operations a	vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284 NOx: 61.53 SO2: 4.14		ed insuffici Vessel Em Fuel: 1,724 CO2: 5,466 NOx: 102.4 SO2: 6,90		
Emissions & Fuel Consumption	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission: Fuel: 4,648 CO2: 14,733 NOX: 276.07 SO2: 18.59 Vessel Energy U W The assessment Option 2A is asse	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar s (in tonnes): se: 199,852 GJ W of the Atmospher essed as being We	I Marine Impact seaker than all oth mpact to express being Neutral to e nd Option 4C ard ic Emissions & Co eaker than all oth	er options due to a small preferen each other as, whi e equally prefer	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019 NOX: 75.30 SO2: 5.07 Vessel Energy Use: 54 N -criterion is as follows: emissions and fuel use	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per onnes): ,511 GJ	s, tooling operations a rspective.	vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284 NOx: 61.53 SO2: 4.14 Vessel Energy Use: 44,540 GJ	tting operations, these are considered	ed insuffici Vessel Em Fuel: 1,724 CO2: 5,460 NOX: 102.4 SO2: 6.90 Vessel En		
ions & sumpt	The assessment Option 2A is asse low, there is eno All other options Overall, Option Vessel Emission: Fuel: 4,648 CO2: 14,733 NOx: 276.07 SO2: 18.59 Vessel Energy U W The assessment Option 2A is asse All remaining op	of the Operationa essed as being We ough cumulative in s are assessed as b 3B, Option 4A ar s (in tonnes): se: 199,852 GJ W of the Atmospher essed as being We ptions are assessed	I Marine Impact s eaker than all oth mpact to express being Neutral to e nd Option 4C ard ind Option 4C ard <i>ic</i> Emissions & Co eaker than all oth d as being Neutra	er options due to a small preferen each other as, whi e equally prefer ensumptions sub er options as the al to each other a	s follows: o a combination of the ce for all options over (ile there are difference red from an Operatio Vessel Emissions (in to Fuel: 1,268 CO2: 4,019 NOX: 75.30 SO2: 5.07 Vessel Energy Use: 54 N -criterion is as follows: emissions and fuel use s, while there are smal	noise impact from the l Option 2A. Is in the vessel duration Inal Marine Impact per onnes): ,511 GJ	s, tooling operations an rspective.	s and tooling operations and the nd potential for releases from cut Vessel Emissions (in tonnes): Fuel: 1,036 CO2: 3,284 NOx: 61.53 SO2: 4.14 Vessel Energy Use: 44,540 GJ N	tting operations, these are considered	ed insuffici Vessel Em Fuel: 1,724 CO2: 5,460 NOX: 102.4 SO2: 6.90 Vessel En		



: - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

Noise (days on-site): 24.4 days g Noise (Hydraulic Shears) = 9.5 days

tion releases:

eaning and flushing operations will use Best

nmental Practice (BEP) and the Best Available Techniques o minimise as far as possible both residual hydrocarbon her chemical levels in line post flush and releases to the e environment during flushing activities.

g of line ends and midline cuts would lead to an elevated e of fluids from within the line. However, given the prior ng of the line, the concentration and quantity of release d still be low overall. Therefore, the related impact is also pated to be low.

releases:

cludes Ballast, Grey and Black Water, this is driven by on of vessel operations and therefore at 24.4 days is not lered significant. The environmental impact is considered negligible.

tions. Whilst the environmental impact is expected to be

ficient to express a preference.

Emissions (in tonnes): ,724 ,466 02.43 .90

Energy Use: 74,150 GJ

he other options.

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			O2A - Full Remo	oval - Cut and I	ift	O3B - Leave	(Major) - Trench & Bu	ury Entire Line	O4A - Leave (Minor) - Rock Placement Over Are Exposure / Shallow Burial	eas of Spans / O4	04C
ıtal	sı		ons (CO2 in tonne	es):		Material Emissions (C	CO2 in tonnes):		Material Emissions (CO2 in tonnes):	Mate	eria
nen	Other umptions	Recovered Mate				Recovered Material:			Recovered Material:	Reco	
nno	Other Imptio	Remaining Mate	erial: 110			Remaining Material:	14,663		Remaining Material: 14,663	Rema	
iviro	2.3 C onsur	Total: 11,704				Total: 14,663			Total: 14,663	Total	al: 14
2. Environmental	Cor	Rock: 160 tonnes	5			Rock: 5,000 tonnes			Rock: 23,000 tonnes	Rock	k: 6
		S	S	N		S	N		W		
					criterion is as follo		•				
									eturned material and there being minimal rock reso		
				-	Option 4A. Optio	n 2A is assessed as beir	ng Neutral to Option 4	Cas, while there is a gre	ater impact from replacing material left in-situ and t	ne higher amount of	froo
c			fficient to express		tion (A cathora is			ntion 7D. Ontion 7D is a	eeeeed oo boing Noutral to Option (Coo while there		
Su	nmary		press a preferenc		LION 4A as there is	Significantly less fock i	resource required in O		ssessed as being Neutral to Option 4C as, while there	IS MOLE TOCK LESOULCE	.e n
					ion 4C due to the	much greater rock reso	ource required in Optio	on 4A.			
					Consumptions p						
			-			-					
_ 1		Seabed Disturba	ance (m2) [.]			Seabed Disturbance	(m2) [.]		Seabed Disturbance (m2):	Seab	bec
nta	- e	Rock Cover: 250	(112).			Rock Cover: 5,000	(1112).		Rock Cover: 19,000	Rock	
me	abed bance					Trenching: 292,030					
IU O	Seabed urbance	Habitat Loss/Ch	nange (m2):						Habitat Loss / Change (m2):	Habi	oitat
ر ۲	2.4 Se Distur	Rock Bags: 250				Habitat Loss/Change	e (m2):		Rock Cover: 19,000	Rock	kВ
2. Environmental						Rock Cover: 5,000					
		•									
		S	MS	N		S	W		MW		
					criterion is as follo						
									se surface laid lines versus a significant area of tempo ted with the full removal of these surface laid lines ver		
									permanent habitat change in Option 4C being insuf		
Su	mmary								cant area of impact from the trenching operations is l		
						ent habitat change fro					
		Option 4A is asse	essed as being M	luch Weaker th	n Option 4C due	to the significant area o	of permanent habitat o	change from the rock co	ver in Option 4A.		
		Overall, Option	2A and Option	4C are equally	preferred from a	Seabed Disturbance	perspective.				
ľ		No legacy marin	ne impact from th	nis full removal	option.	Line cleaning and flu	ushing operations will	use Best	Line cleaning and flushing operations will use Best	Line	e cle
al	e					Environmental Pract	ice (BEP) and the Best	Available Techniques	Environmental Practice (BEP) and the Best Availabl		iror
ent	lari s					. ,		sidual hydrocarbon and	(BAT) to minimise as far as possible both residual hy		
2. Environmental	Legacy Marine Impacts					other chemical levels	s in line post flush.		other chemical levels in line post flush.	ando	oth
/iro	gac mp.							and of the one low	The large supervises increase from the eleveroleses of t	haaa law. Tha l	
ĒŊ							npact from the slow rel Itity releases is therefor		The legacy marine impact from the slow release of t concentration / guantity releases is therefore expect		-
5.	2.5					overall.	itity releases is therefor	e expected to be low	overall.	overa	
		S	S	S		N	N		N		
			• •		b-criterion is as fo						
								gacy environmental im			
Su	mmary	All other options legacy environm		being neutral t	each other as the	e innes remain in each (or the options with the	regacy impact from SIOV	v releases of residual (minimal) contents and degrada	ation products is expe	lect
				from a Legacy	Marine Impacts	perspective.					
		,				· · · · · · · · · · · · · · · · · · ·					



- Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

al Emissions (CO2 in tonnes): ered Material: 732 ining Material: 13,745 14,477

608 tonnes

e greater impact from generating replacement material ock resource required in Option 4C, this difference is

required in Option 3B, the difference is considered

d Disturbance (m2): Cover: 950

t Loss / Change (m2): ags: 950

hing the lines and permanent habitat change from the of permanent habitat change from the rock cover in Option ference.

npact is temporary in nature. Option 3B is assessed as

eaning and flushing operations will use Best nmental Practice (BEP) and the Best Available Techniques o minimise as far as possible both residual hydrocarbon her chemical levels in line post flush.

gacy marine impact from the slow release of these low ntration / quantity releases is therefore expected to be low I.

ted to be similar for all options presenting a similar (minor)

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		O2A - Full Remo	val - Cut and Li	ft	O3B - Leave	(Major) - Trench & Bu	ry Entire Line		lacement Over Areas of Spans / Shallow Burial	04C -	
3.1 Technical Risk	multiple option Technical Risks	ty: Cut and lift tec as available on the : Technical risks w operation. (Score :	e market. (Score . ith this option ar	3)	limited track record (Technical Risks: A cor	enching of large diamet Score 1) mparatively large scope uired to confirm if it is fe	e. Geotechnical	Concept Maturity: Rock placeme (Score 3)	Technical Risks: Limited technical risks associated with option		
	Ν	W	W	ľ	w	W	r	N			
mmary	Option 2A is ass is assessed as be Option 3B is ass Option 4A is ass	eing Weaker than sessed as being W sessed as being No	eutral to Option Option 4A and Yeaker than Option eutral to Option	3B as the challeng Option 4C as thes on 4A and Option 4C as these option	e options employ large	ely routine operations. nges associated with tre routine operations.		tings on this scale and trenching o ameter versus largely routine ope	of these large diameter lines are ex rations in the other options.	xpected to	
4.1 Fishing		uption associated tructure is remove r. (Score 2)			localised area of distu	relatively short term op urbance. If successful, th to be conducted. (Score	ne area would be clear	Minimal operation, a small amo during operation. However, rocl from the fishing industry's persp	k berms are not preferred option	Rock bag minimise	
	S	MS	MS	ľ	S	S		N	r	×.	
ummary	Option 2A is ass lines remaining Option 3B is ass areas / problem Option 4A is ass	g in-situ (surface la sessed as being St areas removed in	ronger than Opt aid) with problen ronger than Opt n the other optio eutral to Option	ion 3B as the lines n areas rock cover ion 4A and Option ns. 4C as the lines rer	are removed versus re ed or removed in the o n 4C as the while the li main surface laid with	other options.	l options, they are fully	trenched and buried thus preser	essed as being Much Stronger tha ting a clear seabed in Option 3B v		
4.2 Other Users	there is also a ve likely have to go Materials Return Steel: 4,610 tonn		of concrete retur		Minimal societal ben Materials Returned: None.	efits/impacts with this	option. (Score 3)	Minimal societal benefits/impa Materials Returned: None.	cts with this option. (Score 3)	Minimal s Materials Steel: 291 Concrete	
	W	W	W		N	N		N	<u> </u>	r	
Summary	Option 2A is ass All other option a preference.	s are assessed as k	eaker than all ot being Neutral to	her options as wh each other as wh	ile there is benefit in t ile there are difference		s, with Option 4C retur		ty of concrete returned which is lik which is offset by the concrete ret		



C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial

pt Maturity: Cut and lift has a good track record (Score 3) ical Risks: No significant technical risk with this option. 3)

to provide a similar level of technical challenges. Option 2A

bags intended to be installed with a suitable gradient to hise impact on fishing operations. (Score 3)

A A and Option 4C as the lines are removed versus the

e lines remaining surface laid with rock cover over problem

al societal benefits/impacts with this option. (Score 3)

als Returned: 291 tonnes (recyclable) ete: 419 tonnes (landfill)

nd up in landfill. oing to landfill, these differences are insufficient to express

O2A - Full Removal - Cut and		val - Cut and Lift		(Major) - Trench & Bu	ry Entire Line	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial			
5. Economic 5.1 Short- term Costs	±22.47 Million		£4.931 Million			£1.164 Million		£4.572 N	
	MW	MW	MW	W	N		S	¥	
	17.539 million more	21.306 million more	17.898 million more	3.767 million more	0.359 million more		3.408 million less		
	355.7% higher	1830.4% higher	391.5% higher	323.6% higher	7.9% higher		74.5% lower		
Summary	Option 3B is as Option 4A is as	ssessed as being W ssessed as being St	eaker than Option 4A	C due to the costs being more than	mes higher (£3.8 millic	n more). Option 3E	is assessed as being Neutral to Option	n 4C due to the costs being simila	ar.
Economic Long-term Costs	Surveys: N/A FLTC: N/A			Surveys: £0.942 Million FLTC: N/A	n		Surveys: £0.942 Million FLTC: £0.089 Million		Surveys: FLTC: £0
5. Econ 5.2 Long Cos	Total Legacy C	ost: £0 Million		Total Legacy Cost: £0.	942 Million		Total Legacy Cost: £1.03 Million		Total Le
	N	N	N	N	N		Ν		
Summary	All options are preference.	assessed as being			osts associated with the	full removal option	n, the costs associated with the monito	ring and surveying of the lines re	emaining i



C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial 2 Million Option 4A due to the costs being around 19 times higher eys: £0.942 Million £0.089 Million Legacy Cost: £1.03 Million



H.2 Group 7 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial		Weighting
O2A - Full Removal - Cut and Lift	Z	мw	VMW	w		7.9%
O3B - Leave (Major) - Trench & Bury Entire Line	MS	N	w	s		26.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	S	N	MS		50.5%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	w	мw	N		15.2%
<	- Cut	r) - tire	ır) - Ver V	rr) - ans / w		

1.3 High Consequence Events	O2A - Full Removal - Cu and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	¥	12.0%
O3B - Leave (Major) - Trench & Bury Entire Line	MS	N	N	s	33.6%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	s	33.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	w	w	N	20.8%

1.2 Other Users	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow		Weighting
O2A - Full Removal - Cut and Lift	Z	w	w	w	18.2 %
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	и	27.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	N	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%

1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	MS	MS	41.3%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	MS	MS	33.7%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	мw	мw	N	w	11.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MW	MW	S	N	13.8%



H.3 Group 7 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	Z	w	w	*	18.2%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	z	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	R	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%

2.3 Other Consumptions	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	z	30.1%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	z	24.6%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	w	N	w	18.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	S	N	27.2%

2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	33.3%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	N	N	22.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	N	22.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	22.2%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2 %
O3B - Leave (Major) - Trench & Bury Entire Line	S	N	N	N	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	N	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	s	MS	N	33.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	w	20.8%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MW	w	N	мw	12.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	S	MS	N	33.6%



H.4 Group 7 Pairwise Comparison Matrices – Technical



H.5 Group 7 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	Z	s	MS	MS	43.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	s	s	25.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	мw	w	N	z	15.6%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	мw	w	N	N	15.6%

4.2 Other Users	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	z	27.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	S	N	N	z	27.3%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	27.3%



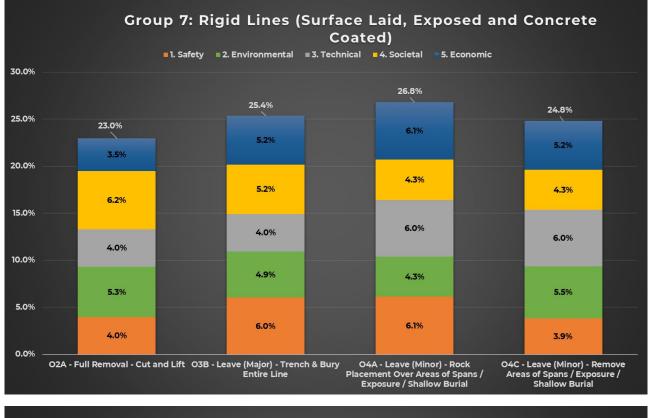
H.6 Group 7 Pairwise Comparison Matrices – Economic

5.1 Short-term Costs	O2A - Full Removal - Cut and Lift	03B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	мw	9.9%
O3B - Leave (Major) - Trench & Bury Entire Line	MS	N	w	N	26.9%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	S	N	s	36.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	N	w	N	26.9 %

5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	O3B - Leave (Major) - Trench & Bury Entire Line	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	Weighting
O2A - Full Removal - Cut and Lift	N	N	N	N	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	N	25.0%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	25.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	25.0%



H.7 Group 7 Results Charts



Group 7: Rigid Lines (Surface Laid, Exposed and Concrete Coated)

	30.0%				
5.1 Short-term Costs				26.8%	
			25.4%	2.5%	24.8%
4.2 Other Users	25.0%	23.0%	2.5%		2.5%
4.1 Fishing		2.5%	2.7%	3.6%	2.7%
■ 3.1 Technical Risk	20.0%	1.0%	2.7%	2.7%	2.7%
2.5 Legacy Marine			2.5%	1.6%	1.6%
Impacts	15.0%	4.4%	21070		
2.4 Seabed Disturbance			4.0%	6.0%	6.0%
■ 2.3 Other Consumptions	10.0%	4.0%	0.9%	0.9%	
2.2 Atmospheric		1.3%	1.0% 1.1%	1.1%	0.9%
Emissions & Fuel Consumption 2.1 Operational	5.0%	1.2% 0.7% 0.7%	1.1% 1.7%	1.1% 0.6%	1.1%
Marine Impact		2.1%	1.7%	1.4%	1.1% 0.7%
1.4 Legacy Risk	0.0%	0.6% 0.9%	1.4% 1.3%	2.5%	1.4%
1.3 High Consequence Events	0.0% —— O24	- Full Removal - Cut and Lift	Trench & Bury Entire Line	94A - Leave (Minor) - Rock Placement Over Areas of pans / Exposure / Shallow Burial	O4C - Leave (Minor) - Remove Areas of Spans /

5.2 Long-term Costs



APPENDIX I GROUP 8 – DETAILED EVALUATION RESULTS

I.1 Group 8 Attributes Table

5				Pipelines (Surface Laid and Roo	-
		O2C - Full Remov	PL114 (al - Reverse Installlation With Debur	N0602) - 10" Gas Pipeline from North Cormorant to Western Leg T O4A - Leave (Minor) - Rock Placement Over Areas of Spans Exposure / Shallow Burial	
		- Pipeline disconnecto - Line de-buried using - Line cut around cros - Line recovered to rec	MFE	- Pipeline disconnected - Pipeline end transitions cut and recovered in 10m sections - Rock placed over areas of span / exposure / shallow burial	- Pipeline disconnected - Pipeline end transitions cut and recovered in 10m sections - Rock bags placed over cut ends only to mitigate snag hazard
1. Safety	1.1 Operations Personnel	Project Management	1.40E-03 (5.95E-03 0,068 / 7.55E-04 4,929 hrs E-03 Hours / PLL Iement: 545.6 / 4,365 / 1.75E-05 656.0 / 5,248 / 2.10E-05 ncludes Cleaning & Disposal): 53.0 / 3,3 3,005 hrs 6E-04 rs: 47,934 hrs	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 7.0 / 6,402 / 4.80E-04 Rockdump Vessel: 20 / 6.4 / 1,529 / 1.15E-04 Total offshore hours: 7,931 hrs Total offshore PLL: 5.95E-04 Resource Type: Days / Hours / PLL Engineering & Management: 136.8 / 1,094 / 4.38E-06 Project Management: 138.0 / 1,104 / 4.42E-06 Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 92 / 7.87E-06 Total onshore hours: 2,262 hrs Total onshore PLL: 1.67E-05 Total operational hours: 10,193 hrs Total operational PLL: 6.11E-04	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 7.3 / 6,612 / 4.96E-04 Total offshore hours: 6,612 hrs Total offshore PLL: 4.96E-04 Resource Type: Days / Hours / PLL Engineering & Management: 95.6 / 765 / 3.06E-06 Project Management: 101.0 / 808 / 3.23E-06 Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 1,637 hrs Total onshore PLL: 1.42E-05 Total operational hours: 8,249 hrs Total operational PLL: 5.10E-04
		MW	MW	N	
		14.00982	16.7843137	1.198039216	
Sum	imary	with the full removal o around 17 times high Option 4A is assessed	of the line versus the smaller scope to p er in Option 2C. This is due to the great as being Neutral to Option 5 as the risk	Adue to the risk exposure being around 14 times higher in Option 2C d erform rock cover over the problem areas. Option 2C is assessed as bei er offshore scope (with diver support) associated with the full removal of exposure for these options is largely similar. Aduet to Operations Personnel perspective. Vessel Days:	ng Much Weaker than Option 5 due to the risk exposure being
1. Safety	1.2 Other Users	DSV: 14.2 Reel Vessel: 11.0 Total vessel days: 25.2 Transits: 6	days	CSV: 7.0 Rockdump Vessel: 6.4 Total vessel days: 13.4 days Transits: 4	CSV: 7.3 Total vessel days: 7.3 days Transits: 2
		N	N	N	
Sum	imary	The assessment of the All options are assesse (and low) across all op	Other Users sub-criterion is as follows: ed as being Neutral to each other as, wi	nile there are small differences in the number of vessel days and transi	ts, the impact on the safety of other users is expected to be similar
1. Safety 1.3 High	Consequence Events	ends through the wat there is the potential offloading of the reels	ng operations. There are 7 lifts of the lin er column to initiate reeling. In addition or dropped object associated with the to the quayside. Small number of liftin and recover deburial equipment (MFE)	 lifting operations (24) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside Small number of lifting operations to deploy and recover cuttin 	column to recover line ends. Additional lifting to transfer e. pipeline sections to quayside. Small number of lifting
		MW	MW	N	
Sum	mary	Option 2C is assessed quayside versus the li Option 4A is assessed	mited offshore lifting operations in the as being Neutral to Option 5 as the po	and Option 5 due to the potential for high consequence events from t	
	v	No legacy risk from th	is full removal option.	The line would remain in-situ with this option although the majority of its length is already rock covered. Areas of spans/ exposure will be rock covered to mitigate potential snag hazaro The survey & monitoring programme is committed to ensuring	

ifety	acy Risk			that the potential snag hazard from left continues to be managed & mitigated a		that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate.	
1. Sa	1.4 Leg					Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 29.5 / 15,560 / 1.17E-03	
				Total offshore hours: 15,560 hrs Total offshore PLL: 1.17E-03		Total offshore hours: 15,560 hrs Total offshore PLL: 1.17E-03	
		MS	MS	r	S		
		The assessment of the	Legacy Risk sub-crite	rion is as follows:			
		•			Option 5 as there is no legacy risk with the	ne full removal option vers	sus the line remaining surface laid with rock cover over problem
Sun	nmary	areas or (limited) prob	-				
			0 0			em areas are rock covered	in Option 4A while they remain in Option 5.
		Overall, Option 2C is	preferred from a Leg	gacy Risk perspective	•		

TAQA Subsea Decommissioning Support Comparative Assessment Report – Consultation Draft



	O2C - Full Remova	al - Reverse Installlation With Deburial	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag F
	Vessel Noise (days on-	site): 15.2 days	Vessel Noise (days on-site): 5.0 days	Vessel Noise (days on-site): 3.0 days
	Tooling Noise (MFE) = 9	9.4 days	Tooling Noise (Hydraulic Shears) = 0.9 days	Tooling Noise (Hydraulic Shears) = 0.9 days
	Operation releases:		Operation releases:	Operation releases:
	-	hing operations will use Best	Line cleaning and flushing operations will use Best	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		Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon	Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residu
Impact	and other chemical levels in line post flush and releases to the		and other chemical levels in line post flush and releases to the	hydrocarbon and other chemical levels in line post flush an
<u></u>		during flushing activities.	marine environment during flushing activities.	releases to the marine environment during flushing activiti
ine		5 5		
Marine	There will be potential	for the release of all residual contents in	Cutting of line ends would lead to an elevated release of fluids	Cutting of line ends would lead to an elevated release of flu
	one location at one tin	ne during the reverse reeling operations.	from within the line. However, given the prior cleaning of the	from within the line. However, given the prior cleaning of th
ational		or cleaning of the lines, the concentratio		line, the concentration and quantity of release should still b
era		e should still be low overall. Therefore, the	overall. Therefore, the related impact is also anticipated to be low.	low overall. Therefore, the related impact is also anticipated be low.
Oper	related impact is also a	anticipated to be low.	IOW.	be low.
2.1	Vessel releases:		Vessel releases:	Vessel releases:
	This includes Ballast, C	Grey and Black Water, this is driven by	This includes Ballast, Grey and Black Water, this is driven by	This includes Ballast, Grey and Black Water, this is driven by
	duration of vessel oper	rations and therefore at around 15.2 days	s duration of vessel operations and therefore at 5 days is not	duration of vessel operations and therefore at 3 days is the
	the highest of all optic	ns but not considred significant. The	considered significant. The environmental impact is considered	lowest of the options. The environmental impact is conside
	environmental impact	t is considered to be negligible.	to be negligible.	to be negligible.
	N	N	N	
ſ		Operational Marine Impact sub-criterion		
l			the the marine environmental impact from vessel noise, tooling noise	se and releases higher for Option 2C than the other options, t
nmary	considered insufficien	t to express a preference. It is noted that	he impact from releases from the line are insignificant as this line wa	s used for gas injection.
-	Overall, all options ar	e equally preferred from an Operation	al Marine Impact perspective.	
ł				
	Vessel Emissions (in to	nnes):	Vessel Emissions (in tonnes):	Vessel Emissions (in tonnes):
<u>.</u>	Fuel: 659		Fuel: 1,091	Fuel: 1,023
io Fu	CO2: 2,089		CO2: 3,458	CO2: 3,244
npt npt	NOX: 39.15		NOx: 64.80 SO2: 4.36	NOx: 60.79 SO2: 4.09
issions & Fuel onsumption	302. 2.84		302.4.36	302.4.09
				Vessel Energy Use: 44,007 GJ
nis Con	Vessel Energy Use: 28,3	340 GJ	Vessel Energy Use: 46,907 GJ	Vessel Energy Use. 44,007 US
Emise	CO2: 2,089 NOX: 39.15 SO2: 2.64 Vessel Energy Use: 28,3	340 GJ	Vessel Energy Use: 46,907 GJ	Vessel Ellergy Ose. 44,007 OJ
Emis: Con	Vessel Energy Use: 28,3	340 GJ	Vessel Energy Use: 46,907 GJ	Vessel Energy Use. 44,007 CJ
Emis: Con	Vessel Energy Use: 28,	340 GJ	N	Vessel Energy Use. 44,007 CJ
Emise	N	N	N	Vessel Energy Use. 44,007 CJ
ι Ε Ο	N The assessment of the All options are assesse	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil	N sub-criterion is as follows: a there are differences in the atmospheric emissions generated acros	
	N The assessment of the All options are assesse express a preference fr	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e.	
ι Ε Ο	N The assessment of the All options are assesse express a preference fr	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv	N sub-criterion is as follows: a there are differences in the atmospheric emissions generated acros	
ι Ε Ο	N The assessment of the All options are assesse express a preference fr Overall, all options ar	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil rom an environmental impact perspectiv re equally preferred from an Atmosphe	N sub-criterion is as follows: a there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective.	s the options, these differences are considered insufficient to
ן די ס חmary	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes):	N sub-criterion is as follows: a there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes):	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes):
ן די ס חmary	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes):	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes): Recovered Material: 14
ן האסיין איז סיין איז	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material:	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes):	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970
ן האסיין איז סיין איז	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes):	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes): Recovered Material: 14
2.3 Other 2.3 Other Em	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material:	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes):	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970
2.3 Other 2.3 Other Em	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil rom an environmental impact perspectiv re equally preferred from an Atmosphe 02 in tonnes): 198	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984
2.3 Other 2.3 Other Em	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 398	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N	s the options, these differences are considered insufficient to Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984
2.3 Other U Em Consumptions A	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 398 N Other Consumptions sub-criterion is as fo	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes
2.3 Other 2.3 Other Err Err Consumptions Alar	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 398 N Other Consumptions sub-criterion is as fo	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N ollows: npacts associated with returned / replaced material and rock consum	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes
2.3 Other 2.3 Other Err Err Consumptions Alar	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil om an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 398 N Other Consumptions sub-criterion is as fi d as being Neutral to each other as the ir	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N ollows: npacts associated with returned / replaced material and rock consum	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes
2.3 Other Consumptions	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse Overall, all options ar	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil form an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 1998 N Other Consumptions sub-criterion is as fi d as being Neutral to each other as the ir re equally preferred from an Other Cor	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N pollows: mpacts associated with returned / replaced material and rock consum sumptions perspective.	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes
2.3 Other Consumptions	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse Overall, all options ar Seabed Disturbance (r	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil form an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 1998 N Other Consumptions sub-criterion is as fi d as being Neutral to each other as the ir re equally preferred from an Other Cor	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N ollows: mpacts associated with returned / replaced material and rock consum sumptions perspective.	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes ption is similar across all options.
2.3 Other Consumptions	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse Overall, all options ar	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil form an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 1998 N Other Consumptions sub-criterion is as fi d as being Neutral to each other as the ir re equally preferred from an Other Cor	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N pollows: mpacts associated with returned / replaced material and rock consum sumptions perspective.	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes
2.3 Other Consumptions	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse Overall, all options ar Seabed Disturbance (r	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil rom an environmental impact perspectiv re equally preferred from an Atmosphe 22 in tonnes): 198 N Other Consumptions sub-criterion is as fi d as being Neutral to each other as the ir re equally preferred from an Other Cor m2):	N sub-criterion is as follows: e there are differences in the atmospheric emissions generated acros e. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N ollows: mpacts associated with returned / replaced material and rock consum sumptions perspective.	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes ption is similar across all options.
Disturbance 2.3 Other 2.4 Em Em Em Consumptions Alabeled Consumptions Consumptions C	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse Overall, all options ar Seabed Disturbance (r MFE: 109,500 No rock cover in this op Additional disturbance	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil rom an environmental impact perspectiv re equally preferred from an Atmosphe 22 in tonnes): 398 N Other Consumptions sub-criterion is as fi d as being Neutral to each other as the ir re equally preferred from an Other Cor m2): m2): btion. e plume associated with disturbing	N sub-criterion is as follows: a there are differences in the atmospheric emissions generated acrosse. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes Dellows: mpacts associated with returned / replaced material and rock consum sumptions perspective. Seabed Disturbance (m2): Rock Cover: 470 Habitat Loss / Change (m2): Rock Cover: 470	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes ption is similar across all options.
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Seabed Disturbance 2.3 Other 2.4 Em Em Consumptions Ale C	N The assessment of the All options are assesse express a preference fr Overall, all options ar Material Emissions (CC Recovered Material: 1,5 Remaining Material: Total: 1,598 Rock: N/A tonnes N The assessment of the All options are assesse Overall, all options ar Seabed Disturbance (r MFE: 109,500 No rock cover in this op Additional disturbance sediment during MFE a greater consideratio line. W The assessment of the	N Atmospheric Emissions & Consumptions d as being Neutral to each other as, whil rom an environmental impact perspectiv re equally preferred from an Atmosphe D2 in tonnes): 398 N Other Consumptions sub-criterion is as fe d as being Neutral to each other as the ir re equally preferred from an Other Cor m2): btion. e plume associated with disturbing operations, although temporary in natur n especially in areas local to platform enc W Seabed Disturbance sub-criterion is as fe	N sub-criterion is as follows: a there are differences in the atmospheric emissions generated acrosse. ric Emissions & Consumptions perspective. Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 320 tonnes N plows: apacts associated with returned / replaced material and rock consum sumptions perspective. Seabed Disturbance (m2): Rock Cover: 470 Habitat Loss / Change (m2): Rock Cover: 470 N	Material Emissions (CO2 in tonnes): Recovered Material: 14 Remaining Material: 2,970 Total: 2,984 Rock: 32 tonnes ption is similar across all options. Seabed Disturbance (m2): Rock Cover: 50 Habitat Loss / Change (m2): Rock Bags: 50
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Option 4A is assessed as being Neutral to Option 5 as, while there are differences in the area of seabed impacted by rock placement, these differences are considered insufficient to express a preference.

Overall, Option 4A and Option 5 are equally preferred from a Seabed Disturbance perspective.

-	e	No legacy marine imp	pact from this full rem	oval option.	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available			
	s farir s				(BAT) to minimise as far as possible both residual hydrocarbon	Techniques (BAT) to minimise as far as possible both residual			
	cy Ma bacts				and other chemical levels in line post flush.	hydrocarbon and other chemical levels in line post flush.			
	-egacy Impa				The legacy marine impact from the slow release of these low	The legacy marine impact from the slow release of these low			
	2.5				concentration / quantity releases is therefore expected to be low	concentration / quantity releases is therefore expected to be low			
					overall.	overall.			
		S	S		N				
		The assessment of the	Legacy Marine Impa	cts sub-criterion is as fo	llows:				
		Option 2C is assessed	as being Stronger tha	n Option 4A and Optio	on 5 as the line is removed leaving no legacy impact.				
	Summary	Option 4A is assessed	as being Neutral to O	ption 5 as the line remain	ains in both options with the legacy impact from degradation proc	ducts is expected to be similar presenting a similar (minor) legacy			
	-	environmental impac	environmental impact.						
		Overall, Option 2C is	preferred from a Le	gacy Marine Impacts	perspective.				

TAQA Subsea Decommissioning Support Comparative Assessment Report – Consultation Draft



		O2C - Full Domovr	al - Dovorso Installi	ation With Deburial	O4A - Leave (Minor) - Rock Placement Over Ar	eas of Spans / O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
		Concept Maturity: Rev			Exposure / Shallow Burial Concept Maturity: Cut and lift and rock placement	
nica		track record. (Score 2)	eree reer er rigid pip		proven techniques. (Score 3)	(Score 3)
3. Technical 3.1 Technical	α	Technical Risks: Some logistics of this option.		ciated with the scale /	Technical Risks: Limited technical risks associated (Score 3)	with option Technical Risks: Limited technical risks associated with option (Score 3)
3. T 3.1 T		logistics of this option.	. (SCOLE 2)			
		W	W		N	
		The assessment of the				
		•	-		n 5 as, while all options employ largely routine opera ut and lift line ends operations.	ations, the scale of operations to fully recover the line is expected to encounter
Summa	arv				operations and scope are similar.	
	ľ	Overall, Option 4A ar	nd Option 5 are eq	ually preferred from a 1	Fechnical Risk perspective.	
-		Significant short term	disturbance infrast	ructure is removed	Minimal operation, a small amount of short term c	disturbance Short operation, small area of localised disturbance. Rock used
tal ng		although rock will rem			during operation. However, rock berms are not pre-	
4. Societal 4.1 Fishing		(Score 2)			from the fishing industry's perspective. (Score 1)	gradient to avoid impacts for the fishing industry. (Score 2)
4. S						
		C	C	r		
	÷	S	S	Fishing sub-criterion is a	S sfollows:	
				•		d versus the line remaining surface laid with problem areas rock covered or
Summa	ary	problem areas remain	•	han Ontion 5 as while the	line remains in both ontions, the problem areas ar	re rock covered in Option 4A but remain in Option 5.
			• •	ocietal impact on Fish		
er		Significant quantity of	f recyclable materia	l returned. (Score 3)	Minimal societal benefits / impacts with this option	n. (Score 3) Minimal societal benefits/impacts with this option. (Score 3)
4.2 Other	Users	Materials Returned:			Materials Returned:	Materials Returned:
4. S 4.2		Steel: 1,588 tonnes (recyclable)			Steel: 15 tonnes (recyclable)	Steel: 15 tonnes (recyclable)
		N	Ν		N	Y
		N The assessment of the	N Societal impact on	Other Users sub-criterio	n is as follows:	·
Summa	arv	The assessment of the All options are assesse	Societal impact on d as Neutral to each	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C	, the quantity is considered insufficient to express a preference.
Summa	arv	The assessment of the All options are assesse	Societal impact on d as Neutral to each	n other as, while there is g	n is as follows:	, the quantity is considered insufficient to express a preference.
0	ary	The assessment of the All options are assesse	Societal impact on d as Neutral to each	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C	the quantity is considered insufficient to express a preference. £1.243 Million
.c	ary	The assessment of the All options are assesse Overall, all options ar	Societal impact on d as Neutral to each	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective.	
nomic thort-	Costs	The assessment of the All options are assesse Overall, all options ar	Societal impact on d as Neutral to each	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective.	
nomic hort-	ary	The assessment of the All options are assesse Overall, all options ar	Societal impact on d as Neutral to each	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective.	
nomic thort-	Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million	Societal impact on ed as Neutral to each re equally preferred	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective.	
nomic thort-	Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million	Societal impact on ed as Neutral to each re equally preferred MW 5.35 million	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million	
nomic thort-	Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more	Societal impact on ed as Neutral to each re equally preferred MW 5.35 million more	n other as, while there is g	E1.538 Million	
nomic thort-	term Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more 328.5% higher	Societal impact on ed as Neutral to each re equally preferre MW 5.35 million more 430.2% higher	n other as, while there is g	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million	
nomic thort-	term Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a	Societal impact on ed as Neutral to each re equally preferre MW 5.35 million more 430.2% higher Short-term Costs su as being Much Wea	n other as, while there is a d from a Societal impa- societal impa- nu- nu- nu- nu- nu- nu- nu- nu- nu- nu	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million N 0.3 million more 23.7% higher to the costs to deliver this option being around 4 time	
nomic thort-	term Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op	Societal impact on ed as Neutral to each re equally preferre 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co	n other as, while there is a d from a Societal impa- societal impa- nu- nu- nu- nu- nu- nu- nu- nu- nu- nu	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million N 0.3 million more 23.7% higher to the costs to deliver this option being around 4 times is higher (£5.6 million more) than Option 5.	£1.243 Million
5. Economic 5.1 Short-	tern Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed	Societal impact on ed as Neutral to each re equally preferre 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to	n other as, while there is a d from a Societal impa- ib-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost:	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million N 0.3 million more 23.7% higher to the costs to deliver this option being around 4 times is higher (£5.6 million more) than Option 5.	£1.243 Million
5. Economic 5.1 Short-	tern Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed	Societal impact on ed as Neutral to each re equally preferre 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to	n other as, while there is a d from a Societal impa- ib-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost:	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. E1.538 Million N 0.3 million more 23.7% higher to the costs to deliver this option being around 4 tin s higher (£5.6 million more) than Option 5. s being similar. Short-term Cost perspective.	f1.243 Million
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5. Economic 5.1 Short-	erry Costs	The assessment of the All options are assesse Overall, all options ar £6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed Overall, Option 4A ar	Societal impact on ed as Neutral to each re equally preferre 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to	n other as, while there is a d from a Societal impa- ib-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost:	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. E1.538 Million N 0.3 million more 23.7% higher to the costs to deliver this option being around 4 tin s higher (£5.6 million more) than Option 5. s being similar. Short-term Cost perspective.	f1.243 Million
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5. Economic 5.1 Short-	Costs Costs	The assessment of the All options are assesse Overall, all options ar f6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed a Overall, Option 4A ar Surveys: N/A FLTC: N/A Total Legacy Cost: £0 N	Societal impact on ed as Neutral to each re equally preferred 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to nd Option 5 are equ Million	n other as, while there is a d from a Societal impar- ub-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost ually preferred from a S	n is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. E1.538 Million N 0.3 million more 23.7% higher to the costs to deliver this option being around 4 times s higher (£5.6 million more) than Option 5. s being similar. Short-term Cost perspective. Surveys: £0.884 Million FLTC: N/A	E1.243 Million f1.243 Million nes higher (£5.1 million more) than Option 4A. Option 2C is assessed as being Surveys: £0.884 Million FLTC: £0.066 Million
5. Economic 5.1 Short-	Costs Costs	The assessment of the All options are assesse Overall, all options ar f6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed a Overall, Option 4A ar Surveys: N/A FLTC: N/A Total Legacy Cost: £0 N N	Societal impact on ed as Neutral to each re equally preferred MW 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to nd Option 5 are equ Million N	n other as, while there is a d from a Societal impar- ib-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost ually preferred from a so ib-criterion is as follows:	h is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. E1.538 Million E1.538 Million	E1.243 Million f1.243 Million nes higher (£5.1 million more) than Option 4A. Option 2C is assessed as being Surveys: £0.884 Million FLTC: £0.066 Million
5. Economic G 5. Economic 5. Economic 5.2 Long-term	Costs Costs	The assessment of the All options are assesse Overall, all options ar f6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed a Overall, Option 4A ar Surveys: N/A FLTC: N/A Total Legacy Cost: £0 N N The assessment of the All options are assesse line remaining in-situ	Societal impact on ed as Neutral to each re equally preferred MW 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to nd Option 5 are equ Million Million	n other as, while there is a d from a Societal impar- b-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost ually preferred from a s ually preferred from a s b-criterion is as follows: to each other as, while the r and insufficient to express	In is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million Image: Content of the content	fl.243 Million nes higher (£5.1 million more) than Option 4A. Option 2C is assessed as being Surveys: £0.884 Million FLTC: £0.066 Million Total Legacy Cost: £0.95 Million
5. Economic G 5. Economic 5.2 Long-term	Costs Costs	The assessment of the All options are assesse Overall, all options ar f6.59 Million MW 5.06 million more 328.5% higher The assessment of the Option 2C is assessed a Much Weaker than Op Option 4A is assessed a Overall, Option 4A ar Surveys: N/A FLTC: N/A Total Legacy Cost: £0 N N The assessment of the All options are assesse line remaining in-situ	Societal impact on ed as Neutral to each re equally preferred MW 5.35 million more 430.2% higher Short-term Costs su as being Much Wea otion 5 due to the co as being Neutral to nd Option 5 are equ Million Million	n other as, while there is a d from a Societal impa- ib-criterion is as follows: ker than Option 4A due osts being around 5 time: Option 5 due to the cost ually preferred from a s ually preferred from a s	In is as follows: greater useful material (steel) returned in Option 2C ct on Other Users perspective. £1.538 Million Image: Content of the content	fl.243 Million nes higher (£5.1 million more) than Option 4A. Option 2C is assessed as being Surveys: £0.884 Million FLTC: £0.066 Million Total Legacy Cost: £0.95 Million



eighting

(Minimal) Ends & Snag Risk

I.2 Group 8 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	O2C - Full Removal - Reverse Installlation With Deburial	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	1.2 Other Users	02C - Full Removal - Reverse Installlation With Deburial
O2C - Full Removal - Reverse Installlation With Deburial	N	мw	мw	14.3%	O2C - Full Removal - Reverse Installlation With Deburial	N
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	42.9%	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	N	42.9 %	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N
1.3 High Consequence Events	O2C - Full Removal - Reverse Installlation With Deburial	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	1.4 Legacy Risk	02C - Full Removal - Reverse Installlation With Deburial
Consequence	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Z Rock Placement Over Z Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - ₹ Remove Ends & Remediate Snag Risk	Guitheaver	1.4 Legacy Risk 02C - Full Removal - Reverse Installation With Deburial	O2C - Full Removal - Reverse Installlation With Deburial
Consequence Events 02C - Full Removal - Reverse Installlation		0 <u>~</u> –			O2C - Full Removal - Reverse Installiation	• -

	02C - F Revers Wit	O4A - L Rock Pl Area Expos	O5 - Lex Rem Remed	Š
II Removal - Installlation Deburial	N	N N N		33.3%
ave (Minor) - cement Over of Spans / re / Shallow	N	N	N	33.3%
re (Minimal) - ve Ends & te Snag Risk	N	N	N	33.3%
jacy Risk	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
II Removal - Installlation Deburial	N	MS	MS	59.8 %
ave (Minor) - cement Over of Spans / re / Shallow	MW	N	s	22.8%
re (Minimal) - ve Ends & te Snag Risk	MW	w	N	17.4%

I.3 Group 8 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2C - Full Removal - Reverse Installlation With Deburial	04.A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	2.2 Atmospheric Emissions & Fuel Consumption	O2C - Full Removal - Reverse Installlation With Deburial	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	N	и	33.3%	O2C - Full Removal - Reverse Installlation With Deburial	N	N	И	33.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	33.3%	O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	33.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	N	33.3%	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	N	33.3%

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2.3 Other Consumptions	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	N	N	33.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	33.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	N	33.3%

2.5 Legacy Marine Impacts	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	s	s	42.9 %
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	28.6%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	N	28.6%

2.4 Seabed Disturbance	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	w	w	25.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	37.5%
05 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	s	N	N	37.5%

I.4 Group 8 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	×	w	25.0%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	37.5%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	N	37.5%



04A - Leave (Minor) -Rock Placement Over Rock Placement Over Reverse Installlation With Deburial Remediate Snag Risl 05 - Leave (Minimal) 05 - Leave (Minimal) Reverse Installlatio 04A - Leave (Minor) Areas of Spans / Exposure / Shallow 02C - Full Removal Exposure / Shallow Remediate Snag Ris 02C - Full Remova Remove Ends & Areas of Spans / Remove Ends & With Deburial Weighting Weighting 4.1 Fishing 4.2 Other Users O2C - Full Removal -O2C - Full Removal -**Reverse Installation** Ν s s 42.6% **Reverse Installation** Ν Ν 33.3% Ν With Deburial With Deburial O4A - Leave (Minor) -O4A - Leave (Minor) -**Rock Placement Over Rock Placement Over** Ν s N Ν w 32.5% Ν **33.3**% Areas of Spans / Areas of Spans / Exposure / Shallow Exposure / Shallow O5 - Leave (Minimal) -O5 - Leave (Minimal) -Remove Ends & w w Ν 24.8% Remove Ends & Ν Ν Ν 33.3% Remediate Snag Risk Remediate Snag Risk

I.5 Group 8 Pairwise Comparison Matrices – Societal

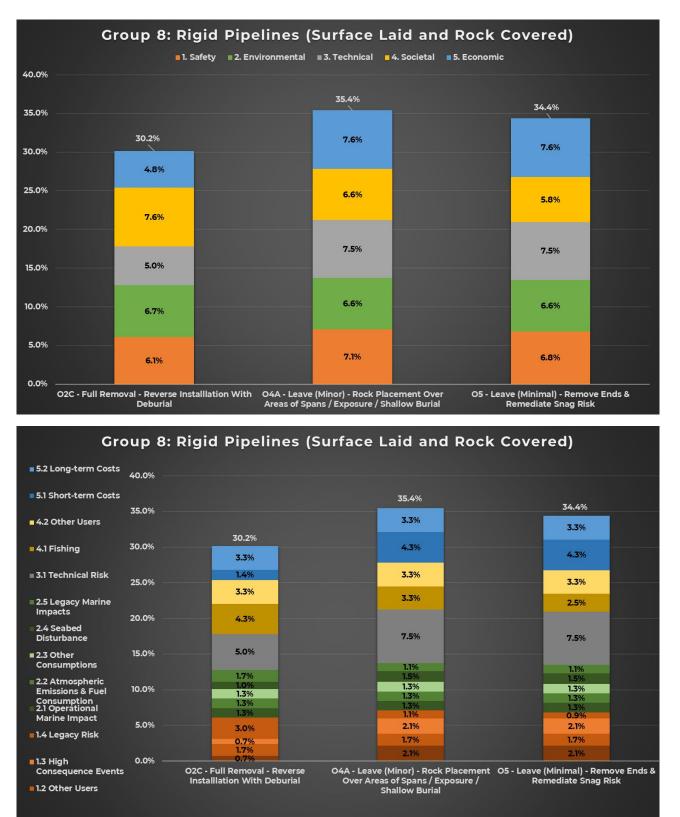
I.6 Group 8 Pairwise Comparison Matrices – Economic

5.1 Short-term Costs	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	мw	мw	14.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	42.9 %
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	N	42.9%

5.2 Long-term Costs	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	N	N	33.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	33.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Z	N	Z	33.3%



I.7 Group 8 Results Charts





APPENDIX J GROUP 9 – DETAILED EVALUATION RESULTS

Group 9 Attributes Table J.1

Group 9: Rigid Pipelines (Trenched and Buried)

PL1084 (N0740) - 8" Oil Pipeline 1 from Pelican to Cormorant Alpha - 8.467 km | PL1085 (N0741) - 8" Oil Pipeline 2 from Pelican to Cormorant Alpha - 8.338 km | PL1086 (N1121) 6" Gas Lift Pipeline from Cormorant Alpha to Pelican - 8.387 km | PL1087 (N0915) - 8" Water Injection Pipeline from Cormorant Alpha to Pelican 8.337 km

PL3572 (N0605) - 10" Production Pipeline from Cladhan to Tern - 16.8 km | PL3573 (N1149) - 4" Cas Lift Pipeline - Piggybacked to PL3572 from Tern to Cladhan - 16.866 km | PL3574 (N0942) - 10" Water Injection Pipeline from Tern to Cladhan - 16.6 km PL1018/A - 10" Production Pipeline from Hudson to Tern - 10.167 km | PL1019/A - 10" Production Pipeline from Hudson to Tern - 10.150 km | PL1020/A - 8" Production/Test Line from Hudson to Tern - 10.134 km | PL1025/A - 6" L2 Production/Test Pipeline from Well L2 to Hudson Manifold - 1.61 km

	O2C - Full R	emoval - Reverse	e Installlation W	Vith Deburial		- Rock Placement O bosure / Shallow Bur			Bury Areas of Spans / Exposur w Burial	e O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
		preparation			- Pipeline is disconnec - Rock placement over	ed		- Pipeline is disconnected - Re-trench and bury areas of spa - Removal of line ends outwith ex - Placement of rock bags to mitig	ns/exposures/shallow burial kisting trench	 Pipeline is disconnected Remove areas of spans / exposures / shallow burial by cut and lift Removal of line ends outwith existing trench Remediate cut ends with rock 	- Pipeline is disconnected - Remove pipeline ends by cut and lift - Remediate cut ends with rock
I. Sarey 1.1 Operations Personnel	DSV: 110 / 7.6 / 10 Divers: 18 / 7.6 / 3 CSV: 76 / 118.1 / 10 Reel Vessel: 76 / 3 Total offshore ho Total offshore PL Resource Type: E Engineering & M Project Manager Onshore Operat 1.87E-03 Total onshore PL	296 / 3.20E-03 7,680 / 8.08E-03 55.4 / 50,516 / 3.79 urs: 171,563 hrs L: 1.58E-02 Pays / Hours / PLL lanagement: 3,22 ment: 3,041.0 / 24, ons (includes Cle urs: 65,360 hrs L: 2.07E-03 l hours: 236,923 h	E-03 5.0 / 25,800 / 1.03 328 / 9.73E-05 aning & Disposa		Vessel Type: PoB / Day CSV: 76 / 22.8 / 20,803 / Rockdump Vessel: 20 / Total offshore hours: 24 Total offshore PLL: 1.81 Resource Type: Days / H Engineering & Manage Project Management: Total onshore hours: 20 Total onshore PLL: 8.19 Total operational hour Total operational PLL:	L56E-03 13.7 / 3,278 / 2.46E-04 ,081 hrs -03 lours / PLL ement: 425.0 / 13,600 / 430.0 / 6,880 / 2.75E-05 ,480 hrs E-05		Vessel Type: PoB / Days / Hours / F CSV: 76 / 22.8 / 20,803 / 1.56E-03 Trenching Vessel: 55 / 12.6 / 8,329 / Total offshore hours: 29,132 hrs Total offshore PLL: 2.18E-03 Resource Type: Days / Hours / PLL Engineering & Management: 630 Project Management: 600.0 / 4,8 Onshore Operations (includes Cle 3.94E-05 Total onshore hours: 10,167 hrs Total onshore PLL: 7.87E-05 Total operational hours: 39,299 hr Total operational PLL: 2.26E-03	/6.25E-04 0.9/5,047/2.02E-05 00/1.92E-05 eaning & Disposal): 5.0/320/	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 32.2 / 29,330 / 2.20E-03 Rockdump Vessel: 20 / 6.2 / 1,486 / 1.11E-04 Total offshore hours: 30,816 hrs Total offshore PLL: 2.31E-03 Resource Type: Days / Hours / PLL Engineering & Management: 444.1 / 3,553 / 1.42E-05 Project Management: 415.0 / 3,320 / 1.33E-05 Onshore Operations (includes Cleaning & Disposal): 9.0 / 576 / 7.08E-05 Total onshore hours: 7,449 hrs Total onshore PLL: 9.83E-05 Total operational hours: 38,264 hrs Total operational PLL: 2.41E-03	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 21.0 / 19,134 / 1.44E-03 Rockdump Vessel: 20 / 6.7 / 1,601 / 1.20E-04 Total offshore hours: 20,735 hrs Total offshore PLL: 1.56E-03 Resource Type: Days / Hours / PLL Engineering & Management: 350.0 / 2,800 / 1.12E-05 Project Management: 328.0 / 2,624 / 1.05E-05 Onshore Operations (includes Cleaning & Disposal): 5.0 / 320 / 3.94E-05 Total onshore hours: 5,744 hrs Total onshore PLL: 6.11E-05 Total operational hours: 26,479 hrs Total operational PLL: 1.62E-03
	MW	MW	MW	MW	N	N	N	N	w	w	
Summar	Option 2C is asse lines in Option 4 the greater full r Option 4A is asse Option 4B is asse duration offshore Option 4C is asse	A. Option 2C is as emoval scope. Op essed as being Ne essed as being Ne e operations to tre essed as being We	uch Weaker than ssessed as being otion 2C is assess eutral to all other eutral to Option ench and bury th eaker than Option	n Option 4A due Much Weaker the sed as being Muc roptions as, whil 4C as, while ther ne problem areas on 5 due to the ri	to the risk exposure bein nan Option 4B due to the ch Weaker than Option 5 e there are small differer e are small differences ir s of the lines versus line e	risk exposure being a due to the risk exposu ces in the risk exposu the risk exposure acro nd removal only.	around 8 times higher ure being around 11 tir re across these option oss these options, thes	in Option 2C again, due to the gre nes higher in Option 2C again, due s, these differences are considered	ater full removal scope. Option 2 to the greater full removal scope insufficient to express a preferen icient to express a preference. O	ce. ption 4B is assessed as being Weaker than Option 5 due to the risk e:	exposure being around 7 times higher in Option 2C again, due to
1.2 Other Users	Vessel Days: DSV: 7.6 CSV: 118.1 Reel Vessel: 55.4 Total vessel days Transits: 34	: 181.1 days			Vessel Days: CSV: 22.8 Rockdump Vessel: 13.7 Total vessel days: 36.5 c Transits: 4	ays		Vessel Days: CSV: 22.8 Trenching Vessel: 12.6 Total vessel days: 35.4 days Transits: 4		Vessel Days: CSV: 32.2 Rockdump Vessel: 6.2 Total vessel days: 38.4 days Transits: 4	Vessel Days: CSV: 21.0 Rockdump Vessel: 6.7 Total vessel days: 27.7 days Transits: 4
Summar	Option 2C is asse All other options	are assessed as b	eaker than all oth being Neutral to	her options due t each other as the	N to the higher number of e number of vessel days ually preferred from a r	and transits are largely	, similar across these o		N	N	



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	O2C - Full I	Removal - Revers	e Installlation \	With Deburial					Bury Areas of Spans / Exposure		O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
I. 3diety I.3 High Consequence Events	ends through t additional 38 li the crossing loc dropped objec line sections to	k reeling operatio he water column t fts associated reco cations. In additio t associated with t the quayside. Sm ecover cutting eq	to initiate reeling overing the cut so n there is the po he offloading of nall number of lif	g. There are an ections around tential for the reels and cut	Routine, low risk rock o operations (264) to rec operations through th cutting equipment.	over the line ends. Sr e water column to de n addition there is the	h number of lifting nall number of lifting	Routine, low risk trenching oper operations (302) to recover the lin Small number of lifting operatio deploy and recover trenching an	ne ends and to place rock bags. ons through the water column to nd cutting equipment. In or dropped object associated with	Shallow Burial High number of lifting operations (445) to recover the line ends and areas of spans / exposure / shallow burial. Small number of lifting operations through the water column to deploy and recover cutting equipment. In addition there is the potential for dropped object associated with the offloading of the cut line sections to the quayside.	High number of lifting operations (264) to recover the line ends and to place rock bags. Small number of lifting operations through the water column to deploy and recover cutting equipment. In addition there is the potential for dropped object associated with the offloading of the cut line sections to the quayside.
	N	N	S	N	N	S	N	S	N	w	
Summary	is assessed as b Option 4A is as Option 4B is as	eing Stronger tha sessed as being N	n Option 4C as t eutral to Option tronger than Op	here are more (are 4B and Option 5 tion 4C as there a	bund 450) offshore liftin as the potential for high re more (around 450) of	g operations in Optio consequence events fshore lifting operatio	n 4C. from a dropped object ns in Option 4C. Optior	in the (around 300) offshore lifting	g operations in these options is sim	ntial for high consequence events from a dropped object in the (aroun nilar. Option 4A is assessed as being Stronger than Option 4C as the h consequence events from a dropped object in the (around 300) off	re are more (around 450) offshore lifting operations in Option 4C.
I. selety 14 Legacy Risk	Overall, Option	n 2C, Option 4A, (Option 4B and valoption.	Option 5 are equ	The lines would remain majority of their lengt placement over areas The survey & monitorin that the potential snar continues to be mana Vessel Type: PoB / Day Survey Vessel (Legacy	High Consequence E n in-situ with this opt h would be trenched of spans \exposures \ ng programme is com g hazard from left in-s ged & mitigated as ap rs/Hours/PLL): 44/53.0/27,968/2.1	vents perspective. ion although the and buried with rock shallow burial. nmitted to ensuring situ infrastructure opropriate. 0E-03	fully trenched and buried. The survey & monitoring program that the potential snag hazard fr continues to be managed & miti Vessel Type: PoB / Days / Hours / Survey Vessel (Legacy): 44 / 53.0 /	rom left in-situ infrastructure igated as appropriate. PLL /27,968/2.10E-03	fully trenched and buried as areas of spans / exposures / shallow burial are removed. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 53.0 / 27,968 / 2.10E-03	The lines would remain in-situ with this option although the majority of their length would be trenched and buried. The line ends will be removed with small areas of rock cover to mitigate potential snag hazard from cut ends. Spans and exposures 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 Survey Vessel (Legacy): 44 / 53.0 / 27,968 / 2.10E-03
Legacy	Overall, Option	n 2C, Option 4A, (Option 4B and o val option.	Option 5 are equ	The lines would remain majority of their lengt placement over areas The survey & monitorin that the potential snar continues to be mana Vessel Type: PoB / Day	High Consequence E n in-situ with this opt h would be trenched of spans \exposures \ ng programme is com g hazard from left in-s ged & mitigated as ap rs/Hours/PLL	ion although the and buried with rock shallow burial. hmitted to ensuring situ infrastructure opropriate.	fully trenched and buried. The survey & monitoring program that the potential snag hazard fr continues to be managed & miti Vessel Type: PoB / Days / Hours /	mme is committed to ensuring rom left in-situ infrastructure igated as appropriate. PLL	fully trenched and buried as areas of spans/exposures/shallow burial are removed. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB/Days/Hours/PLL	majority of their length would be trenched and buried. The line ends will be removed with small areas of rock cover to mitigate potential snag hazard from cut ends. Spans and exposures 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

Overall, Option 2C is preferred from a Legacy Risk perspective.



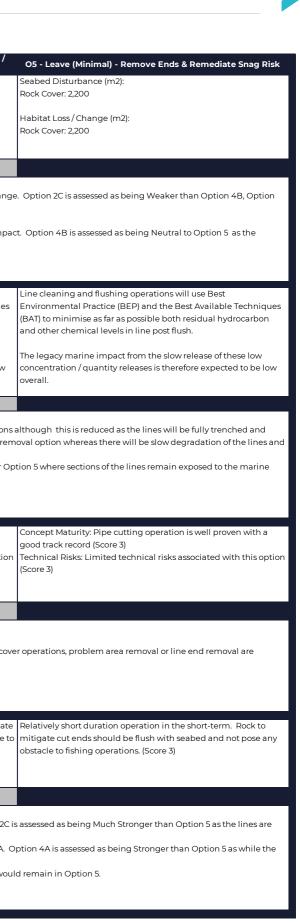
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	O2C - Full Re	emoval - Revers	e Installlation With Deburial						O4C - Leave (Minor) - Remove Areas of Spans / Exposure /	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
	Vessel Noise (day	ys on-site): 134.3 d	lavs	Vessel Noise (days on	xposure / Shallow Bu	rial	Vessel Noise (days on-site): 26.9 d	ow Burial Javs	Shallow Burial Vessel Noise (days on-site): 29.8 days	Vessel Noise (days on-site): 18.3 days
			hears) = 101.1 days		ulic Shears) = 5.9 days		Tooling Noise (Trenching & Hydra		Tooling Noise (MFE & Hydraulic Shears) = 18.3 days	Tooling Noise (Hydraulic Shears) = 5.9 days
	Operation releas			Operation releases:		_	Operation releases:		Operation releases:	Operation releases:
			itions will use Best		ushing operations will u		Line cleaning and flushing opera		Line cleaning and flushing operations will use Best	Line cleaning and flushing operations will use Best
ч			d the Best Available Techniqu		ice (BEP) and the Best		Environmental Practice (BEP) an		Environmental Practice (BEP) and the Best Available Techniques	Environmental Practice (BEP) and the Best Available Techniques
pac			le both residual hydrocarbon a				(BAT) to minimise as far as possib		(BAT) to minimise as far as possible both residual hydrocarbon	(BAT) to minimise as far as possible both residual hydrocarbon
_ <u>Ē</u>			flush and releases to the mari		s in line post flush and r	releases to the marine	· · ·	t flush and releases to the marine	and other chemical levels in line post flush and releases to the	and other chemical levels in line post flush and releases to the
enta	environment du	uring flushing acti	IVITIES.	environment during	flushing activities.		environment during flushing act	tivities.	marine environment during flushing activities.	marine environment during flushing activities.
ξĒ	There will be pot	tential for the rele	ease of all residual contents in	As line is being rock o	covered there is negligi	ible release from the	Cutting of line ends would lead t	to an elevated release of fluids	Cutting of line ends and midline cuts would lead to an elevated	Cutting of line ends would lead to an elevated release of fluids
iro nal	one location at o	one time during tl	he reverse reeling operations.	line.			from within the line. However, gi	iven the prior cleaning of the line,	release of fluids from within the line. However, given the prior	from within the line. However, given the prior cleaning of the line
tio I	However, given t	the prior cleaning	g of the lines, the concentratio	1			the concentration and quantity of	of release should still be low	cleaning of the line, the concentration and quantity of release	the concentration and quantity of release should still be low
era	and quantity of r	release should sti	II be low overall. Therefore, the	Vessel releases:			overall. Therefore, the related im	npact is also anticipated to be low.	should still be low overall. Therefore, the related impact is also	overall. Therefore, the related impact is also anticipated to be low
å	related impact is	s also anticipated	to be low.	This includes Ballast,	Grey and Black Water,	, this is driven by			anticipated to be low.	
510				duration of vessel ope	erations and therefore	at 25 days is not	Vessel releases:			Vessel releases:
	Vessel releases:			considered significan	nt. The environmental i	impact is considered to	This includes Ballast, Grey and B	lack Water, this is driven by	Vessel releases:	This includes Ballast, Grey and Black Water, this is driven by
	This includes Bal	allast, Grey and Bla	ack Water, this is driven by	be negligible.			duration of vessel operations and	d therefore at 26.9 days is not	This includes Ballast, Grey and Black Water, this is driven by	duration of vessel operations and therefore at 18.3 days is not
			therefore at 134.3 days is the				considered significant. The envir	ronmental impact is considered	duration of vessel operations and therefore at 29.8 days is not	considered significant. The environmental impact is considered
	highest of all opt	tions. The enviror	nmental impact is considered	to			to be negligible.		considered significant. The environmental impact is considered	to be negligible.
	be negligible.								to be negligible.	
	W	W	w w	N	N	N	N	N	N	
			al Marine Impact sub-criterion			N	N	N	N	
									other options. Other impacts are negligible.	
Summary	An other options		being Neutral to each other as Option 4C and Option 5 are o	-		- · ·	s.			
_										
	Vessel Emissions	s (in tonnes):		Vessel Emissions (in t	tonnes):	•	Vessel Emissions (in tonnes):	·	Vessel Emissions (in tonnes):	Vessel Emissions (in tonnes):
	Vessel Emissions Fuel: 5,580	s (in tonnes):		Vessel Emissions (in t Fuel: 2,417	tonnes):		Vessel Emissions (in tonnes): Fuel: 2,399		Vessel Emissions (in tonnes): Fuel: 2,550	Vessel Emissions (in tonnes): Fuel: 2,245
ntal eric -uel	Fuel: 5,580	s (in tonnes):			tonnes):					
mental pheric & Fuel otion	Fuel: 5,580	is (in tonnes):		Fuel: 2,417	ionnes):		Fuel: 2,399		Fuel: 2,550	Fuel: 2,245
onmental 10spheric 11s & Fuel 11mbtion	Fuel: 5,580	is (in tonnes):		Fuel: 2,417 CO2: 7,661	tonnes):		Fuel: 2,399 CO2: 7,604		Fuel: 2,550 CO2: 8,082	Fuel: 2,245 CO2: 7,116
ivironmental Atmospheric ssions & Fuel nsumption	Fuel: 5,580 CO2: 17,689 NOx: 331.46 SO2: 22.32			Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67			Fuel: 2,399 CO2: 7,604 NOx: 142.48		Fuel: 2,550 CO2: 8,082 NOx: 151.44 SO2: 10.20	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98
2.2 Atmospheric 2.2 Atmospheric Emissions & Fuel Consumption	Fuel: 5,580			Fuel: 2,417 CO2: 7,661 NOx: 143.55			Fuel: 2,399 CO2: 7,604 NOx: 142.48		Fuel: 2,550 CO2: 8,082 NOX: 151.44	Fuel: 2,245 CO2: 7,116 NOx: 133.34
2. Environmental 2.2 Atmospheric Emissions & Fuel Consumption	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us	lse: 239,948 GJ		Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10	33,914 GJ	Ν	Fuel: 2,399 CO2: 7,604 NOx: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 GJ	Ν	Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ	Fuel: 2,245 CO2: 7,116 NOx: 133.34 SO2: 8.98
2. Environmental 2.2. Atmospheric Emissions & Fuel Consumption	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us	se: 239,948 GJ	W W	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10	03,914 GJ	N	Fuel: 2,399 CO2: 7,604 NOX: 142.48 SO2: 9.59	N	Fuel: 2,550 CO2: 8,082 NOx: 151.44 SO2: 10.20	Fuel: 2,245 CO2: 7,116 NOx: 133.34 SO2: 8.98
2. Environmental 2.2 Atmospheric Emissions & Fuel Consumption	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of	se: 239,948 GJ	W W ric Emissions & Consumptions eaker than all other options as	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows:	03,914 GJ N		Fuel: 2,399 CO2: 7,604 NOx: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 GJ	N	Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98
2. Environme 2.2 Atmosph Emissions & Consumeti	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of Option 2C is asse	se: 239,948 GJ w of the Atmospher essed as being We	ric Emissions & Consumptions eaker than all other options as	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows: the emissions and fuel us	13,914 CJ N se is around double tha	at of the other options.	Fuel: 2,399 CO2: 7,604 NOX: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 GJ		Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98
2. Environme 2.2 Atmosph Emissions & Consumpti	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of Option 2C is asse All other options	se: 239,948 GJ of the Atmospheressed as being Wess are assessed as being we say that we	ric Emissions & Consumptions eaker than all other options as	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows: the emissions and fuel us while there are difference	N Se is around double that es in the emissions and	at of the other options. I fuel use across these o	Fuel: 2,399 CO2: 7,604 NOX: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 GJ N		Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98
a 2. Environme 2.2 Atmosph Emissions & Consumpti	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of Option 2C is asse All other options Overall, Option	se: 239,948 GJ of the Atmospheressed as being Wess are assessed as being we say that we	L L L ric Emissions & Consumptions eaker than all other options as being Neutral to each other as Option 4C and Option 5 are o	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows: the emissions and fuel us while there are difference	N N Se is around double that es in the emissions and n Atmospheric Emiss	at of the other options. I fuel use across these o	Fuel: 2,399 CO2: 7,604 NOX: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 GJ N	red insufficient to express a prefer	Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98
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tal 2. Atmonthe 2.2 Atmosph Bis Athen State Constant &	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of Option 2C is asse All other options Overall, Option Material Emissio Recovered Mater	v of the Atmospheressed as being Wess are assessed as being Wess are assessed as being wess are assessed as being the	L L L ric Emissions & Consumptions eaker than all other options as being Neutral to each other as Option 4C and Option 5 are o	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows: the emissions and fuel us while there are difference equally preferred from an Material Emissions (C Recovered Material: 1	N Se is around double that es in the emissions and n Atmospheric Emiss CO2 in tonnes): 115	at of the other options. I fuel use across these o	Fuel: 2,399 CO2: 7,604 NOX: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 GJ N ptions, the differences are conside perspective. Material Emissions (CO2 in tonne Recovered Material: 115	red insufficient to express a prefer	Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ N ence. Material Emissions (CO2 in tonnes): Recovered Material: 212	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98 Vessel Energy Use: 96,526 GJ Material Emissions (CO2 in tonnes): Recovered Material: 115
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tal S. Environme 2.2 Atmosph 5.2 Atmosph 5.2 Atmosph 5.2 Atmosph 6.2 Atmosph 6.2 Atmosph 6.2 Atmosph 6.2 Atmosph 7.2 Atmosph 7	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of Option 2C is asse All other options Overall, Option Material Emissio Recovered Mater Remaining Mate Total: 6,049 Rock: N/A tonnes S The assessment of Option 2C is asse	V of the Atmospheressed as being We s are assessed as being We s are assessed as being Ke ons (CO2 in tonnes rial: 6,049 erial: s N of the Other Consessed as being Str	N N sumptions Sumptions acker than all other options as being Neutral to each other as Defion 4C and Option 5 are of the second sec	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows: the emissions and fuel us while there are difference qually preferred from an Material Emissions (C Recovered Material: T Remaining Material: Total: 11,147 Rock: 18,512 tonnes W illows: greater impact from the re	N Se is around double that es in the emissions and n Atmospheric Emiss CO2 in tonnes): 115 11,032 W eplacing material left in	at of the other options. I fuel use across these o ions & Consumptions	Fuel: 2,399 CO2: 7,604 NOx: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 CJ N ptions, the differences are conside perspective. Material Emissions (CO2 in tonne Recovered Material: 115 Remaining Material: 115 Remaining Material: 11,032 Total: 11,147 Rock: 352 tonnes N the material returned in Option 20	ered insufficient to express a prefer es): N Cand the consumption of a moder	Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ N ence. Material Emissions (CO2 in tonnes): Recovered Material: 212 Remaining Material: 212 Remaining Material: 10,852 Total: 11,064 Rock: 2,450 tonnes N ate quantity of rock resource in Option 4A. Option 2C is assessed as	Fuel: 2,245 CO2: 7,116 NOx: 133.34 SO2: 8.98 Vessel Energy Use: 96,526 GJ Material Emissions (CO2 in tonnes): Recovered Material: 115 Remaining Material: 11,032 Total: 11,147 Rock: 550 tonnes being Neutral to Option 4B, Option 4C and Option 5 as, while there
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2. Environmental 6 2. Environme 2.3 Other 2.2 Atmosph Consumptions A Consumpti	Fuel: 5,580 CO2: 17,689 NOX: 331.46 SO2: 22.32 Vessel Energy Us W The assessment of Option 2C is asse All other options Overall, Option Material Emissio Recovered Mater Remaining Mater Total: 6,049 Rock: N/A tonness S The assessment of Option 2C is asse is greater impact Option 4A is asses	se: 239,948 GJ of the Atmosphere essed as being We s are assessed as be 4A, Option 4B, C ons (CO2 in tonnes rial: 6,049 erial: s of the Other Cons essed as being Str t from replacing r essed as being We	N N sumptions sub-criterion is as for ronger than Option 4 due to material left in-situ in these op (eaker than all other options du	Fuel: 2,417 CO2: 7,661 NOX: 143.55 SO2: 9.67 Vessel Energy Use: 10 N sub-criterion is as follows: the emissions and fuel us while there are difference equally preferred from an Material Emissions (C Recovered Material: 1 Remaining Material: Total: 11,147 Rock: 18,512 tonnes W Ilows: greater impact from the re- tions versus recycling the ue to greater quantity of re-	N See is around double that es in the emissions and n Atmospheric Emiss CO2 in tonnes): 115 11,032 W eplacing material left in e material returned in Co ock consumption in Op	At of the other options. If uel use across these o ions & Consumptions W n-situ versus recycling t Option 2C, this difference option 4A.	Fuel: 2,399 CO2: 7,604 NOx: 142.48 SO2: 9.59 Vessel Energy Use: 103,142 CJ N ptions, the differences are conside perspective. Material Emissions (CO2 in tonne Recovered Material: 115 Remaining Material: 115 Remaining Material: 11,032 Total: 11,147 Rock: 352 tonnes N the material returned in Option 20	ered insufficient to express a preferes): N C and the consumption of a moder	Fuel: 2,550 CO2: 8,082 NOX: 151.44 SO2: 10.20 Vessel Energy Use: 109,630 GJ N ence. Material Emissions (CO2 in tonnes): Recovered Material: 212 Remaining Material: 212 Remaining Material: 10,852 Total: 11,064 Rock: 2,450 tonnes N ate quantity of rock resource in Option 4A. Option 2C is assessed as	Fuel: 2,245 CO2: 7,116 NOX: 133.34 SO2: 8.98 Vessel Energy Use: 96,526 GJ Material Emissions (CO2 in tonnes): Recovered Material: 115 Remaining Material: 11,032 Total: 11,147 Rock: 550 tonnes being Neutral to Option 4B, Option 4C and Option 5 as, while the



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	O2C - Full R	Removal - Reverse	e Installlation \	With Deburial		Exposure / Shallow Bur			Bury Areas of Spans / Exposure w Burial	O4C - Leave (Minor) - Remove Areas of Spans / Exposure , Shallow Burial
- e	Seabed Disturb MFE: 579,280	ance (m2):			Seabed Disturbance Rock Cover: 22,612	(m2):		Seabed Disturbance (m2): Rock Cover: 550		Seabed Disturbance (m2): Rock Cover: 9,800
abec banc								Trenching: 29,619		
2.4 Seabed Disturbance	No rock cover in	n this option.			Habitat Loss/Chang Rock Cover: 22,612	ie (m2):		Habitat Loss / Change (m2): Rock Bags: 550		Habitat Loss / Change (m2): Rock Cover: 9,800
	S	W	W	w	w	W	W	s	N	w
	-	t of the Seabed Dis				VV		3	N	, vv
ummary	4C and Option 5 Option 4A is ass Option 4B is ass impact from the Option 4C is ass	5 as the large area sessed as being W sessed as being St e larger area of ten	of albeit tempo eaker than Opt ronger than Op nporary seabed eaker than Opt	orary impact in Op ion 4B, Option 4C otion 4C as, while t d disturbance from ion 5 due to the g	otion 2C is considered l and Option 5 as, while here is a moderate are the trenching operat reater area of permane	ess preferred than the v all options have varying a of temporary impact f	arying but small areas g areas of temporary a from the trenching ope ve a similar impact to t	of permanent habitat change acro nd permanent impacts, Option 4A arations in Option 4B, the larger ar he smaller area of permanent hab	oss the other options. has the greatest area of permane ea of permanent habitat change f	area impacted in Option 4A represents a permanent habitat char nt habitat change from the rock cover introduced. rom the rock cover in Option 4C is considered to have greater imp Option 5.
	No legacy marir	ne impact from th	is full removal c	option.	Line cleaning and flu	ushing operations will u	se Best	Line cleaning and flushing opera	ations will use Best	Line cleaning and flushing operations will use Best
		·			Environmental Pract	tice (BEP) and the Best A	Available Techniques	Environmental Practice (BEP) an	d the Best Available Techniques	Environmental Practice (BEP) and the Best Available Technique
y Marine acts					(BAT) to minimise as other chemical level	far as possible both resi s in line post flush.	dual hydrocarbon and	(BAT) to minimise as far as possib other chemical levels in line post	-	(BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush.
2.5 Legacy Marine Impacts						npact from the slow rele htity releases is therefore		The legacy marine impact from t concentration / quantity releases overall.		The legacy marine impact from the slow release of these low concentration / quantity releases is therefore expected to be low overall.
			6				· ·			
	S The assessment	S t of the Legacy Ma	S rine Impacts su	b-criterion is as fo	N N	N	S	N	S	S
	environment. Option 4C is ass Overall, Option Concept Maturi Technical Risks:	sessed as being Sti 2 C is preferred f ty: Limited track ro Large scale scope ndant upon pipel	ronger than Op from a Legacy ecord. (Score 1)	tion 5 as the legac	y marine impact is experspective.	pected to be marginally	greater for Option 5 w	here sections of the lines remain e	xposed to the marine environmer	e legacy marine impact is expected to be marginally greater for it. Concept Maturity: Pipe cutting operation is well proven with a
		tial for failure. (Sco			Technical Risks: Limi (Score 3)	ted technical risks assoc	ciated with this option	track record. (Score 3) Technical Risks: The group represent therefore trenching should be fea- exposure may be associated with 2)		good track record (Score 3) Technical Risks: Limited technical risks associated with this opti- (Score 3)
3.1 Te R	W The assessment	W	re 2)	W In is as follows:		ited technical risks assoc	ciated with this option	Technical Risks: The group repres therefore trenching should be fea	asible. However, areas of	Technical Risks: Limited technical risks associated with this opti-
Summary	The assessment Option 2C is asse Option 4A is ass expected to pre- Option 4B is ass Option 4C is ass Overall, Option Large operation	t of the Technical F essed as being We sessed as being St esent similar, low p sessed as being W sessed as being Ne	re 2) W Risk sub-criterio caker than all of ronger than Option potential for tech reaker than Option and Option 5 ar ocalised disrup	n is as follows: ther options as, wh tion 4B as the sim hnical challenges tion 4C and Option a 5 as the problem re equally preferr tion.	(Score 3) S nile all operations are ple rock cover operations area removal or line e ed from a Technical Relatively short oper	N considered routine, ther ons are expected to pres perations are likely to pre nd removal are expected	N re are challenges perfo sent less challenges the esent greater technical d to present similar, low not fishing industry's	Technical Risks: The group represent therefore trenching should be fear exposure may be associated with 2) W rming deburial and cutting / lifting	asible. However, areas of difficult to trench sections. (Score w g at this scale (115 km of lines), whe of the lines. Option 4A is assessed a / line end removal. ss.	Technical Risks: Limited technical risks associated with this optio (Score 3)
ι. ummary	The assessment Option 2C is ass Option 4A is ass expected to pre- Option 4B is ass Option 4C is ass Overall, Option Large operation Infrastructure re	W t of the Technical F essed as being We essed as being We essed as being W sessed as being W sessed as being Ne a 4A, Option 4C a h with significant F emoved, seabed le	re 2) W Risk sub-criterio eaker than all o ronger than Op botential for teck eaker than Opt eaker than Opt eatral to Option nd Option 5 ar ocalised disrup eft clear for fishin	n is as follows: ther options as, wi tition 4B as the sim hnical challenges tion 4C and Option a 5 as the problem re equally preferr tion. ng. (Score 2)	(Score 3) S nile all operations are ple rock cover operations area removal or line e ed from a Technical I Relatively short oper preferred decommis	N considered routine, ther ons are expected to pres perations are likely to pre nd removal are expecter Risk perspective. ation. Rock berms are n sioning solution. (Score	N re are challenges perfo sent less challenges the esent greater technical d to present similar, low not fishing industry's 1)	Technical Risks: The group representation of the second se	asible. However, areas of difficult to trench sections. (Score W g at this scale (115 km of lines), whe of the lines. Option 4A is assessed a / line end removal. is. the short-term. If successful, g operations. (Score 3)	Technical Risks: Limited technical risks associated with this optio (Score 3) N reas the scopes for the other options are smaller in scale. I as being Neutral to Option 4C and Option 5 as the simple rock co Significant duration operation in the short-term. Rock to mitiga cut ends should be flush with seabed and not pose any obstacle fishing operations. (Score 2)
ι. ummary	The assessment Option 2C is assi Option 4A is ass expected to pre- Option 4B is ass Option 4C is ass Overall, Option Large operation Infrastructure re	W t of the Technical P sessed as being We sessed as being Str sent similar, low p sessed as being W sessed as being Ne a 4A, Option 4C a h with significant lo	re 2) W Risk sub-criterio eaker than all o ronger than Op botential for teck eaker than Opt eaker than Opt eater than Opt ocalised disrup ocalised disrup eft clear for fishin	n is as follows: ther options as, which on 4B as the sim hnical challenges, tion 4C and Option 5 as the problem re equally preferr tion. ng. (Score 2)	(Score 3) S ile all operations are ople rock cover operations area removal or line e ed from a Technical Relatively short oper preferred decommis W	N considered routine, ther ons are expected to pres perations are likely to pre nd removal are expecter Risk perspective. ation. Rock berms are n	N re are challenges perfo sent less challenges the esent greater technical d to present similar, low not fishing industry's	Technical Risks: The group represent therefore trenching should be fear exposure may be associated with 2) W rming deburial and cutting / lifting an the trenching of problem areas challenges than the problem areas w potential for technical challenge	asible. However, areas of difficult to trench sections. (Score w g at this scale (115 km of lines), whe of the lines. Option 4A is assessed a / line end removal. ss.	Technical Risks: Limited technical risks associated with this optio (Score 3) N reas the scopes for the other options are smaller in scale. I as being Neutral to Option 4C and Option 5 as the simple rock co
i ki	The assessment Option 2C is asse Option 4A is ass expected to pre- Option 4B is ass Option 4C is ass Overall, Option Large operation Infrastructure re S The assessment Option 2C is asse removed versus Option 4A is ass lines remain in I Option 4B is ass	W tof the Technical P ressed as being We ressed as being Str resent similar, low p resessed as being W ressed as being W ressed as being Ne removed, seabed le semoved, seabed le set of the Societal im ressed as being Str s lines remaining I ressed as being W both options, prot ressed as being Ne	re 2) W Risk sub-criterio eaker than all of ronger than Opt ootential for teck eaker than Opt outral to Option 5 ar ocalised disrup: ft clear for fishing onger than Opt argely trenched eaker than Opt olem areas are re outral to Option	n is as follows: ther options as, which tion 4B as the sim- hnical challenges tion 4C and Option a 5 as the problem re equally preferr tion. ng. (Score 2) MS g sub-criterion is a tion 4A, Option 4E d and buried with- tion 4B and Option rock covered in Option a 4C as both option	(Score 3) S iiie all operations are of the ple rock cover operations are of the ple rock cover operation of the sast the trenching operation of the sast t	N considered routine, ther ons are expected to pre- merations are likely to pre- nd removal are expected Risk perspective. ation. Rock berms are no sioning solution. (Score w to the lines ing. remain in all three option problem areas would rem- ted. Option 4B is assessed	N re are challenges perfores and the second	Technical Risks: The group representation of the second state of t	asible. However, areas of a difficult to trench sections. (Score w g at this scale (115 km of lines), whe of the lines. Option 4A is assessed a / line end removal. rs. e short-term. If successful, g operations. (Score 3) MS d buried with problem areas addi- abed due to the problem areas be res remain in both options, proble	Technical Risks: Limited technical risks associated with this optio (Score 3) N reas the scopes for the other options are smaller in scale. I as being Neutral to Option 4C and Option 5 as the simple rock co Significant duration operation in the short-term. Rock to mitiga cut ends should be flush with seabed and not pose any obstacle fishing operations. (Score 2)



Comparative Assessment Report – Consultation Draft

	O2C - Full R	emoval - Revers	se Installlation V	Vith Deburial						e O4C - Leave (Minor) - Remove Areas of Spans / Exposure		
S		frecyclable mate	erial returned. ner) that may hav			xposure / Shallow Bur efits / impacts with this		/ Shallo Minimal societal benefits/impac	w Burial cts with this option. (Score 3)	Shallow Burial Minimal societal benefits/impacts with this option. (Score 3)		
4. Societal 4.2 Other Users	Materials Return Steel: 5,954 tonn Polymer: 1,177 to	ed: es (recyclable)	ier) that may hav	<i>e</i> to go to land	Materials Returned: Steel: 114 tonnes (recyclable) Polymer: 23 tonnes (landfill)			Materials Returned: Steel: 114 tonnes (recyclable) Polymer: 23 tonnes (landfill)		Materials Returned: Steel: 209 tonnes (recyclable) Polymer: 42 tonnes (landfill)		
	N	N	N	N	N	N	N	N	N	N		
5.1 Short- erm Costs	All options are a likely to end up	ssessed as Neutra In landfill.	al to each other a	-			gely insignificant acro	ss all options. It is noted that a gre £6.042 Million	ater quantity of useful, recyclable	Effective function for the societal be function and the societal be for the societal be societad be societ		
5.1 Sh term	MW	MW	MW	MW	N	N	N	N	N	N		
	25.113	23.805	25.608	26.109	N	N	N	N	N	N		
	million more	million	million more	million more	1.308 million less	0.495 million more	0.996 million more	1.803 million more	2.304 million more	0.501 million more		
	530.5% higher	394.0% higher	604.1% higher	698.5% higher	21.6% lower	11.7% higher	26.6% higher	42.5% higher	61.6% higher	13.4% higher		
Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2C is assessed as being Much Weaker than Option 4A due to the costs being around 6 times higher (£25.1 million more) for Option 4A. Option 2C is assessed as being Much Weaker than Option 4B due to the costs being around 5 times higher (£23.8 million more) for Option 4C due to the costs being around 7 times higher (£25.6 million more) for Option 4C. Option 2C is assessed as being Much Weaker than Option 4B due to the costs being around 5 times higher (£23.8 million more) for Option 4C. Option 4C. Option 2C is assessed as being Much Weaker than Option 4B due to the costs being around 5 times higher (£23.8 million more) for Option 4A is assessed as being Neutral to Option 4B, Option 4C and Option 5 as, while there are differences in the costs to deliver these options, they are insufficient to express a preference. Option 4B is assessed as being Neutral to Option 5 as, while there are differences in the costs to deliver these options, they are insufficient to express a preference. Option 4C is assessed as being Neutral to Option 5 as, while there are differences in the costs to deliver these options, they are insufficient to express a preference. Option 4C is assessed as being Neutral to Option 5 as, while there are differences in the costs to deliver these options, they are insufficient to express a preference. Option 4C is assessed as being Neutral to Option 5 as, while there are differences in the costs to deliver these options, they are insufficient to express a preference. Option 4A , Option 4B , Option 4C and Option 5 as , while there are differences in the costs to deliver these options, they are insufficient to express a preference. Option 4A , Option 4B , Option 4C and Option 5 as , while there are differences in the costs to deliver these options, they are insufficient to express a preference.											
conomic Long- n Costs	Surveys: N/A FLTC: N/A				Surveys: £1.59 Million FLTC: £0.348 Million			Surveys: £1.59 Million FLTC: N/A		Surveys: £1.59 Million FLTC: N/A		
5. Eco 5.2 L term	Total Legacy Cos	t: £0 Million			Total Legacy Cost: £1.9	4 Million		Total Legacy Cost: £1.59 Million		Total Legacy Cost: £1.59 Million		
	S	S	S	S	N	N	N	N	N	N		
Summary	The assessment Option 2C is asse All other options	of the Long-term essed as being St are assessed as	n Costs sub-criteri cronger than all o being Neutral to	ion is as follows: ther options due 1	to there being no legac long-term costs are lar		Option 2C versus the o			ture left in-situ in the other options.		



 e1
 O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk

 Minimal societal benefits/impacts with this option. (Score 3)

 Materials Returned:

 Steel: 114 tonnes (recyclable)

 Polymer: 23 tonnes (landfill)

 enefit of this is offset by the larger quantity of polymer returned which is

 £3.738 Million

 enefit of Option 4B. Option 2C is assessed as being Much Weaker than

Surveys: £1.59 Million FLTC: £0.348 Million Total Legacy Cost: £1.94 Million



J.2 Group 9 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	
O2C - Full Removal - Reverse Installlation With Deburial	N	мw	мw	мw	мw	7.7%	6
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	N	N	23.09	%
04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	w	21.29	6
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	w	21.2%	6
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	s	s	N	27.09	%
1.3 High Consequence Events	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	
O2C - Full Removal - Reverse Installlation With Deburial	N	N	N	s	N	21.49	%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	s	N	21.49	%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure /	N	N	N	s	N	21.49	%

O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	N	N	N	S	N	21.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	w	w	N	¥	14.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	z	s	z	21.4%

1.2 Other Users	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	OS - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	w	w	w	w	14.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	N	N	21.4%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	s	N	N	х	N	21.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	N	N	N	N	21.4%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	s	N	N	х	N	21.4%

1.4 Legacy Risk	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	s	s	s	MS	29.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	s	15.7%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	S	N	N	MS	23.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	N	MS	23.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	мw	мw	N	8.8%



Group 9 Pairwise Comparison Matrices – Environment J.3

2.1 Operational Marine Impact	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	w	w	w	w	14.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	S	N	N	N	N	21.4%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	s	N	N	и	N	21.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	N	N	N	N	21.4%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	N	N	N	21.4%

2.3 Other Consumptions	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	 O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial 	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	s	N	N	N	21.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	w	14.3%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	N	s	N	N	z	21.4 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	s	N	N	N	21.4%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	s	N	N	N	21.4%

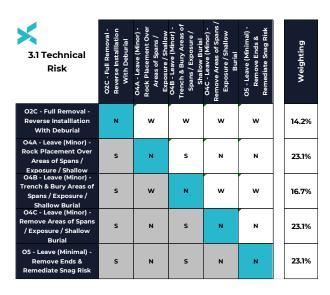
2.5 Legacy Marine Impacts	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	s	s	s	MS	30.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	N	s	19.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	N	s	19.2 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	s	19.2 %
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	w	w	N	12.1%

2.2 Atmospheric Emissions & Fuel Consumption	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow		04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	OS - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	w	w	w	w	14.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	s	N	N	N	N	21.4%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	s	N	N	х	N	21.4%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	N	N	N	N	21.4%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	N	N	N	21.4%

2.4 Seabed Disturbance	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	s	w	w	w	16.6%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	w	14.1%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	S	S	N	S	N	24.9%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	S	s	w	N	w	19.5%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	s	s	N	s	N	24.9 %



J.4 Group 9 Pairwise Comparison Matrices – Technical



J.5 Group 9 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	s	s	s	MS	29.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	s	15.7%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	s	Z	N	MS	23.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	N	MS	23.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	мw	мw	N	8.8 %

4.2 Other Users	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	N	N	N	N	20.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	N	N	N	N	и	20.0%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	N	N	N	N	и	20.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	N	N	N	N	N	20.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	N	N	N	20.0%



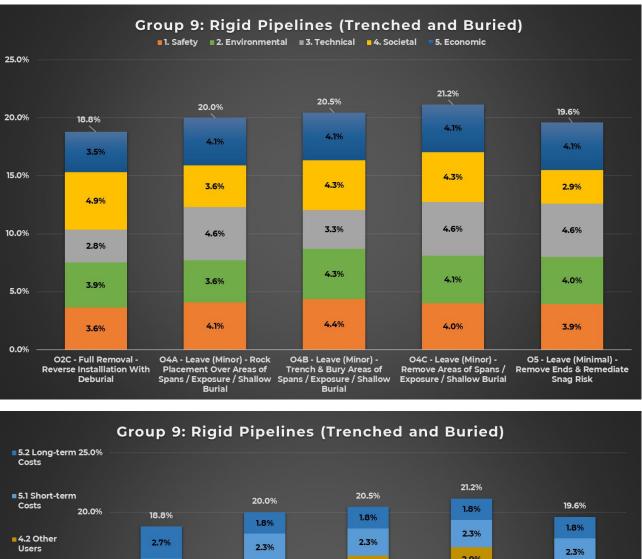
J.6 Group 9 Pairwise Comparison Matrices – Economic

5.1 Short-term Costs	O2C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installlation With Deburial	N	мw	мw	мw	мw	7.7%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	N	N	23.1%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	N	23.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	N	N	N	N	23.1%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	N	N	N	23.1%

5.2 Long-term Costs	02C - Full Removal - Reverse Installlation With Deburial	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Installiation With Deburial	N	s	s	s	s	27.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	N	N	18.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	и	N	18.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	N	N	N	18.2%



J.7 Group 9 Results Charts







APPENDIX K GROUP 16 – DETAILED EVALUATION RESULTS



K.1 Group 16 Attributes Table



Group 16: Rigid Pipeline (Trenched & Buried, Blocked)

PL1024/A - 6" L1 Production / Test Pipeline from Well L1 to Hudson Manifold - 1.631 km

		O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
		- Pipeline safety venting operation is completed upfront	- Pipeline safety venting operation is completed upfront
		- Pipeline is disconnected	- Pipeline is disconnected
		- De-burial of line by MFE (2 passes)	- Remove pipeline ends by cut and lift - Remediate cut ends with rock
		- Line is fully recovered by cut and lift	- Remediate cut ends with rock
		Vessel Type: PoB / Days / Hours / PLL	Vessel Type: PoB / Days / Hours / PLL
		CSV: 76/12.7/11,537/8.65E-04	CSV: 76 / 6.1 / 5,536 / 4.15E-04
		Total offshore hours: 11,537 hrs	Total offshore hours: 5,536 hrs
	-	Total offshore PLL: 8.65E-04	Total offshore PLL: 4.15E-04
	nne	Resource Type: Days/Hours/PLL	Resource Type: Days/Hours/PLL
2	erso	Engineering & Management: 154.4 / 1,235 / 4.94E-06	Engineering & Management: 73.5/588/2.35E-06
fety	e s	Project Management: 161.0 / 1,288 / 5.15E-06	Project Management: 84.0 / 672/2.69E-06
l. Sai	l.l Operations Personnel	Onshore Operations (includes Cleaning & Disposal): 4.0 / 256 / 3.15E-05	Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-06
	pera	Total onshore hours: 2,779 hrs	Total onshore hours: 1,324 hrs
	ō.	Total onshore PLL: 4.16E-05	Total onshore PLL: 1.29E-05
	-	Total operational hours: 14,316 hrs	Total operational hours: 6,860 hrs
		Total operational PLL: 9.07E-04	Total operational PLL: 4.28E-04
		W	
		2.119158879	
		The assessment of the Operations Personnel sub-criterion is as follows:	
Sum	nmary		posure being around double for Option 2A, driven by the longer offshore
		Overall, Option 5 is preferred from a risk to Operations Personnel p	perspective.
	rs	Vessel Days:	Vessel Days:
ity	Users		
Safety	her Users	Vessel Days: CSV: 12.7	Vessel Days: CSV: 6.1
1. Safety	2 Other Users	Vessel Days:	Vessel Days:
l. Safety	12 Other Users	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days
1. Safety	1.2 Other Users	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days
1. Safety	1.2 Other Users	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows:	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2
n I. Safety	12 Other Users	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was
1. Safety a	12	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective.
I. Safety	12	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective.
	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective.
	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. 5 Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting
ſ	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. b Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to
ſ	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. 5 Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting
	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover deburial (MFE) and cutting equipment.	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. 5 Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting
	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover deburial (MFE) and cutting equipment.	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. b Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
l. Safety 13 High	Lo nigh Consequence un 12 Events A	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover deburial (MFE) and cutting equipment.	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. o Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
l. Safety 13 High	۲ nmary 8	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover deburial (MFE) and cutting equipment.	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. Other Users perspective. Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.
l. Safety 13 High	Lo nigh Consequence un 12 Events A	Vessel Days: CSV: 12.7 Total vessel days: 12.7 days Transits: 2 N The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the transits are the considered insufficient to express a preference from a safety impact on Overall, Option 2A and Option 5 are equally preferred from a risk to Routine cut and lift operations. High number of lifts (168) through the water column to recover line sections. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover deburial (MFE) and cutting equipment. W The assessment of the High Consequence Events sub-criterion is as follo Option 2A is assessed as being Weaker than Option 5 due to the greate	Vessel Days: CSV: 6.1 Total vessel days: 6.1 days Transits: 2 e same for both options and the differential in vessel days was other users perspective. Other Users perspective. Other Users perspective. Routine cut and lift operations. Small number of lifting operations (30) through the water column to recover line ends. Additional lifting to transfer pipeline sections to quayside. Small number of lifting operations to deploy and recover cutting equipment.



	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
	No legacy risk from this full removal option.	The line would remain in-situ with this option although it is trenched
		and buried along its entire length.
		The survey & monitoring programme is committed to ensuring that
s,		the potential snag hazard from left in-situ infrastructure continues to
I. Sarety I.4 Legacy Risk		be managed & mitigated as appropriate.
are Jac		
- Leic		Vessel Type: PoB / Days / Hours / PLL
7		Survey Vessel (Legacy): 44/24.4/12,862/9.65E-04
		Total offshore hours: 12.862 hrs
		Total offshore PLL: 9.65E-04
	S	
	The assessment of the Legacy Risk sub-criterion is as follows:	
Summary	Option 2A is assessed as being Stronger than Option 5 as there is no lega given the line remaining in-situ would be trenched and buried along its	
	Overall, Option 2A is preferred from a Legacy Risk perspective.	sentre length.
	Vessel Noise (days on-site): 8.6 days	Vessel Noise (days on-site): 2.0 days
	Tooling Noise (MFE & DWC) = 8.3 days	Tooling Noise (Hydraulic Shears) = 0.6 days
	Operation releases:	Operation releases:
ಕ	Line cleaning and flushing operations are unable to be completed	Line cleaning and flushing operations are unable to be completed
ba	fully due to this line being blocked. The maximum residual contents are: Oil (0.4 m3) Water (10.3 m3) Gas (17.9 m3) Total (28.6 m3)	fully due to this line being blocked. The maximum residual contents
2. Environmental 2.1 Operational Marine Impact	are. On (0.4 ms) Water (10.5 ms) Gas (17.5 ms) Total (20.6 ms)	are: Oil (0.4 m3) Water (10.3 m3) Gas (17.9 m3) Total (28.6 m3)
Environmental Itional Marine I	There will be potential for the release of the contents of the line during	There will be potential for limited release of the contents of the line
Ma	cutting operations. Worst-case composition and quantity of the line	during cutting operations at the line ends. Worst-case composition
nal Iro	contents are known and their release is covered by a permit. Therefore,	and quantity of the line contents are known and their release is
tion I	the related impact is anticipated to be low.	covered by a permit. Therefore, the related impact is anticipated to be
era .		low.
d d	Vessel releases:	
2.1	This includes Ballast, Grey and Black Water, this is driven by duration of	
	vessel operations and therefore at around 8.6 days is the highest of all	This includes Ballast, Grey and Black Water, this is driven by duration of
	options but not considered significant. The environmental impact is	vessel operations and therefore at 2.0 days is the lowest of the options.
	considered to be negligible.	The environmental impact is considered to be negligible.
		7
	W	
	The assessment of the Operational Marine Impact sub-criterion is as follo Option 2A is assessed as being Weaker than Option 5 as, while the differ	
Summarv	of line contents in Option 24 is sufficient to express a small proference for	
Summary	Overall, Option 5 is preferred from an Operational Marine Impact pe	
	Vessel Emissions (in tonnes):	Vessel Emissions (in tonnes):
		Fuel: 826
uel ci	Fuel: 312	Fuel: 826 CO2: 2.617
hental bheric & Fuel	Fuel: 312 CO2: 990 NOx: 18.54	Fuel: 826 CO2: 2,617 NOx: 49.04
onmental lospheric ns & Fuel motion	Fuel: 312 CO2: 990 NOx: 18.54	CO2: 2,617
Vironmental Atmospheric sions & Fuel	Fuel: 312 CO2: 990 NOx: 18.54	CO2: 2,617 NOX: 49.04
Environmental 2 Atmospheric missions & Fuel Construmation	Fuel: 312 CO2: 990 NOx: 18.54	CO2: 2,617 NOX: 49.04
2. Environmental 2.2 Atmospheric Emissions & Fuel Concumption	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25	CO2: 2,617 NOX: 49.04 SO2: 3.30
2. Environmental 2.2 Atmospheric Emissions & Fuel Concumution	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25 Vessel Energy Use: 13,425 GJ	CO2: 2,617 NOX: 49.04 SO2: 3.30
2. Environmental 2.2 Atmospheric Emissions & Fuel Constitution	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25 Vessel Energy Use: 13,425 GJ	CO2: 2,617 NOX: 49.04 SO2: 3.30 Vessel Energy Use: 35,500 GJ
2. Environmental 2.2 Atmospheric Emissions & Fuel Construmention	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25 Vessel Energy Use: 13,425 GJ The assessment of the Atmospheric Emissions & Consumptions sub-crite	CO2: 2,617 NOx: 49.04 SO2: 3.30 Vessel Energy Use: 35,500 GJ erion is as follows:
	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25 Vessel Energy Use: 13,425 GJ The assessment of the Atmospheric Emissions & Consumptions sub-crite Option 2A is assessed as being Neutral to Option 5 as while there different	CO2: 2,617 NOx: 49.04 SO2: 3.30 Vessel Energy Use: 35,500 GJ erion is as follows: nces between the emissions and fuel use for the options, these
2. Environmental 2.2 Atmospheric Emissions & Fuel Construction	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25 Vessel Energy Use: 13,425 GJ The assessment of the Atmospheric Emissions & Consumptions sub-crite Option 2A is assessed as being Neutral to Option 5 as while there difference differences are considered insufficient to express a preference from an e	CO2: 2,617 NOX: 49.04 SO2: 3.30 Vessel Energy Use: 35,500 GJ erion is as follows: nces between the emissions and fuel use for the options, these nvironmental impact perspective.
	Fuel: 312 CO2: 990 NOX: 18.54 SO2: 1.25 Vessel Energy Use: 13,425 GJ The assessment of the Atmospheric Emissions & Consumptions sub-crite Option 2A is assessed as being Neutral to Option 5 as while there different	CO2: 2,617 NOX: 49.04 SO2: 3.30 Vessel Energy Use: 35,500 GJ erion is as follows: nces between the emissions and fuel use for the options, these nvironmental impact perspective.

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		O2A - Full Remo	oval - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk		
	,					
al		Material Emissions (CO2 in tonnes):		Material Emissions (CO2 in tonnes):		
ş	ĽŠ	Recovered Material: 82		Recovered Material: 11		
Ĕ	bti Pel	Remaining Material:		Remaining Material: 132		
ы	δĒ	Total: 82		Total: 143		
<u>vir</u>	2.3 Other nsumptio					
2. Environmental	2.3 Other Consumptions	Rock: N/A tonnes		Rock: 32 tonnes		
2.	Ŭ					
		N				
		The assessment of the Other Consu	motions sub-oritorion is as follows:			
				- II - manual after the second second in the Casting Case of the second size		
				hall amount of rock resource required in Option 5 and the emissions		
Su	mmary			se differences are considered insufficient to express a preference from		
		an environmental impact perspect				
		Overall, Option 2A and Option 5 a	are equally preferred from an Othe	r Consumptions perspective.		
2. Environmental		Seabed Disturbance (m2):		Seabed Disturbance (m2):		
len	2.4 Seabed Disturbance	MFE: 8,155		Rock Cover: 50		
Ľ	2.4 Seabed Disturbance					
2	s F	No rock cover in this option.		Habitat Loss / Change (m2):		
2	2.4 Dist			Rock Bags: 50		
2. E						
		W	r .	V		
		The assessment of the Seabed Dist				
Su	mmary			of seabed disturbed during the deburial operations in Option 2A versus		
Ju	, initial y			er being a permanent habitat change .		
		Overall, Option 5 is preferred from	m a Seabed Disturbance perspectiv	/e.		
a	e	No legacy marine impact from this	full removal option.	Line cleaning and flushing operations are unable to be completed		
ŗ	arir			fully due to this line being blocked. The maximum residual contents		
me	ξ ŭ			are: Oil (0.4 m3) Water (10.3 m3) Gas (17.9 m3) Total (28.6 m3)		
2. Environmental	2.5 Legacy Marine Impacts					
š	<u>a</u> ĝ			The legacy marine impact from the slow release of the residual		
Ъ	Ľ.			contents (covered by a permit) is expected to be low overall.		
5	5					
		S				
			ne Impacts sub-criterion is as follows:			
				acy impact associated with the full removal option versus the impact		
				ted to minimal given the slow degradation of the line / slow release of		
Su	mmary	the residual contents.		5 5 .		
		Overall, Option 2A is preferred fro	om a Legacy Marine Impacts persp	ective.		
2						
cal	cal			Concept Maturity: Minimal operations, well proven techniques. (Score		
į	chnica tisk	options available on the market. (S		3)		
sch	echr Risk	Technical Risks: Minimal technical	risks with this option. (Score 3)	Technical Risks: Limited technical risks associated with option (Score 3)		
Ĕ.	3.1 T					
M	м					
		N				
		The assessment of the Technical Ris	sk sub-criterion is as follows:			
		Option 2A is assessed as being Neu	tral to Option 5 as both options emp	oy routine operations with the length of the line (1.6 km) being		
Su	mmary	insufficient to express a preference	from a scale perspective.			
			are equally preferred from a Techn	ical Risk perspective.		
P						
		Minimal disruption associated with	the removal operation.	Short operation, small area of localised disturbance. Rock used to		
a	Б	Minimal disruption associated with		Short operation, small area of localised disturbance. Rock used to remediate cut ends should be profiled with a suitable gradient to avoid		
cietal	shing	infrastructure is removed long term	the removal operation, n, beneficial for the fishing industry.	remediate cut ends should be profiled with a suitable gradient to avoid		
Societal	Fishing					
4. Societal	4.1 Fishing	infrastructure is removed long term		remediate cut ends should be profiled with a suitable gradient to avoid		
4. Societal	4.1 Fishing	infrastructure is removed long term		remediate cut ends should be profiled with a suitable gradient to avoid		
4. Societal	4.1 Fishing	infrastructure is removed long term		remediate cut ends should be profiled with a suitable gradient to avoid		
4. Societal	4.1 Fishing	infrastructure is removed long term (Score 3) N		remediate cut ends should be profiled with a suitable gradient to avoid impacts for the fishing industry. (Score 2)		
4. Societal	4.1 Fishing	infrastructure is removed long term (Score 3) N The assessment of the Societal imp	n, beneficial for the fishing industry. act on Fishing sub-criterion is as follo	remediate cut ends should be profiled with a suitable gradient to avoid impacts for the fishing industry. (Score 2)		
		infrastructure is removed long term (Score 3) N The assessment of the Societal imp Option 2A is assessed as being Neu	n, beneficial for the fishing industry. act on Fishing sub-criterion is as follo tral to Option 5 as, while the line is re	remediate cut ends should be profiled with a suitable gradient to avoid impacts for the fishing industry. (Score 2)		
	4.1 Fishing	infrastructure is removed long term (Score 3) N The assessment of the Societal imp Option 2A is assessed as being Neu	n, beneficial for the fishing industry. act on Fishing sub-criterion is as follo tral to Option 5 as, while the line is re	remediate cut ends should be profiled with a suitable gradient to avoid impacts for the fishing industry. (Score 2) ws: moved in Option 2A, the line left in-situ in Option 5 will be fully		
		infrastructure is removed long term (Score 3) N The assessment of the Societal imp Option 2A is assessed as being Neu trenched and buried. As such, the o operations perspective.	n, beneficial for the fishing industry. act on Fishing sub-criterion is as follo tral to Option 5 as, while the line is re	remediate cut ends should be profiled with a suitable gradient to avoid impacts for the fishing industry. (Score 2) ws: moved in Option 2A, the line left in-situ in Option 5 will be fully a preference between the options from a commercial fishing		
		infrastructure is removed long term (Score 3) N The assessment of the Societal imp Option 2A is assessed as being Neu trenched and buried. As such, the o operations perspective.	n, beneficial for the fishing industry. act on Fishing sub-criterion is as follo tral to Option 5 as, while the line is re differences are insufficient to express	remediate cut ends should be profiled with a suitable gradient to avoid impacts for the fishing industry. (Score 2) ws: moved in Option 2A, the line left in-situ in Option 5 will be fully a preference between the options from a commercial fishing		

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Small amount of recyclable material returned. (Score 3) Minimal societal benefits / Impacts with this option. (Score 3) Materials Returned: Steel: 80 tonnes (recyclable) Materials Returned: Steel: 80 tonnes (recyclable) Polymer: 36 tonnes (andfill) Steel: 10 tonnes (recyclable) Polymer: 36 tonnes (andfill) N Steel: 10 tonnes (recyclable) Polymer: 36 tonnes (andfill) Polymer: 5 tonnes (andfill) Polymer: 5 tonnes (andfill) N The assessment of the Societal impact on Other Users sub-criterion is as follows: Overall, Option 2A is assessed as being Neutral to Option 5 as the societal benefits are considered minimal for both options. Overall, Option 2A and Option 5 are equally preferred from a Societal impact on Other Users perspective. E1.017 Million Image: Start S		O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
N The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the societal benefits are considered minimal for both options. Overall, Option 2A and Option 5 are equally preferred from a Societal impact on Other Users perspective. 1 El.762 Million El.017 Million 0.755 million more 73.3% higher The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small differential in cost to execute the options is considered insufficient to exprive preference. Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Surveys: N/A FLTC: N/A Surveys: £0.731 Million FLTC: N/A N Surveys: £0.731 Million FLTC: N/A N Descent for the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small difference between no long-term costs in Option 2A versus the small long-term	ers	Small amount of recyclable material returned. (Score 3)	Minimal societal benefits / impacts with this option. (Score 3)
N The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the societal benefits are considered minimal for both options. Overall, Option 2A and Option 5 are equally preferred from a Societal impact on Other Users perspective. Image: State of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the societal impact on Other Users perspective. Image: State of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small differential in cost to execute the options is considered insufficient to exprive freence. Outrall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Ummary preference: Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Surveys: N/A FLTC: N/A FLTC: N/A Surveys: £0.731 Million FLTC: N/A Total Legacy Cost: £0 Million N Descent for the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term	C	Materials Deturned:	Materials Deturned:
N The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the societal benefits are considered minimal for both options. Overall, Option 2A and Option 5 are equally preferred from a Societal impact on Other Users perspective. Itel:/f22.Willion E1:/f22.Willion Itel:/f22.Willion Itel:/f22.Willi	her		
N The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the societal benefits are considered minimal for both options. Overall, Option 2A and Option 5 are equally preferred from a Societal impact on Other Users perspective. E1.762 Million E1.762 Million O.755 million more 73.3% higher The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small differential in cost to execute the options is considered insufficient to expr preference. Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Using 100 Surveys: N/A FLTC: N/A Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million N The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term	ð		
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Overall, Option 2A and Option 5 are equally preferred from a Societal impact on Other Users perspective. • • • • • • • • • • • • • • • • • • •			
# 1.762 Million £1.017 Million # 1.762 Million £1.017 Million N 0.75 million more 73.3% higher 73.3% higher The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small differential in cost to execute the options is considered insufficient to expresente. Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Surveys: N/A FLTC: N/A FLTC: N/A Surveys: £0.731 Million FLTC: N/A Total Legacy Cost: £0 Million The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term	ummary		
is is is in the second seco		Overall, Option 2A and Option 5 are equally preferred from	a Societal impact on Other Users perspective.
Singlest N 0.75 million more 73.3% higher 73.3% higher The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small differential in cost to execute the options is considered insufficient to expression of the Short-term Cost perspective. Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million Surveys: f0.731 Million FLTC: N/A Total Legacy Cost: £0 Million The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term		£1.762 Million	£1.017 Million
Single N 0.75 million more 73.3% higher The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the small differential in cost to execute the options is considered insufficient to expression of the Short-term Cost and Option 5 are equally preferred from a Short-term Cost perspective. Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million N The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term	÷tš		
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Summary preference. Overall, Option 2A and Option 5 are equally preferred from a Short-term Cost perspective. Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million FLTC: N/A Total Legacy Cost: £0 Million FLTC: N/A Total Legacy Cost: £0 Million			
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Surveys: N/A Surveys: £0.731 Million FLTC: N/A FLTC: N/A Total Legacy Cost: £0 Million FLTC: N/A Total Legacy Cost: £0 Million Total Legacy Cost: £0.731 Million N The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term			differential in cost to execute the options is considered insufficient to express a
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N The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term		preference. Overall, Option 2A and Option 5 are equally preferred from	a Short-term Cost perspective.
N The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term		preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A	a Short-term Cost perspective.
Image: Second system Image: Second system Image: Second		preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A	a Short-term Cost perspective.
N The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term		preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A FLTC: N/A	a Short-term Cost perspective. Surveys: £0.731 Million FLTC: N/A
The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term	Long-term Costs	preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A FLTC: N/A	a Short-term Cost perspective. Surveys: £0.731 Million FLTC: N/A
Option 2A is assessed as being Neutral to Option 5 as the difference between no long-term costs in Option 2A versus the small long-term	Long-term Costs	preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million	a Short-term Cost perspective. Surveys: £0.731 Million FLTC: N/A
	Long-term Costs	preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million	a Short-term Cost perspective. Surveys: £0.731 Million FLTC: N/A Total Legacy Cost: £0.731 Million
	Long-term Costs	preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million N The assessment of the Long-term Costs sub-criterion is as follow	a Short-term Cost perspective. Surveys: £0.731 Million FLTC: N/A Total Legacy Cost: £0.731 Million VS:
Overall, Option 2A and Option 5 are equally preferred from a Long-term Cost perspective.	5.2 Long-term Costs	Preference. Overall, Option 2A and Option 5 are equally preferred from Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million N The assessment of the Long-term Costs sub-criterion is as follow Option 2A is assessed as being Neutral to Option 5 as the difference	a Short-term Cost perspective. Surveys: £0.731 Million FLTC: N/A Total Legacy Cost: £0.731 Million VS:



K.2 Group 16 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	1.2 Other Users	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	40.0%	O2A - Full Removal - Cut and Lift	N	N	50.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	60.0%	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	50.0%
1.3 High Consequence Events	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	40.0%	O2A - Full Removal - Cut and Lift	N	s	60.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	60.0%	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	40.0%

K.3 Group 16 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	40.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	60.0%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	50.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	50.0%

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2.3 Other Consumptions	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	z	50.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	50.0%

2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	60.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	40.0%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	40.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	60.0%

K.4 Group 16 Pairwise Comparison Matrices – Technical





K.5 Group 16 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting	4.2 Other Users	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	50.0%	O2A - Full Removal - Cut and Lift	N	N	50.0%
05 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Ν	N	50.0%	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	50.0%

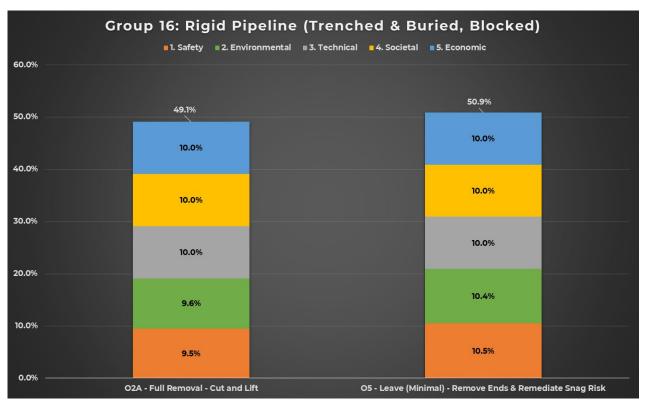
K.6 Group 16 Pairwise Comparison Matrices – Economic

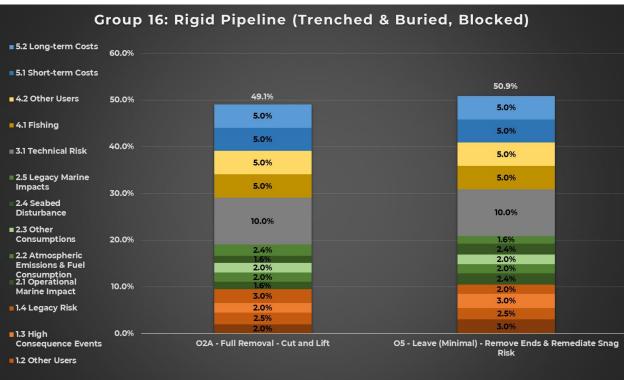
5.1 Short-term Costs	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	50.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Ν	N	50.0%

5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	50.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	50.0%



K.7 Group 16 Results Charts







APPENDIX L GROUP 17 – DETAILED EVALUATION RESULTS

Group 17 Attributes Table L.1



Group 17: Rigid Pipelines (Trenched and Partially Buried)

PL1022 - 6" Gas Lift Pipeline from Tern to Hudson Manifold - 10.161 km | PL1021/A - 8" Water Injection Pipeline from Tern to Hudson Manifold - 10.185 km

		O2A - Full Remo	oval - Cut and Lif	t	O3A - Leave (Ma	ajor) - Rock Placemen	t Over Entire Line	O3B - Leave (N	Aajor) - Trench & Bury Entire Line	e 05 - Le
		lisconnected nes by MFE (1 pass recovered by cut a			- Pipelines are discon - Entirety of lines are	nnected rock covered using a Fl	νV	- Pipelines are disconne - All lines in existing tre - Entirety of lines requir		- Pipelir - Remov - Remec
Г	Vessel Type: PoE CSV: 76 / 111.5 / 10	3/Days/Hours/F 01,642/7.62E-03	PLL		Vessel Type: PoB / Da Rockdump Vessel: 20	ays/Hours/PLL)/41.3/9,922/7.44E-04		Vessel Type: PoB / Days Trenching Vessel: 55/10		Vessel Ty CSV: 76
le		Total offshore hours: 101,642 hrs Total offshore PLL: 7.62E-03				9,922 hrs 44E-04		Total offshore hours: 6,5 Total offshore PLL: 4.94		Total off Total off
l. Safety Operations Person	Engineering & N Project Manage Onshore Operat 2.91E-04	ment: 1,284.0 / 10, ions (includes Cle	38.2/11,106/4.44E			gement: 283.8/2,271/9 t: 472.0/3,776/1.51E-05 6,047 hrs		Resource Type: Days / H Engineering & Manage Project Management: 2 Total onshore hours: 3,7 Total onshore PLL: 1.51E	ment: 239.7 / 1,918 / 7.67E-06 33.0 / 1,864 / 7.46E-06 82 hrs	Resourc Enginee Project I Onshore 06
7	Total onshore he Total onshore Pl				Total operational hou Total operational PLL			Total operational hours: Total operational PLL: 5		Total on: Total on:
	Total operationa Total operationa	al hours: 125,388 h al PLL: 8.00E-03	irs							Total op Total op
	MW	MW	MW		w	N		N		
	10.4167	15.7171	11.5108		1.50884086	1.10503597		0.73237410	01	
Summa	Option 2A is asso in Option 3A. O trenching of the recover line end Option 3A is asso Option 3B is ass	essed as being Mu ption 2A is assessed Ines in Option 3 Is only in Option 5 essed as being W essed as being Ne	ed as being Much 5B. Option 2A is as 5. Yeaker than Optio eutral to Option 5	Option 3A due t Weaker than O ssessed as being n 3B due to the n s as the risk expo	o the risk exposure bein ption 3B due to the risk Much Weaker than Op	k exposure being more otion 5 due to the risk e ound 50% higher from t	around 16 times highe xposure being around	r in Option 2A due to the 11 times higher in Option	pe associated with the full removal greater offshore scope associated v 2A due to the greater offshore scop nes. Option 3A is assessed as being	with the full remove oe associated with
		SB and Option :	s are equally pre	erred from a r		sonner perspective.				
ety Users	Vessel Days: CSV: 111.5				Vessel Days: Rockdump Vessel: 41	1.3		Vessel Days: Trenching Vessel: 10.0		Vessel D CSV: 9.9
1. Safety 1.2 Other Us	Total vessel days Transits: 10	s: 111.5 days			Total vessel days: 41.3 Transits: 20	3 days		Total vessel days: 10.0 d Transits: 2	ays	Total ves Transits:
	N	W	W	r	W	w	ľ	N		r
Summa	Option 2A is asse	essed as being Ne		A as, while there	are more transits asso nber of vessel days and	-		-	A and the impact on the safety of o	ther users is consid



Leave (Minimal) - Remove Ends & Remediate Snag Risk

elines are disconnected nove pipeline ends by cut and lift nediate cut ends with rock

Type: PoB/Days/Hours/PLL 76/9.9/9,038/6.78E-04

offshore hours: 9,038 hrs offshore PLL: 6.78E-04

urce Type: Days/Hours/PLL neering & Management: 138.2/1,106/4.42E-06 ct Management: 141.0 / 1,128 / 4.51E-06 ore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-

onshore hours: 2,298 hrs onshore PLL: 1.68E-05

operational hours: 11,336 hrs operational PLL: 6.95E-04

ersus the smaller scope to perform rock cover over the lines noval of these lines versus the smaller scope to perform ith the full removal of these lines versus the smaller scope to

ion 5 as the risk exposure is largely similar.

l Days: 9.9

vessel days: 9.9 days its: 2

nsidered similar across both options. Option 2A is assessed as

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		O2A - Full Remo	val - Cut and	Lift	O3A - Leave (M	ajor) - Rock Placemen	t Over Entire Line	O3B - Leave (M	ajor) - Trench & Bury Entire Line	O5 - Lea
l. Safety l.3 High Consequence Evonte						k placement operations		Routine, low risk trenchi	ng operations. Small number of lifting ne water column to deploy and recover	Small nur to recover transfer p operation
	MW	MW	W		Ν	S	r	S		
Summary	2A is assessed a Option 3A is ass operations asso Option 3B is ass	s being Weaker th essed as being Ne ciated with Optio sessed as being St	nan Option 5 d eutral to Optio n 5. ronger than O	ue to the much hig n 3B as there is lim ption 5 due to the p	gher number of offshor ited potential for high	re lifting operations asso consequence events in equence events from dr	ciated with Option 2A both options. Option 3	·	m dropped object, associated with Optio onger than Option 5 due to the potential ed with Option 5	
l. Safety Legacy Risk	No legacy risk fr	isk from this full removal option. The line would remain in-situ with this option although it would be fully trenched and rock covered. 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.					mitted to ensuring tu infrastructure	be fully trenched and bu The survey & monitoring that the potential snag h	n-situ with this option although it would ried. programme is committed to ensuring nazard from left in-situ infrastructure d & mitigated as appropriate.	The line w its length will be ren from cut e The surve that the p
1. 1.4 Le					Vessel Type: PoB / Da Survey Vessel (Legad	ays / Hours / PLL cy): 44 / 29.1 / 15,360 / 1.15	E-03	Vessel Type: PoB / Days / Survey Vessel (Legacy): 4		continues Vessel Typ Survey Ve
	S	S	MS	ľ	N	S		S		
Summary	Option 2A is ass assessed as beir Option 3A is ass in both options, Option 3B is ass	ng Much Stronger ressed as being Ne , it is fully rock cov	ronger than Option 5 r than Option 5 eutral to Optio rered in Option ronger than O	ption 3A and Optio 5 as the line remain n 3B as the lines re 1 3A whereas areas ption 5 as, while th	ns in-situ with areas of e main in-situ in both op of exposure (within exi	exposure (within existing ptions either rock covere isting trench) remain in	g trench) remaining. d (to top of trench) or t Option 5.	renched and backfilled wi	ng in-situ either rock covered (to top of tre thin existing trench. Option 3A is assesse s of exposure (within existing trench) rem	ed as being S



_eave (Minimal) - Remove Ends & Remediate Snag Risk

number of lifting operations (64) through the water column over line ends and to place rock bags. Additional lifting to er pipeline sections to quayside. Small number of lifting tions to deploy and recover cutting equipment.

us limited / no lifting with Option 3A and Option 3B. Option

consequence events from dropped object from the lifting

ne would remain in-situ with this option with the majority of gth within a trench but with light cover only. The line ends e removed with rock cover to mitigate potential snag hazard ut ends.

rvey & monitoring programme is committed to ensuring ne potential snag hazard from left in-situ infrastructure ues to be managed & mitigated as appropriate.

Type: PoB / Days / Hours / PLL / Vessel (Legacy): 44 / 29.0 / 15,307 / 1.15E-03

renched and backfilled within existing trench. Option 2A is

ng Stronger than Option 5 as, while the line remains in-situ

tion 5.

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		O2A - Full Remo	val - Cut and I	Lift	O3A - Leave (Maj	or) - Rock Placement Over Entire Line	O3B - Leave (Major) - Tr	rench & Bury Entire Line	05 - Lea
	Vessel Noise (da	ays on-site): 95.4 d	ays		Vessel Noise (days on-	site): 10.3 days	Vessel Noise (days on-site): 6.0 da	ays	Vessel No
	Tooling Noise (N	MFE & DWC) = 93.6	5 days		Tooling Noise = none		Tooling Noise (Trenching) = 4.1 da	ays	Tooling N
	Operation relea	ises:			Operation releases:		Operation releases:		Operation
	Line cleaning a	nd flushing opera	ations will use E	Best	Line cleaning and flus	hing operations will use Best	Line cleaning and flushing opera	ations will use Best	Line clear
	Environmental	Practice (BEP) an	d the Best Avai	lable Techniques	Environmental Practic	e (BEP) and the Best Available Techniques	Environmental Practice (BEP) and	d the Best Available Techniques	Environm
	(BAT) to minimi	se as far as possib	le both residua	l hydrocarbon and	(BAT) to minimise as fa	ar as possible both residual hydrocarbon and	(BAT) to minimise as far as possib	le both residual hydrocarbon and	(BAT) to n
	other chemical	levels in line post	flush and relea	ases to the marine	other chemical levels i	n line post flush and releases to the marine	other chemical levels in line post	flush and releases to the marine	and other
	environment du	uring flushing act	ivities.		environment during fl	ushing activities.	environment during flushing acti	ivities.	marine ei
	Cutting of line e	ends and midline	cuts would lead	d to an elevated	As lines are being rock	covered there is negligible release from the	As lines are being trenched there	is negligible release from the	Cutting of
	release of fluids	from within the li	ine. However, g	iven the prior	line.		line.		from with
	cleaning of the	line, the concentr	ation and quar	ntity of release					the conce
		ow overall. Theref			Vessel releases:		Vessel releases:		overall. Th
	anticipated to b	be low.		-	This includes Ballast, C	Grey and Black Water, this is driven by	This includes Ballast, Grey and Bl	ack Water, this is driven by	
					duration of vessel oper	rations and therefore at 10.3 days is not	duration of vessel operations and	I therefore at 6.0 days is not	Vessel rele
Th	Vessel releases:				considered significant	. The environmental impact is considered to	considered significant. The envir	onmental impact is considered	Thisinclu
	This includes Ba	allast, Grey and Bl	ack Water, this	is driven by	be negligible.		to be negligible.		
	duration of vess	el operations and	l therefore at 95	5.4 days is the					of all optio
	highest of all th	e options. The en	vironmental in	npact is					negligible
	considered to b	e negligible.							
	14/				N	N	N	Y	
	w	W	W		N	N	N	Y	F
	The assessment	t of the Operation	al Marine Impa	ct sub-criterion is a	as follows:				
·у	The assessment Option 2A is ass	I t of the Operation ressed as being W	al Marine Impa eaker than Opt	tion 3A, Option 3B a	as follows: and Option 5 as there ar	e many more vessel days and days of tooling	operations associated with Option	n 2A which generate a greater nois	se impact th
ry	The assessment Option 2A is ass All other option:	t of the Operation essed as being W s are assessed as b	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	as follows: and Option 5 as there ar e marine impacts are lar		operations associated with Option	2A which generate a greater nois	se impact th
ry	The assessment Option 2A is ass All other option: Overall, Option	t of the Operation essed as being W s are assessed as h 3A, Option 3B a	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	as follows: and Option 5 as there ar marine impacts are lar ed from an Operationa	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective.	operations associated with Option 5.	2A which generate a greater nois	
ry	The assessment Option 2A is ass All other option: Overall, Option Vessel Emission	t of the Operation essed as being W s are assessed as h 3A, Option 3B a	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	as follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective.	operations associated with Option s. Vessel Emissions (in tonnes):	2A which generate a greater nois	Vessel Em
У	The assessment Option 2A is ass All other option: Overall, Option Vessel Emission Fuel: 3,079	t of the Operation essed as being W s are assessed as h 3A, Option 3B a	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	as follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective.	operations associated with Option s. Vessel Emissions (in tonnes): Fuel: 986	a 2A which generate a greater nois	Vessel Em Fuel: 1,082
on	The assessment Option 2A is ass All other options Overall, Option Vessel Emission Fuel: 3,079 CO2: 9,759	t of the Operation essed as being W s are assessed as h 3A, Option 3B a	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	as follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527 CO2: 4,841	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective.	operations associated with Option s. Vessel Emissions (in tonnes): Fuel: 986 CO2: 3,126	a 2A which generate a greater nois	Vessel Em Fuel: 1,082 CO2: 3,431
ption	The assessment Option 2A is ass All other options Overall, Option Vessel Emission Fuel: 3,079 CO2: 9,759 NOX: 182.87	t of the Operation essed as being W s are assessed as h 3A, Option 3B a	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	s follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527 CO2: 4,841 NOx: 90.72	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective.	operations associated with Option 5. Vessel Emissions (in tonnes): Fuel: 986 CO2: 3,126 NOx: 58.58	2A which generate a greater nois	Vessel Em Fuel: 1,082 CO2: 3,431 NOX: 64.30
	The assessment Option 2A is ass All other options Overall, Option Vessel Emission Fuel: 3,079 CO2: 9,759	t of the Operation essed as being W s are assessed as h 3A, Option 3B a	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	as follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527 CO2: 4,841	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective.	operations associated with Option s. Vessel Emissions (in tonnes): Fuel: 986 CO2: 3,126	a 2A which generate a greater nois	Vessel Em Fuel: 1,082 CO2: 3,431
Consumption	The assessment Option 2A is ass All other options Overall, Option Vessel Emission Fuel: 3,079 CO2: 9,759 NOX: 182.87	t of the Operation essed as being W s are assessed as I n 3A, Option 3B a ns (in tonnes):	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	s follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527 CO2: 4,841 NOx: 90.72	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective. nnes):	operations associated with Option 5. Vessel Emissions (in tonnes): Fuel: 986 CO2: 3,126 NOx: 58.58	n 2A which generate a greater nois	Vessel Em Fuel: 1,082 CO2: 3,431 NOx: 64.3 SO2: 4.33
	The assessment Option 2A is ass All other option: Overall, Option Vessel Emission Fuel: 3,079 CO2: 9,759 NOX: 182.87 SO2: 12.31	t of the Operation essed as being W s are assessed as I n 3A, Option 3B a ns (in tonnes):	al Marine Impa eaker than Opt being Neutral t	tion 3A, Option 3B a o each other as the	As follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527 CO2: 4,841 NOX: 90.72 SO2: 6.11	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective. nnes):	operations associated with Option 5. Vessel Emissions (in tonnes): Fuel: 986 CO2: 3,126 NOx: 58.58 SO2: 3.94	2A which generate a greater nois	Vessel Em Fuel: 1,082 CO2: 3,431 NOX: 64.30
Consumption	The assessment Option 2A is ass All other option: Overall, Option Vessel Emission Fuel: 3,079 CO2: 9,759 NOX: 182.87 SO2: 12.31 Vessel Energy U	Use: 132,380 GJ	Al Marine Impa leaker than Opt being Neutral t and Option 5 a	tion 3A, Option 3B a o each other as the re equally preferre	As follows: and Option 5 as there are marine impacts are lar ed from an Operationa Vessel Emissions (in to Fuel: 1,527 CO2: 4,841 NOX: 90.72 SO2: 6.11	e many more vessel days and days of tooling gely similar (and negligible) for these options I Marine Impact perspective. nnes):	operations associated with Option 5. Vessel Emissions (in tonnes): Fuel: 986 CO2: 3,126 NOx: 58.58 SO2: 3.94	n 2A which generate a greater nois	Vessel Em Fuel: 1,082 CO2: 3,431 NOx: 64.3 SO2: 4.33



eave (Minimal) - Remove Ends & Remediate Snag Risk.

Noise (days on-site): 5.7 days g Noise (Hydraulic Shears) = 1.8 days

tion releases:

eaning and flushing operations will use Best

nmental Practice (BEP) and the Best Available Techniques o minimise as far as possible both residual hydrocarbon her chemical levels in line post flush and releases to the e environment during flushing activities.

g of line ends would lead to an elevated release of fluids vithin the line. However, given the prior cleaning of the line, ncentration and quantity of release should still be low . Therefore, the related impact is also anticipated to be low.

releases:

cludes Ballast, Grey and Black Water, this is driven by on of vessel operations and therefore at 5.7 days is the lowest ptions. The environmental impact is considered to be ible.

t than the other options. Other impacts are negligible.

Emissions (in tonnes): 082 431 4.30 33

Energy Use: 46,544 GJ

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	O2A - Full Removal - Cut and Lift	O3A - Leave (Major) - Rock Placement Over Entire Line	O3B - Leave (Major) - Trench & Bury Entire Line	05 - L
2. Environmental 2.3 Other Consumptions	Material Emissions (CO2 in tonnes): Recovered Material: 1,092 Remaining Material: Total: 1,092	Material Emissions (CO2 in tonnes): Recovered Material: Remaining Material: 2,048 Total: 2,048	Material Emissions (CO2 in tonnes): Recovered Material: Remaining Material: 2,048 Total: 2,048	Materia Recover Remain Total: 2,0
2. Envir 2.3 Consu	Rock: N/A tonnes	Rock: 203,460 tonnes	Rock: N/A tonnes	Rock: 64
	S N N	w w	N	r.
Summar	consumption perspective are largely similar across these options. Option 3A is assessed as being Weaker than Option 3B and Option	large quantity of rock resource required in Option 3A. Option 2A is a 5 due to the large quantity of rock resource required in Option 3A. consumption from recycled / replacement material and rock consum		consump
tal	Seabed Disturbance (m2):	Seabed Disturbance (m2):	Seabed Disturbance (m2):	Seabed
ronmen Seabed urbance	MFE: 101,730	Rock Cover: 203,460	Trenching: 203,460	Rock Co
 Environmental 2.4 Seabed Disturbance 	No rock cover in this option.	Habitat Loss / Change (m2): Rock Cover: 203,460	No rock cover in this option.	Habitat Rock Ba
	MS N W	MW VMW	W	
Summar	Weaker than Option 5 as there is limited area of seabed impacted	o the greater impact from the permanent habit change from the roc nited area of seabed impacted in Option 5.		
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	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 ar other chemical levels in line post flush. The legacy marine impact from the slow release of these low	
2. En 2.5 Le		concentration / quantity releases is therefore expected to be low overall.	concentration / quantity releases is therefore expected to be low overall.	concent overall.
	S S MS	N S	S	F
Summar	this is reduced as the lines will be within a trench and either fully of impacts associated with the full removal option whereas there will Option 3A is assessed as being Neutral to Option 3B as the lines removed option 5 as the lines are isolated from the marine environment in	n 3B as there is no legacy marine impacts associated with the full ren overed in rock or fully backfilled thus the lines left in-situ will be larg be slow degradation of the lines and releases over a long time perio nain in-situ but isolated from marine environment so rate of degrad Option 3A versus sections of the lines remaining exposed to the mari e lines are isolated from the marine environment in Option 3B versus	ely isolated from the marine environment. Option 2A is assessed a d with Option 5 where sections of the lines remain exposed to the lation and release to marine environment will be similar (and slow ne environment in Option 5 which will result in degradation produ	s being Mu marine env i in both op ucts impact



eave (Minimal) - Remove Ends & Remediate Snag Risk

al Emissions (CO2 in tonnes): ered Material: 22 ning Material: 2,006 2,028

64 tonnes

otion from recycled / replacement material and rock

d Disturbance (m2): over: 100

t Loss / Change (m2): ags: 100

manent impact (habitat change) from the rock cover ient to express a preference. Option 2A is assessed as being

er than Option 5 due to the much greater impact from the

eaning and flushing operations will use Best nmental Practice (BEP) and the Best Available Techniques o minimise as far as possible both residual hydrocarbon her chemical levels in line post flush.

gacy marine impact from the slow release of these low ntration / quantity releases is therefore expected to be low .

s over a long time period with the other options although luch Stronger than Option 5 as there is no legacy marine wironment.

ptions. Option 3A is assessed as being Stronger than cting more quickly (but still slow / low impact).

ion 5 which will result in degradation products impacting

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			O2A - Full Remo	oval - Cut and Li	ft	O3A - Leave (Maj	jor) - Rock Placement Over Entire Line	O3B - Leave (Major) -	Trench & Bury Entire Line	O5 - I
3. Technical	Concept Maturity: Cut and lift techniques are well proven with multiple options available on the market. (Score 3) Technical Risks: Technical risks with this option are associated with the scale of the operation. (Score 2)			3)	3)	ck placement is a well proven process. (Score ted technical risks associated with option	Concept Maturity: Trenching su (Score 3) Technical Risks: Geotechnical s confirm if it is feasible. (Score 2)	•	Concer good ti Techni (Score 3	
		W	W	W	ľ	N	N	N		P.
Sum	imary	Option 2A is asse All other options	s are assessed as	′eaker than all ot being Neutral to	her options as, wh each other as the		considered routine, there are challenges perfort technical challenges are limited for these of tisk perspective.		ng at this scale (20 km of lines), whe	ereas the
4. Societal	4.1 Fishing	-	uption associated ructure is remove . (Score 2)			Rock berms designed not fishing industry's	d to be over-trawlable, howver, rock berms ar preference. (Score 1)		f successful, the area would be clear	Relativ r mitiga obstacl
		S	S	MS	ľ.	N	S	S		r.
Sum	mary	Option 2A is asse removed versus Option 3A is asse lines remaining Option 3B is asse	essed as being St remaining in the essed as being No in the existing tr essed as being St	ronger than Opt e existing trench eutral to Option ench with expos cronger than Opt	with exposures (w 3B as the as left co ures (within the tr	a 3B as the lines are ren vithin the trench) rema ondition of the lines pre ench) remaining. s a flat seabed versus tl	moved versus being left in-situ albeit rock con aining. esents a largely flat seabed and limited disru he lines remaining in the existing trench wit	ption to fishing operations in both	n cases. Option 3A is assessed as be	
4. Societal	4.2 Other Users	Significant amo Materials Returr Steel: 1,084 tonr Polymer: 24 tonr	nes (recyclable)	material returne	ed. (Score 3)	Minimal societal bene Materials Returned: None.	efits/impacts with this option. (Score 3)	Minimal societal benefits/imp Materials Returned: None.	acts with this option. (Score 3)	Minima Materia Steel: 2 Polyma
		N	N	N	ľ	N	N	N	ľ	
Sum	imary	All options are a benefit of this is	ssessed as Neutra offset by the larg	al to each other a er quantity of po	lymer returned w			oss all options. It is noted that a gr	reater quantity of useful, recyclable	material



Leave (Minimal) - Remove Ends & Remediate Snag Risk

pt Maturity: Pipe cutting operation is well proven with a rack record (Score 3)

ical Risks: Limited technical risks associated with this option 3)

e scopes for the other options are smaller in scale.

vely short duration operation in the short-term. Rock to ate cut ends should be flush with seabed and not pose any cle to fishing operations. (Score 3)

being Much Stronger than Option 5 as the lines are fully

nger than Option 5 as it presents a flat seabed versus the

al societal benefits/impacts with this option. (Score 3)

als Returned: 22 tonnes (recyclable) er: 1 tonnes (landfill)

I (steel) is returned in Option 2A, however the societal

		(02A - Full Remo	oval - Cut and Lift		O3A - Leave (Maj	jor) - Rock Placemen	t Over Entire Line	O3B - Leave (Major)	- Trench & Bury Entire Line	O5 - I
5. Economic	5.1 Short- term Costs	£12.714 Million				£4.793 Million			£2.467 Million		£1.633 N
		MW	MW	MW		W	W		Ν		
		7.921 million more	10.247 million more	11.081 million more		2.326 million more	3.16 million more		0.834 million more		
		165.3% higher	415.4% higher	678.6% higher		94.3% higher	193.5% higher		51.1% higher		
Sui	mmary	Option 3A is asse (£3.2 million mol Option 3B is asse	essed as being W re) than Option 5 essed as being N	Veaker than Option 5. leutral to Option 5 a	3B due to the o s while there is	costs to deliver this opti	on being almost doub	e (£2.3 million more)		ore than 6 times higher (£11.1 millio	-
8	E	Surveys: N/A				Surveys: £0.873 Millio	n		Surveys: £0.873 Million		Survey
omi	-teri ts	FLTC: N/A				FLTC: N/A			FLTC: N/A		FLTC: £
5. Economic	5.2 Long-term Costs	Total Legacy Cos	t: £0 Million			Total Legacy Cost: £0.	873 Million		Total Legacy Cost: £0.873 Milli	on	Total L
		N	Ν	N		N	N		N	l l	
			-	n Costs sub-criterior							
Su	nmary		ssessed as being	Neutral to each oth	ner as, while th	ere are no long-term co	osts associated with the	e full removal option,	the costs associated with the mo	nitoring and surveying of the lines	remaining
		'	ons are equally	preferred from a l	ong-term Co	st perspective.					



Leave (Minimal) - Remove Ends & Remediate Snag Risk

Million

nan Option 3B due to the costs to deliver this option being nan Option 5.

the costs to deliver this option being almost 3 times higher

ys: £0.87 Million £0.061 Million

egacy Cost: £0.931 Million

g in-situ are relatively minor and insufficient to express a



L.2 Group 17 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	мw	10.0%
O3A - Leave (Major) - Rock Placement Over Entire Line	MS	N	w	N	27.0%
O3B - Leave (Major) - Trench & Bury Entire Line	MS	S	N	N	33.1%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	N	N	29.9 %
	- Cut	ır) - Dver	rr) - tire	al) - & ?isk	

1.3 High Consequence Events	O2A - Full Removal - Cu and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	w	12.0%
O3A - Leave (Major) - Rock Placement Over Entire Line	MS	N	N	s	33.6%
O3B - Leave (Major) - Trench & Bury Entire Line	MS	N	N	s	33.6%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	w	w	N	20.8%

1.2 Other Users	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	w	w	20.0%
O3A - Leave (Major) - Rock Placement Over Entire Line	и	N	w	w	20.0%
O3B - Leave (Major) - Trench & Bury Entire Line	s	s	N	N	30.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	S	N	N	30.0%

1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	O3B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	MS	38.1%
O3A - Leave (Major) - Rock Placement Over Entire Line	w	N	N	s	23.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	N	s	23.6%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	w	N	14.7%



L.3 Group 17 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2%
O3A - Leave (Major) - Rock Placement Over Entire Line	S	N	N	N	27.3%
O3B - Leave (Major) - Trench & Bury Entire Line	S	N	N	N	27.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	N	N	27.3%

2.3 Other Consumptions	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	O3B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	N	N	27.3%
O3A - Leave (Major) - Rock Placement Over Entire Line	w	N	w	w	1 8.2 %
O3B - Leave (Major) - Trench & Bury Entire Line	N	s	N	N	27.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	S	N	N	27.3%

2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	O3B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	MS	38.1%
O3A - Leave (Major) - Rock Placement Over Entire Line	w	N	N	s	23.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	N	s	23.6%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	w	N	14.7%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	w	w	w	18.2%
O3A - Leave (Major) - Rock Placement Over Entire Line	s	N	N	и	27.3%
O3B - Leave (Major) - Trench & Bury Entire Line	s	N	N	N	27.3%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	N	N	N	27.3%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	O3B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MS	N	w	24.6 %
O3A - Leave (Major) - Rock Placement Over Entire Line	MW	N	мw	VMW	6.9 %
O3B - Leave (Major) - Trench & Bury Entire Line	N	MS	N	w	24.6%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	VMS	S	N	43.9%



L.4 Group 17 Pairwise Comparison Matrices – Technical



L.5 Group 17 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	O3B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	MS	38.1%
O3A - Leave (Major) - Rock Placement Over Entire Line	w	N	z	s	23.6%
O3B - Leave (Major) - Trench & Bury Entire Line	w	N	N	s	23.6%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MW	w	w	N	14.7%

4.2 Other Users	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	N	N	25.0%
O3A - Leave (Major) - Rock Placement Over Entire Line	N	N	N	z	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	N	N	z	25.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	N	N	25.0%



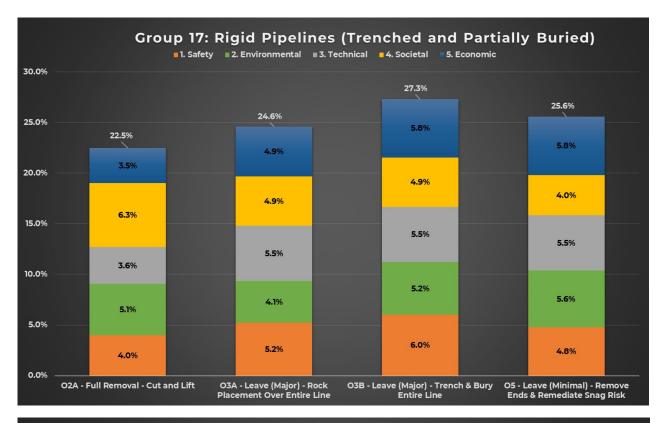
L.6 Group 17 Pairwise Comparison Matrices – Economic

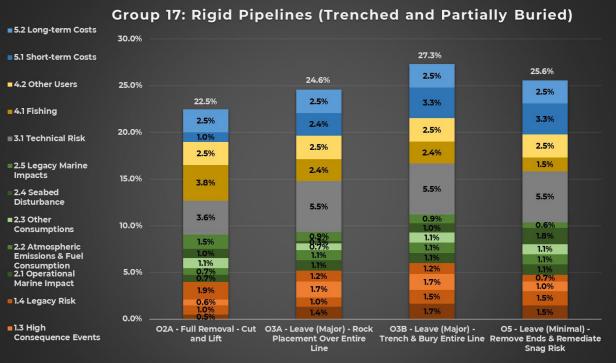
5.1 Short-term Costs	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	мw	9.9 %
O3A - Leave (Major) - Rock Placement Over Entire Line	MS	N	w	w	24.3%
O3B - Leave (Major) - Trench & Bury Entire Line	MS	s	N	z	32.9%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	S	N	N	32.9%

5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	03A - Leave (Major) - Rock Placement Over Entire Line	03B - Leave (Major) - Trench & Bury Entire Line	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	N	N	N	25.0%
O3A - Leave (Major) - Rock Placement Over Entire Line	N	N	N	N	25.0%
O3B - Leave (Major) - Trench & Bury Entire Line	N	Я	N	N	25.0%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	N	N	N	N	25.0%



L.7 Group 17 Results Charts







APPENDIX M GROUP 18 – DETAILED EVALUATION RESULTS

Group 18 Attributes Table **M**.1



Group 18: Rigid Pipelines (Trenched and Buried, Low Integrity or Concrete Coated)

Hudson: PL1022.1 - 2" L1 Gas Lift Pipeline from Hudson Manifold to Well L1 - 1.641 km | PL1022.2 - 2" L2 Gas Lift Pipeline from Hudson Manifold to Well L2 - 1.761 km | PL1018 10" - Production Pipeline (disused) from Hudson Manifold to Tern Alpha - 10.41 km PL1019 - 10" Production Pipeline (disused) from Hudson Manifold to Tern Alpha - 10.41 km | PL1020 - 8" Production/Test Pipeline (disused) from Hudson Manifold to Tern Alpha - 10.41 km | PL1024 - 8" L1 Production/Test Pipeline (disused) from Well L1 to Hudson Manifold - 1.761 km PL1025 - 8" L2 Production/Test Pipeline (disused) from Well L2 to Hudson Manifold - 1.761 km | PL1021 - 8" Water Injection Pipeline (disused) from Tern Alpha to Hudson Manifold - 10.41 km

Eider: PL475 (N0506) - 12" Oil Pipeline from Eider (Oil Production Tee) to North Cormorant - 13.145 km | PL476 (N1001) - 12" Water Injection Pipeline - Disused Tern to Eider - 16.4 km

Tern: PL478 (N0604) - 8" Gas Pipeline from North Cormorant to Tern - 13. km

Central Cormorant UMC: PL304 (N0902) - 2 x 3" Well Injection Flowlines from UMC to Well W4 - 3.524 km | PL305 (N0903) - 2 x 3" Well Injection Flowlines from UMC to Well W4 - 3.524 km | PL306 (N0707) - 3" Oil - TFL from Well P5 to UMC - 3.142 km PL307 (N0708) - 3" Oil - TFL from Well P5 to UMC - 3.1 km | PL184 (N0901) - 8" Water Injection Pipeline - New from Cormorant Alpha to UMC - 7.7 km | PL184 (N0930) - 8" Water Injection Pipeline - Old from Cormorant Alpha to UMC - 7.5 km

Otter: PL3132 (T0129) - 10" Water Injection Pipeline from Eider (Water Injection Tee) to Otter - 21.1 km | PL1869 (T0124) - 10" Water Injection Pipeline - Disused from Eider to Otter - 21.1 km | PL1868 (T0123) - 10" Multiphase Pipeline from Otter to Eider - 21.2 km PL1868a (T0123a) - 10" Multiphase Pipeline - Replacement from Otter to Eider (Oil Production Tee) - 6 km

O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shall O2A - Full Removal - Cut and Lift / Shallow Burial Shallow Burial Pipelines are disconnected Pipelines are disconnected Pipelines are disconnected ipelines are disconnected De-burial of lines by MFE (1 pass) Re-trench and bury areas of spans / exposures / shallow burial emove areas of spans/exposures/shallow burial by cut and lift Pipeline ends are removed by cut and lift in 10m sections Rock placement over mid-line areas of spans/exposures/shallow burial Lines are fully recovered by cut and lift Remediate cut ends with rock using an FPV Concrete spalling debris is recovered by DSV (25% of cuts), 3 lines only sel Type: PoB / Days / Hours / PLL ssel Type: PoB / Days / Hours / PLL el Type: PoB/Days/Hours/PLL l Type: PoB / Days / Hours / PLI DSV: 110 / 26.3 / 34,769 / 2.61E-03 CSV: 76/52.1/47,470/3.56E-03 enching Vessel: 55/100.5/66,323/4.97E-03 CSV: 76/441.2/402,347/3.02E-02 vivers: 18/26.3/11.379/1.10E-02 ockdump Vessel: 20 / 89.1 / 21,372 / 1.60E-03 ockdump Vessel: 20 / 105.7 / 25,361 / 1.90E-03 CSV: 76 / 983.5 / 896.934 / 6.73E-02 lotal offshore hours: 66 323 hrs Total offshore hours: 68.842 hrs Total offshore PLL: 4.97E-03 Total offshore hours: 427.708 hrs Total offshore hours: 943.081 hrs Total offshore PLL: 5.16E-03 Total offshore PLL: 3.21F-02 otal offshore PLL: 8.09E-02 Resource Type: Days/Hours/PLL Engineering & Management: 2,495.6 / 19,965 / 7.99E-05 esource Type: Days/Hours/PLL esource Type: Days / Hours / PLL source Type: Days/Hours/PLL ngineering & Management: 1,551.5/12,412/4.96E-05 roject Management: 2,313.0 / 18,504 / 7.40E-05 ngineering & Management: 6,214.7 / 49,718 / 1.99E-04 ngineering & Management: 12,916.2 / 103,329 / 4.13E-04 roject Management: 2,154.0 / 17,232 / 6.89E-05 roject Management: 6,081.0 / 48,648 / 1.95E-04 oject Management: 12,513.0 / 100,104 / 4.00E-04 shore Operations (includes Cleaning & Disposal): 22.0 / 1,408 / 1.73E-04 Total onshore hours: 38.469 hrs nshore Operations (includes Cleaning & Disposal): 205.0 / 13,120 / 1.61E shore Operations (includes Cleaning & Disposal): 946.0 / 60,544 / 7.45E-03 Fotal onshore PLL: 1.54E-04 otal onshore hours: 31.052 hrs Total onshore hours: 111.486 hrs otal onshore hours: 263,977 hrs otal onshore PLL: 2.92E-04 Total operational hours: 104,792 hrs otal onshore PLL: 2.01E-03 otal onshore PLL: 8.26E-03 Total operational PLL: 5.13E-03 fotal operational hours: 99,893 hrs Total operational hours: 539,193 hrs fotal operational hours: 1,207,059 hrs Total operational PLL: 5.45E-03 Total operational PLL: 3.41E-02 otal operational PLL: 8.92F-02 MW MW w MW Ν MS w MS MW Ν 1.062378168 0.159824047 1.480978261 0.150439883 16.366972 17.387914 2.6158358 24.23913 1.394021739 9.266304348 essment of the Operations Pers nnel sub-crite on is as follows

option 2A is assessed as being Much Weaker than Option 4A and Option 4B due to the risk exposure being around 17 times higher in Option 2A. This is due to the greater offshore scope (with diver support) associated with the full removal of these lines versus the smaller scope and lower risk activities to pe and Option 4B. Option 2A is assessed as being Weaker than Option 4C due to the risk exposure being more than double in Option 2A due to the greater offshore scope to fully remove the lines versus the smaller scope to remove problem areas of the lines. Option 2A is assessed as being Much Weaker than cope associated with fully removing the lines versus the smallest scope to remove the line ends only in Option 5.

ption 4A is assessed as being Neutral to Option 4B as the scope and the risk exposure is similar for both options. Option 4A is assessed as being Much Stronger than Option 4C due to the risk exposure being around 7 times higher for Option 4C due to the greater scope associated with removing the probl he risk exposure is around 50% higher for Option 4A due to the smallest scope associated with the line end removal in Option 5.

option 4B is assessed as being Much Stronger than Option 4C due to the risk exposure being around 7 times higher for Option 4C due to the greater scope associated with removing the problem areas in Option 4B. Sassessed as being Neutral to Option 5 as the risk exposure is around 40% high Option 5.

ption 4C is assessed as being Much Weaker than Option 5 due to the risk exposure being almost 10 times higher for Option 4C due to the greater scope associated with removing the problem areas in Option 4C

verall, Option 5 is preferred from a risk to Operations Personnel perspective.

		MW	MW	W	MW	w	S	w	MS	N	MW	
	1	Transits: 64				Transits: 34					Transits: 36	
-	Total vessel days: 1,009.8 days							Transits: 10		Total vessel days: 546.8 days		
Safe	her							Total vessel days: 100.5 days				
ety	Ĵ	CSV: 983.5				Rockdump Vessel: 89.1					Rockdump Vessel: 105.7	
	DSV: 26.3				CSV: 52.1			Trenching Vessel: 100.5		CSV: 441.2		
	s	Vessel Days:				Vessel Days:			Vessel Days:		Vessel Days:	

e assessment of the Other Users sub-criterion is as follows

tion 2A is assessed as being Much Weaker than Option 4A, Option 4B and Option 5 due to the much higher number of vessel days and transits in Option 2A is assessed as being Weaker than Option 4C due to the higher number of vessel days and transits in Option ion 4A is assessed as being Weaker than Option 4B and Option 5 as there are more transits required in Option 4A. Option 4A is assessed as being Stronger than Option 4C as, while the transits are similar in both options, there are a much higher number of vessel days in Option 4C. ption 4B is assessed as being Much Stronger than Option 4C due to the much higher number of vessel days and transits in Option 4C. Option 4B is assessed as being Neutral to Option 5 as, while there are differences in the vessel days and transits, these are considered insufficient to express a preference

tion 4C is assessed as being Much Weaker than Option 5 due to the much higher number of vessel days and transits in Option 4C.

rall, Option 4B and Option 5 are equally preferred from a risk to Other Users perspectiv



low	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
	- Pipelines are disconnected
	- Remove pipeline ends by cut and lift
	- Remediate cut ends with rock using an FPV
	Vessel Type: PoB / Days / Hours / PLL
	CSV: 76/49.3/44,943/3.37E-03 Rockdump Vessel: 20/4.8/1,147/8.60E-05
	Total offshore hours: 46,091 hrs
	Total offshore PLL: 3.46E-03
	Resource Type: Days/Hours/PLL
	Engineering & Management: 850.0 / 6,800 / 2.72E-05
	Project Management: 835.0 / 6,680 / 2.67E-05
E-03	Onshore Operations (includes Cleaning & Disposal): 22.0 / 1,408 / 1.73E-04
	Total onshore hours: 14,888 hrs
	Total onshore PLL: 2.27E-04
	Total operational hours: 60,979 hrs
	Total operational PLL: 3.68E-03
	rock placement over / trenching of problem areas of the lines in Option 4A on 5 due the risk exposure being around 24 times higher for the greater
olem a	reas in Option 4C. Option 4A is assessed as being Weaker than Option 5 as
aher fo	r Option 4B due to the smallest scope associated with the line end removal
	Vessel Days:
	CSV: 49.3
	Rockdump Vessel: 4.8
	Total vessel days: 54.1 days
	Transits: 4
4C.	

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		O2A - Full Remov	al - Cut and Lift		04A - Leave (Minor) -		reas of Spans / Exposure	O4B - Leave (Minor) - Trench &	Bury Areas of Spans / Exposure /	O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallo
1. Safety 1.3 High Consequence	Routine cut and lift operations. Very high number of lifts (18886) through the water column to recover line sections. Additional lifting to transfer pipeline sections to quayside. High number of lifting operations to deploy and recover deburial equipment.				(504) to recover the line through the water colur addition there is the po	/ Shallow Burial wer operations. High num ends. Moderate number mn to deploy and recover tential for dropped object a sections to the quayside.	of lifting operations cutting equipment. In associated with the		w Burial 1s. High number of lifting operations g equipment.	Burial High number of lifting operations (8316) to recover the line ends and a of spans / exposure / shallow burial. High number of lifting operations through the water column to deploy and recover cutting equipment. addition there is the potential for dropped object associated with the offloading of the cut line sections to the quayside.
	VMW	VMW	MW	VMW	N	MS	N	MS	N	MW
Summar	Option 2A is assess with Option 2A vers Option 4A is assess Option 4B is assess Option 4C is assess	sus around 8,000 in O ed as being Neutral to ed as being Much Stro ed as being Much We	n Weaker than Opt ption 4C. o Option 4B and O onger than Option aker than Option 5	tion 4A, Option 4B a ption 5 as, while the 1 4C as there are a m 5 as there are a muc	re are differences in the n uch higher number of lift	umber of lifts across these is associated with Option 4 ssociated with Option 4C.	e option, the differences are 4C. Option 4B is assessed a	e deemed insufficient to express a pref	erence. Option 4A is assessed as being	ch fewer lifts (hundreds) with the other options. Option 2A is assessed as Much Stronger than Option 4C as there are a much higher number of li fts across these option, the differences are deemed insufficient to expres
1. Safety 1.4 Legacy Risk	No legacy risk from this full removal option.				their length would be tr of spans \ exposures \ sh The survey & monitoring potential snag hazard fr managed & mitigated a Vessel Type: PoB / Days	allow burial. g programme is committe rom left in-situ infrastructu as appropriate.	ock placement over areas	The lines would remain in-situ with t trenched and buried. The survey & monitoring programme potential snag hazard from left in-sit managed & mitigated as appropriate Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 71.1 / 37,52	e is committed to ensuring that the u infrastructure continues to be e.	The lines would remain in-situ with this option although would be full trenched and buried as areas of spans/exposures/shallow burial are removed. The survey & monitoring programme is committed to ensuring that th potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 71.1 / 37,557 / 2.82E-03
	S	S	S	MS	w	W	S	N	s	S
Summar	Option 4A is assess rock covered in Op Option 4B is assess Option 4C is assess	ed as being Weaker t tion 4A whereas the p red as being Neutral to	han Option 4B and roblem areas woul o Option 4C as both than Option 5 as w	d Option 4C as, while Id remain in Option h options present a hile the lines remain	e the lines remain in all th 5. clear seabed. Option 4B i	nree options, Option 4B an	nd Option 4C present more ger than Option 5 as while	of a clear seabed due to the problem	-	rereas the problem areas would remain in Option 5.
	Vessel Noise (days	on-site): 905.8 days			Vessel Noise (days on-si	te): 87.4 days		Vessel Noise (days on-site): 84.5 days		Vessel Noise (days on-site): 487.6 days
		& DWC) = 865.4 days			Tooling Noise (Hydrauli			Tooling Noise (Trenching) = 74.9 days		Tooling Noise (Hydraulic Shears) = 206.5 days
nmental Marine Impact	Operation releases: 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 releases to the marine environment during flushing activities.				(BEP) and the Best Avai possible both residual h	ing operations will use Be lable Techniques (BAT) to ydrocarbon and other che e marine environment du	emical levels in line post	(BEP) and the Best Available Technic possible both residual hydrocarbon a flush and releases to the marine envi	and other chemical levels in line post ironment during flushing activities.	Operation releases: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as as possible both residual hydrocarbon and other chemical levels in lin post flush and releases to the marine environment during flushing activities.
2. Environ Operational M	Cutting of line ends and midline cuts would lead to an elevated release of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low.				Cutting of line ends would lead to an elevated release of fluids from within the line. However, given the prior cleaning of the line, the concentration e and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low.			As line is being trenched there is neg Vessel releases: This includes Ballast, Grey and Black vessel operations and therefore at 84	Water, this is driven by duration of	Cutting of line ends and midline cuts would lead to an elevated releas fluids from within the line. However, given the prior cleaning of the lin the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low.
2	operations and the	st, Grey and Black Wa refore at 905.8 days is pact is considered to b	the highest of all c		vessel operations and th	ey and Black Water, this is herefore at 87.4 days is not lact is considered to be ne	considered significant.	The environmental impact is conside	ered to be negligible.	Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 487.6 days is notable. The environmental impact is considered to be low.
	VMW	VMW	MW	VMW	N	MS	N	MS	N	MW
Summar	Option 2A is assess Option 4A is assess Option 4B is assess Option 4C is assess	ed as being Neutral to ed as being Much Stro ed as being Much We	n Weaker than Opt o Option 4B and O onger than Option aker than Option 5	tion 4A, Option 4B a ption 5 as, while the 4C as the vessel day 5 as the vessel days a	re are differences in the v	essel days and tooling dur igher for Option 4C. Option ner for Option 4C.	rations, these differences a	re considered insufficient to express a	preference. Option 4A is assessed as be	an Option 4C as the vessel days and tooling noise are higher for Option 2 ing Much Stronger than Option 4C as the vessel days and tooling noise ng durations, these differences are considered insufficient to express a p



low	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
areas	High number of lifting operations (924) to recover the line ends. High
s	number of lifting operations through the water column to deploy and
In	recover cutting equipment. In addition there is the potential for dropped
	object associated with the offloading of the cut line sections to the
	quayside.

as being Much Weaker than Option 4C as there are around 18,000 lifts associated

flifts associated with Option 4C. ess a preference..

lly e	The lines would remain in-situ with this option although the majority of their length would be trenched and buried. The line ends will be removed with small areas of rock cover to mitigate potential snag hazard from cut ends. Spans and exposures 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 Survey Vessel (Legacy): 44 / 71.1 / 37,557 / 2.82E-03
ential f	or snag hazard remains although this is mitigated by the survey and
onger t	han Option 5 as while the lines remain in both options, problem areas are

	Vessel Noise (days on-site): 45.4 days Tooling Noise (Hydraulic Shears) = 19.3 days
as far ne	Operation releases: 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 releases to the marine environment during flushing activities.
ise of ne,	Cutting of line ends would lead to an elevated release of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of release should still be low overall. Therefore, the related impact is also anticipated to be low.
of	Vessel releases: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 45.4 days is the lowest of the options. The environmental impact is considered to be negligible.
2A. e are hi orefere	igher for Option 4C. Ince.

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		O2A - Full Remov	val - Cut and Lift		04A - Leave (Minor) ·		Areas of Spans / Exposure		nch & Bury Areas of Spans / Exposure /				
ital ric uel	Vessel Emissions (ir Fuel: 27,987 CO2: 88,719 NOX: 1,662.43 NOX: 1,662.43 Vessel Energy Use:	tonnes):			Vessel Emissions (in to Fuel: 5,121	/ Shallow Burial nnes):		Vessel Emissions (in tonnes): Fuel: 3,903	shallow Burial	Burial Vessel Emissions (in tonnes): Fuel: 16,304			
nen phe & F	CO2: 88,719			-			CO2: 12,374		CO2: 51,682				
son	NOX: 1,662.43				NOx: 304.21 SO2: 20.49			NOx: 231.86 SO2: 15.61		NOx: 968.43 SO2: 65.21			
Atr issi	SO2. 11.55				302.20.45			302.13.01		302.03.21			
2.2 Em	Vessel Energy Use:	,203,444 GJ		1	Vessel Energy Use: 220	,223 GJ		Vessel Energy Use: 167,846 GJ		Vessel Energy Use: 701,051 GJ			
	MW	MW	W	MW	N	S	N	S	N	W			
		he Atmospheric Emi											
		•						o , 1	•	otion 2A is assessed as being Weaker than Option 4C as the emissions and fu sessed as being Stronger than Option 4C as the fuel use and emissions are 3			
Summar													
Summar	y Option 4B is assessed as being Stronger than Option 4C as the fuel use and emissions are around 4 times higher for Option 4C. Option 4B is assessed as being Neutral to Option 5 as, while there are differences in the emissions and fuel use across these options, the differences are considered insufficient Option 4C is assessed as being Neutral to Option 5 as, while there are differences in the emissions and fuel use across these options, the differences are considered insufficient Option 4C.												
	Overall, Option 4A	, Option 4B and Opt	tion 5 are equally	preferred from an	Atmospheric Emission	s & Consumptions persp	ective.						
					1			1					
2 S	Material Emissions				Material Emissions (CC			Material Emissions (CO2 in tonn	nes):	Material Emissions (CO2 in tonnes):			
tier B	Recovered Material Remaining Materia				Recovered Material: 61 Remaining Material: 4			Recovered Material: Remaining Material: 41,937		Recovered Material: 5,988 Remaining Material: 32,884			
등 문 문	Total: 27,692	•			Total: 41,640	1,025		Total: 41,937		Total: 38,872			
23 (Supervised and a second se													
2.3 Other Consumptior	Rock: N/A tonnes				Rock: 367,050 tonnes			Rock: N/A tonnes		Rock: 57,800 tonnes			
	1/0	•	•						-				
	MS	S	S	S	MW	W	MW	S	S	W			
		he Other Consumption			quantity of rock resource	required in Option (A. O	Intion 2A is assessed as bein	a Stronger than all other options	as there is no rock resource required in (Option 2A and the impact from processing the returned material is almost ha			
	Option 4A is assessed	-		-					an Option 4C due to the higher quantity				
Summar	V	-			is no rock resource requi			5					
	Option 4C is assesse	ed as being Weaker t	than Option 5 due t	to the higher quanti	ty of rock resource requir	red in Option 4C.							
	Overall, Option 2A	is preferred from a	n Other Consump	otions perspective.									
_	Cooked Disturbane	a (ma 2):			Cashed Disturbance (n			Cashad Disturbanes (m2)		Seabed Disturbance (m2):			
8	Seabed Disturbanc Rock Cover: 950	e (mz).			Seabed Disturbance (n Rock Cover: 369,900	112).		Seabed Disturbance (m2): Trenching: 605,955		Rock Cover: 231,200			
anc	MFE: 942,495							Trenching. 003,535		Nock Cover. 251,200			
urb Sea	,				Habitat Loss / Change (m2):			No rock cover in this option.		Habitat Loss / Change (m2):			
2.4 Seabed Disturbance	Habitat Loss/Chan	ge (m2):			Rock Cover: 369,900					Rock Cover: 231,200			
i i	Rock Bags: 950												
	MS	w	MS	W	MW	W	MW	MS	W	MW			
	The assessment of t	he Seabed Disturbar	nce sub-criterion is	as follows:				-					
					significant area of seabe	ed disturbance from the de	eburial operations in Option	n 2A, this impact is temporary in r	nature whereas the area impacted in Op	ion 4A is significant and represents a permanent habitat change. Option 24			
	temporary seabed i	mpact in Option 2A a	and there is a small	l area of permanent	habitat change associat	ed with rock placement ar	round crossing locations. O	ption 2A is assessed as being Muc	ch Stronger than Option 4C as, while the	e is significant area of seabed disturbance from the deburial operations in C			
					-					small area of rock cover despite this being a permanent habitat change.			
Summar	y ·	-				-		-		s introduce significant rock cover, the area impacted by Option 4A is much of			
		•	• ·		•	ed disturbance from the d espite this being a perman		n 4B, this impact is temporary in	nature whereas the area impacted in Op	tion 4C is significant and represents a permanent habitat change. Option 4			
			-			change introduced in this	-						
		preferred from a S		•		ÿ							
e e	No legacy marine in	npact from this full r	emoval option.		-					tice Line cleaning and flushing operations will use Best Environmental			
arii s					(BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post				chniques (BAT) to minimise as far as	Practice (BEP) and the Best Available Techniques (BAT) to minimise as			
egacy Ma Impacts					flush.	nydrocarbon and other ch	iernical levels in line post	flush.	bon and other chemical levels in line po	as possible both residual hydrocarbon and other chemical levels in line post flush.			
u bi ac					nusn.			ildsii.		post ridsh.			
					The legacy marine imp	bact from the slow release	of these low concentration /	The legacy marine impact from	the slow release of these low concentrat	ion The legacy marine impact from the slow release of these low concentra			
2.5					quantity releases is the	erefore expected to be low	overall.	/quantity releases is therefore e	expected to be low overall.	/quantity releases is therefore expected to be low overall.			
	S	S	S	MS	N	N	S	N	S	S			
	The assessment of t	he Legacy Marine Im	pacts sub-criterion	n is as follows:									
	Option 2A is assesse	d as being Stronger	than Option 4A, Op	ption 4B and Option	4C as there is no legacy	marine impacts associate	d with the full removal opti	on whereas there will be slow de	gradation of the lines and releases over a	long time period with the other options although this is reduced as the line			
			in-situ will be large	ly isolated from the	marine environment. O	ption 2A is assessed as bei	ng Much Stronger than Opt	ion 5 as there is no legacy marine	e impacts associated with the full remove	I option whereas there will be slow degradation of the lines and releases over			
Summar	to the marine envir												
Summar										marine impact is expected to be marginally greater for Option 5 where sect			
								assessed as being Stronger than nes remain exposed to the marin		expected to be marginally greater for Option 5 where sections of the lines re			
		is preferred from a				anginaliy greater for Optic	and where sections of the III	ico icinani exposed to the mann	e environment.				

w	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
	Vessel Emissions (in tonnes):
	Fuel: 3,590
	CO2: 11,381
	NOx: 213.26
	SO2: 14.36
	Vessel Energy Use: 154,380 GJ
uelus	se are almost double for Option 2A.
	eshigher for Option 4C.
	ess a preference.
	Material Emissions (CO2 in tonnes):
	Recovered Material: 617
	Remaining Material: 41,023
	Total: 41,640
	Rock: 10,500 tonnes
	Seabed Disturbance (m2):
	Rock Cover: 4,200
	Habitat Loss / Change (m2): Rock Cover: 4,200
	RUCK COVEL 4,200
Aisa	ssessed as being Weaker than Option 4B as there is a larger area of
	n 2A, this impact is temporary in nature whereas the area impacted in
great	
4B is	assessed as being Weaker than Option 5 as the large area of temporary
4	Line cleaning and flushing operations will use Best Environmental
afar e	Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line
0	post flush.
ation	The legacy marine impact from the slow release of these low concentration
	/quantity releases is therefore expected to be low overall.
	II be fully / largely trenched and buried with rock cover trenching / removal
er a le	ong time period with Option 5 where sections of the lines remain exposed
tions	of the lines remain exposed to the marine environment
	of the lines remain exposed to the marine environment. n exposed to the marine environment.

Comparative Assessment Report – Consultation Draft

		O2A - Full Remo	oval - Cut and Lift		O4A - Leave (Minor) - F	Rock Placement Over Ar	eas of Spans / Exposure		Bury Areas of Spans / Exposure /	O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallov	
chnical chnical tisk		Cut and lift techniqu n the market. (Score	ies are well proven w 3)	vith multiple	Concept Maturity: Rock p (Score 3)	/ Shallow Burial blacement is well proven w	with a good track record	Concept Maturity: Post trenching of p record. (Score 3)	ow Burial Dipeline sections has a good track	Burial Concept Maturity: Pipe cutting operation is well proven with a good trac record (Score 3)	
3. Techn 3.1 Techn Risk	Technical Risks: Teo the operation. (Sco		s option are associat	ted with the scale of	Technical Risks: Limited	technical risks associated	with this option (Score 3)	Technical Risks: The group represent trenching should be feasible. Howey associated with difficult to trench sec	ver, areas of exposure may be	Technical Risks: Limited technical risks associated with this option (Score	
	w	W	W	MW	S	S	N	N	W	w	
			ub-criterion is as follo		C as while all operations	sare considered routine th	here are challenges perfor	ming deburial and cutting / lifting at t	this scale (189 km of lines), particularly t	or the concrete coated lines, whereas the scopes for Option 4A, Option 4B	
	Weaker than Optic	on 5 as the activities	are similar but agair	n, the scale for the ful	I removal presents the po	tential for technical challe	enges over 189 km of lines	rather than addressing line ends only	in Option 5.		
Summary	Option 4B is assess Option 4C is assess	ed as being Neutral ed as being Weaker	to Option 4C as trer	nching or removal of hile the operations a	problem areas expected t	to present similar challeng	ges. Option 4B is assessed	as being Weaker than Option 5 as the		being Neutral to Option 5 as the simple rock cover operations or line end r ected to present greater technical challenges than removal of line ends or S.	
4. societal 4.1 Fishing			the removal operation		Relatively short operation decommissioning solution	n. Rock berms are not fish on. (Score 1)	ing industry's preferred	Medium duration operation in the sh left clear for fishing operations. (Score	nort-term. If successful, seabed will be e 3)	Significant duration operation in the short-term. Rock to mitigate cut ends should be flush with seabed and not pose any obstacle to fishing operations. (Score 2)	
	S	S	S	MS	w	w	S	N	S	S	
Summary	Option 2A is assess and buried with pr Option 4A is assess rock covered in Op Option 4B is assess Option 4C is assess	ed as being Stronge oblem areas remain ed as being Weaker tion 4A whereas the red as being Neutral ed as being Stronge	ing. than Option 4B and problem areas woul to Option 4C as bot er than Option 5 as w	otion 4B and Option d Option 4C as, while Id remain in Option h options present a c	the lines remain in all the 5. Iear seabed. Option 4B is i in both options, problem	ree options, Option 4B and s assessed as being Strong	d Option 4C present more ler than Option 5 as while	of a clear seabed due to the problem	areas being trenched or removed versu	g or removal respectively. Option 2A is assessed as being Much Stronger th us being rock covered in Option 4A. Option 4A is assessed as being Strong hereas the problem areas would remain in Option 5.	
ŝ	Significant amoun	t of recyclable mate	rial returned. (Score 3	3)	Minimal societal benefits	s/impacts with this optior	n. (Score 3)	Minimal societal benefits/impacts w	vith this option. (Score 3)	Minimal societal benefits / impacts with this option. (Score 3)	
r Users	Materials Returned	Ŀ			Materials Returned:			Materials Returned:		Materials Returned:	
other	Steel: 17,960 tonne Concrete: 9,126 ton				Steel: 401 tonnes (recycla Concrete: 204 tonnes (la			None.		Steel: 3,884 tonnes (recyclable) Concrete: 1,974 tonnes (landfill)	
4,2 0	Polymer: 1,276 tonr				Polymer: 29 tonnes (landfill)					Polymer: 276 tonnes (landfill)	
	S	S	S	S	N	N	N	N	N	N	
				criterion is as follows: ons due to the signifi		cyclable material returned	d (steel) and the job creati	on / retention associated with the large	e offshore and onshore scope in Option	2A. This is offset somewhat by the significant quantity of material (concre	
Option 2A is assessed as being Stronger than all other options due to the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. This is offset somewhat by the significant quantity of useful, recyclable material returned (steel) and the job creation / retention associated with the large offshore and onshore scope in Option 2A. Thi											
Summary	All other options ar	e assessed as being	Neutral to each othe			is are considered largely si					
	All other options ar	e assessed as being	Neutral to each othe			is are considered largely si		£22.744 Million		£59.484 Million	
5.1 Short-term Costs Anama	All other options ar Overall, Option 24	e assessed as being	Neutral to each othe		pective.	is are considered largely si		£22.744 Million		£59.484 Million	
	All other options ar Overall, Option 24	e assessed as being	Neutral to each othe		pective.	s are considered largely si	W	£22.744 Million	W	£59.484 Million	
	All other options ar Overall, Option 2A £1222 Million	e assessed as being A is preferred from	Neutral to each othe a Societal impact o	on Other Users pers	£21.195 Million	S			W 13.841 million more		
	All other options ar Overall, Option 2A £122.2 Million MW 101.005 million	e assessed as being a is preferred from MW 99.456 million	W 62.716 million more	VMW 113.297 million	£21.195 Million	S	W	S		MW	
	All other options ar Overall, Option 2A E122.2 Million MW 101.005 million more 476.6% higher The assessment of	MW 99.456 million more 437.3% higher	W 62.716 million more 105.4% higher sub-criterion is as fo	VMW 113.297 million more 1272.6% higher	E21.195 Million N 1.549 million less 6.8% lower	S 38.289 million less 64.4% lower	W 12.292 million more 138.1% higher	S 36.74 million less 61.8% lower	13.841 million more 155.5% higher	MW 50.581 million more 568.1% higher	
	All other options ar Overall, Option 2A E122.2 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assessed	MW 99.456 million more 437.3% higher the Short-term Cost ed as being Much W	W 62.716 million more 105.4% higher sub-criterion is as for leaker than Option 4	VMW 113.297 million more 1272.6% higher	£21.195 Million N 1.549 million less 6.8% lower e to the costs to deliver th	S 38.289 million less 64.4% lower	W 12.292 million more 138.1% higher	S 36.74 million less 61.8% lower	13.841 million more 155.5% higher	MW 50.581 million more 568.1% higher	
	All other options ar Overall, Option 2A E1222 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assess than Option 5 due Option 4A is assess	MW 99.456 million more 437.3% higher the Short-term Cost ed as being Much W to the costs being m ed as being Neutral	W 62.716 million more 105.4% higher sub-criterion is as for feaker than Option 4 bore than 13 times high to Option 4B as the	VMW 113.297 million more 1272.6% higher ollows: 4A and Option 4B du gher (£113 million mu costs are similar. Op	E21.195 Million	S 38.289 million less 64.4% lower is option being more than ng Stronger than Option 4	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost.	S 36.74 million less 61.8% lower 100 million more) than Option 4A/Op 3 times higher (£38 million more) for O	13.841 million more 155.5% higher Detion 4C. Option 2A is assessed as being Option 4C. Option 4A is assessed as being	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (£62.7 mill ng Weaker than Option 5 as the costs are almost 1.5 times higher (£12.3 mill	
5. Economic 5.1 Short-term Costs	All other options ar Overall, Option 2A E1222 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assess than Option 5 due Option 4A is assess Option 4B is assess Option 4C is assess	MW 99.456 million more 437.3% higher the Short-term Costs ed as being Much W ed as being Neutral ed as being Stronge ed as being Stronge	W 62.716 million more 105.4% higher sub-criterion is as for feaker than Option 4 as the er than Option 4 C as	VMW 113.297 million more 1272.6% higher ollows: 4A and Option 4B du gher (£113 million mo costs are similar. Op the costs are almost 5 as the costs are mol	E21.195 Million	S 38.289 million less 64.4% lower is option being more than ng Stronger than Option 4	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost btion 4B is assessed as bei	S 36.74 million less 61.8% lower 100 million more) than Option 4A/Op 3 times higher (£38 million more) for O	13.841 million more 155.5% higher Dition 4C. Option 2A is assessed as being	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (£62.7 mill ng Weaker than Option 5 as the costs are almost 1.5 times higher (£12.3 mill	
5.1 Short-term Costs	All other options ar Overall, Option 2A E122.2 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assess Option 4A is assess Option 4A is assess Option 4B is assess Option 4C is assess Overall, Option 5 ia	MW 99.456 million more 437.3% higher the Short-term Costs ed as being Much W ed as being Neutral ed as being Stronge ed as being Stronge	W 62.716 million more 105.4% higher sub-criterion is as for feaker than Option 4 to Option 4B as the er than Option 9 sub-action 5 sub-criterion 5 to Option 4B as the er than Option 5 sub-criterion 5 sub-criterion 5 to Option 4B as the er than Option 5 sub-criterion 5 to Option 4B as the er than Option 5 to Op	VMW 113.297 million more 1272.6% higher ollows: 4A and Option 4B du gher (£113 million mo costs are similar. Op the costs are almost 5 as the costs are mol	E21.195 Million E21.195 Million N 1.549 million less 6.8% lower e to the costs to deliver th tree) than Option 5. tion 4A is assessed as beil 3 times higher (£37 million te than 6 times higher (£55 Surveys: £2.13 Million	S 38.289 million less 64.4% lower is option being more than ng Stronger than Option 4 on more) for Option 4C. Op	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost btion 4B is assessed as bei	S 36.74 million less 61.8% lower 100 million more) than Option 4A/Op 3 times higher (£38 million more) for O ng Weaker than Option 5 as the costs of Surveys: £2.13 Million	13.841 million more 155.5% higher Detion 4C. Option 2A is assessed as being Deption 4C. Option 4A is assessed as being	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (£62.7 mill ng Weaker than Option 5 as the costs are almost 1.5 times higher (£12.3 mill on more) for Option 4B.	
5. Economic 5.1 Short-term Costs	All other options ar Overall, Option 2A E1222 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assess Option 4A is assess	MW 99.456 million more 437.3% higher the Short-term Cost ed as being Much W to the costs being m ed as being Nuchral ed as being Stronge ed as being Stronge ed as being Stronge ed as being Stronge	W 62.716 million more 105.4% higher sub-criterion is as for feaker than Option 4 to Option 4B as the er than Option 9 sub-action 5 sub-criterion 5 to Option 4B as the er than Option 5 sub-criterion 5 sub-criterion 5 to Option 4B as the er than Option 5 sub-criterion 5 to Option 4B as the er than Option 5 to Op	VMW 113.297 million more 1272.6% higher ollows: 4A and Option 4B du gher (£113 million mo costs are similar. Op the costs are almost 5 as the costs are mol	E21.195 Million E21.195 Million N 1.549 million less 6.8% lower e to the costs to deliver th re) than Option 5. tion 4A is assessed as bei 3 times higher (£37 millio re than 6 times higher (£59	S 38.289 million less 64.4% lower is option being more than ng Stronger than Option 4 n more) for Option 4C. Op 0.6 million more) for Optio	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost btion 4B is assessed as bei	S 36.74 million less 61.8% lower 100 million more) than Option 4A / Op 3 times higher (£38 million more) for O ng Weaker than Option 5 as the costs of	13.841 million more 155.5% higher Detion 4C. Option 2A is assessed as being Deption 4C. Option 4A is assessed as being	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (E62.7 mill ng Weaker than Option 5 as the costs are almost 1.5 times higher (E12.3 mill in more) for Option 4B.	
5.1 Short-term Costs	All other options ar Overall, Option 2A E1222 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assess Option 4A is assess Option 5 due Option 4A is assess Overall, Option 5 due	MW 99.456 million more 437.3% higher the Short-term Cost ed as being Much W to the costs being m ed as being Nuchral ed as being Stronge ed as being Stronge ed as being Stronge ed as being Stronge	W 62.716 million more 105.4% higher sub-criterion is as for feaker than Option 4 to Option 4B as the er than Option 9 sub-action 5 sub-criterion 5 to Option 4B as the er than Option 5 sub-criterion 5 sub-criterion 5 to Option 4B as the er than Option 5 sub-criterion 5 to Option 4B as the er than Option 5 to Op	VMW 113.297 million more 1272.6% higher ollows: 4A and Option 4B du gher (£113 million mo costs are similar. Op the costs are almost 5 as the costs are mol	E21.195 Million E21.195 Million N 1.549 million less 6.8% lower e to the costs to deliver th ore) than Option 5. tion 4A is assessed as bei 3 times higher (£37 millio re than 6 times higher (£5 Surveys: £2.13 Million FLTC: N/A	S 38.289 million less 64.4% lower is option being more than ng Stronger than Option 4 n more) for Option 4C. Op 0.6 million more) for Optio	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost btion 4B is assessed as bei	S 36.74 million less 61.8% lower 100 million more) than Option 4A / Op 3 times higher (£38 million more) for O ng Weaker than Option 5 as the costs of Surveys: £2.13 Million FLTC: N/A	13.841 million more 155.5% higher Detion 4C. Option 2A is assessed as being Deption 4C. Option 4A is assessed as being	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (E62.7 million ng Weaker than Option 5 as the costs are almost 1.5 times higher (E12.3 million more) for Option 4B. Surveys: £2.13 Million FLTC: N/A	
5.1 Short-term Costs	All other options ar Overall, Option 2A E122.2 Million MW 101.005 million more 476.6% higher The assessment of 1 Option 2A is assess Option 4A is aspection 4A is assess	e assessed as being a is preferred from MW 99.456 million more 437.3% higher the Short-term Costs ed as being Much W to the costs being m ed as being Neutral ed as being Neutral is preferred from a E0 Million Stope	Neutral to each othe a Societal impact of 62.716 million more 105.4% higher to option 45 as the er than Option 45 sub-criterion is as for feaker than Option 45 short-term Cost pe Short-term Cost pe	VMW 113.297 million more 1272.6% higher billows: 4A and Option 4B dug gher (£113 million mo costs are similar. Op the costs are almost 5 as the costs are more erspective. S billows:	E21.195 Million E21.195 Million N 1.549 million less 6.8% lower e to the costs to deliver th ore) than Option 5. tion 4A is assessed as bei 3 times higher (£5) Surveys: £2.13 Million FLTC: N/A Total Legacy Cost: £2.13 N N	S 38.289 million less 64.4% lower is option being more than ng Stronger than Option 4 n more) for Option 4C. Op 0.6 million more) for Option 4illion	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost btion 4B is assessed as bei on 4C. N	S 36.74 million less 61.8% lower 100 million more) than Option 4A / Op 3 times higher (£38 million more) for C ing Weaker than Option 5 as the costs of Surveys: £213 Million FLTC: N/A Total Legacy Cost: £2.13 Million N	13.841 million more 155.5% higher option 4C. Option 2A is assessed as being option 4C. Option 4A is assessed as being are around 1.5 times higher (£13.8 millio	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (£627 million grower than Option 5 as the costs are almost 1.5 times higher (£12.3 million more) for Option 4B. Surveys: £2.13 Million FLTC: N/A Total Legacy Cost: £2.13 Million N	
5.1 Short-term 5.2 Long-term Costs	All other options ar Overall, Option 2A E122.2 Million MW 101.005 million more 476.6% higher The assessment of Option 2A is assess Option 4A is assess Option 4A is assess Option 4A is assess Option 4A is assess Overall, Option 5 is Surveys: N/A FLTC: N/A Total Legacy Cost: 4 S The assessment of Option 2A is assess All other options ar	e assessed as being A is preferred from 99.456 million more 437.3% higher 437.3% higher 437.3% higher 437.3% higher 437.3% higher 437.3% higher 50 million 50 Million 50 Million 50 Million	Neutral to each othe a Societal impact of a Societal impact of 62.716 million more 105.4% higher sub-criterion is as for (eaker than Option 4C as (eaker than Option 4C as (eaker than Option 4C as (eaker than Option 5 Short-term Cost point) Short-term Cost point) Sasub-criterion is as for r than all other option	VMW 113.297 million more 1272.6% higher 1272.6% higher 1272.6% higher 1272.6% higher 1272.6% se similar. Op the costs are similar. Op the costs are almost 5 as the costs are more respective. S bollows: ons due to there bein er as the long-term c	E21.195 Million E21.195 Million N 1.549 million less 6.8% lower e to the costs to deliver th ore) than Option 5. tion 4A is assessed as bei 3 times higher (£5) Surveys: £2.13 Million FLTC: N/A Total Legacy Cost: £2.13 N N	S 38.289 million less 64.4% lower is option being more than ing Stronger than Option 4 on more) for Option 4C. Op 0.6 million more) for Option 4illion N ited with Option 2A versus to	W 12.292 million more 138.1% higher 15 times higher (around £ 4C as the costs are almost btion 4B is assessed as bei on 4C. N	S 36.74 million less 61.8% lower 100 million more) than Option 4A / Op 3 times higher (£38 million more) for C ing Weaker than Option 5 as the costs of Surveys: £213 Million FLTC: N/A Total Legacy Cost: £2.13 Million N	13.841 million more 155.5% higher Dition 4C. Option 2A is assessed as being Option 4C. Option 4A is assessed as being are around 1.5 times higher (£13.8 millio	MW 50.581 million more 568.1% higher g Weaker than Option 4C due to the costs being around double (£627 million grower than Option 5 as the costs are almost 1.5 times higher (£12.3 million more) for Option 4B. Surveys: £2.13 Million FLTC: N/A Total Legacy Cost: £2.13 Million N	



ow	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk
ack	Concept Maturity: Pipe cutting operation is well proven with a good track
ore 3)	record (Score 3) Technical Risks: Limited technical risks associated with this option (Score 3)
Band	Option 4C are smaller in scale. Option 2A is assessed as being Much
d rem only.	oval are expected to present similar, low potential for technical challenges.
]	Relatively short duration operation in the short-term. Rock to mitigate cut ends should be flush with seabed and not pose any obstacle to fishing
	operations. (Score 3)
than	Option 5 as the lines are removed versus lines remaining largely trenched
	han Option 5 as while the lines remain in both options, problem areas are
.90. 0	
	Minimal societal benefits/impacts with this option. (Score 3)
	Materials Returned:
	Steel: 401 tonnes (recyclable) Concrete: 204 tonnes (landfill)
	Polymer: 29 tonnes (landfil)
rete /	polymer) that is likely to end up in landfill. Overall, Option 2A is deemed to
	£8.903 Million
nillion	more) than Option 4C. Option 2A is assessed as being Very Much Weaker
nillion	more) for Option 4A.
	Surveys: £2.13 Million FLTC: £0.565 Million
	Total Legacy Cost: £2.7 Million



M.2 Group 18 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	w	мw	8.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	мѕ	w	25.1%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	N	N	MS	N	27.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	мw	мw	N	мw	9.8%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	S	N	MS	N	29.5%

1.3 High Consequence Events	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	vмw	vмw	мw	vмw	3.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	N	N	MS	N	29.0%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	VMS	N	N	MS	N	29.0%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	мw	мw	N	мw	9.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	VMS	N	N	MS	N	29.0%

1.2 Other Users	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans/ Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	w	мw	8.5%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	w	s	w	20.4%
04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	S	N	MS	N	29.9%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	w	мw	N	мw	11.4%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	S	N	MS	N	29.9%

1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	MS	30.3%
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	s	16.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	s	N	N	s	20.7%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	N	s	20.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	мw	w	w	w	N	12.0%



M.3 Group 18 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	vмw	vмw	мw	VMW	3.2%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	VMS	N	N	мѕ	z	29.0%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	VMS	N	N	мѕ	N	29.0 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	MS	мw	мw	N	мw	9.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	VMS	N	N	MS	N	29.0%

2.3 Other Consumptions	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MS	s	s	s	29.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MW	N	мw	w	мw	8.8%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	MS	N	s	s	24.9 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	w	N	×	15.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	MS	w	s	Я	21.2%

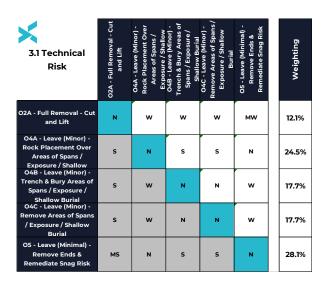
2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	MS	30.4%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	N	s	19.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	N	s	1 9.2 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	s	19.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MW	w	w	w	N	12.1%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	мw	мw	w	мw	8.9 %
04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	MS	N	N	s	N	25.1%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	MS	N	N	s	N	25.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	s	w	w	N	w	15.8%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MS	N	N	S	N	25.1%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MS	w	MS	w	23.0%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	мw	N	мw	w	мw	8.3%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	s	MS	N	MS	w	27.1%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	мw	S	мw	N	мw	9.8%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	S	MS	S	MS	N	31.8%



M.4 Group 18 Pairwise Comparison Matrices – Technical



M.5 Group 18 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	мѕ	30.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	w	w	s	16.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	S	N	R	s	20.7 %
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	S	N	N	s	20.7%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	MW	w	w	w	N	12.0%

4.2 Other Users	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	 O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial 	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	s	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	N	N	18.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2%
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	N	N	N	18.2%



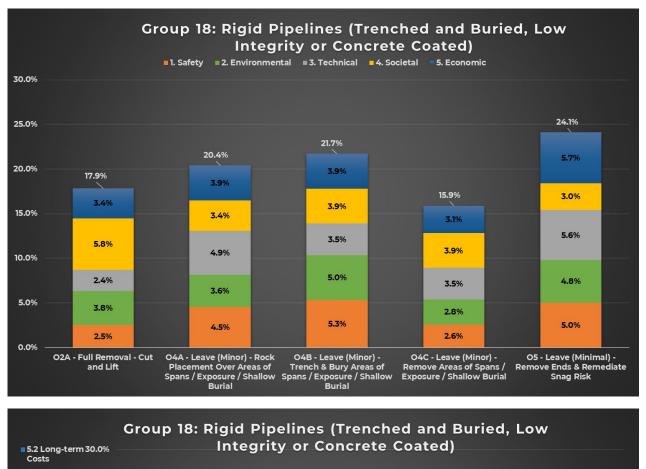
Weighting 5.1 Short-term and Lift O4A - Leave Rock Placem ench & Bur Full Rer Spans/Ex Costs Areas of Expo 04B -02A -35 O2A - Full Removal - Cut and Lift N w vмw мw мw 6.5% O4A - Leave (Minor) -Rock Placement Over MS N s w **21.2**% Ν Areas of Spans / Exposure / Shallow O4B - Leave (Minor) ch & Bury Areas N N s w 21.2% MS nor) of S s w w Ν мw 12.6% ure / Sha Burial 05 - Leave (Min al) VMS s s MS N **38.6**% ve Ends & Remediate Snag Risk

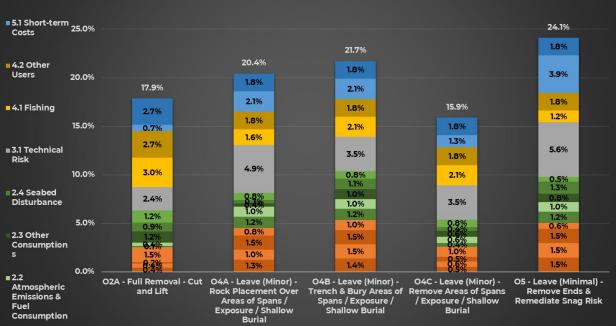
5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	04A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	04B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	04C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	s	s	s	s	27.3%
O4A - Leave (Minor) - Rock Placement Over Areas of Spans / Exposure / Shallow	w	N	N	и	N	18.2%
O4B - Leave (Minor) - Trench & Bury Areas of Spans / Exposure / Shallow Burial	w	N	N	z	N	18.2%
O4C - Leave (Minor) - Remove Areas of Spans / Exposure / Shallow Burial	w	N	N	N	N	18.2 %
O5 - Leave (Minimal) - Remove Ends & Remediate Snag Risk	w	N	N	N	N	18.2 %

M.6 Group 18 Pairwise Comparison Matrices – Economic



M.7 Group 18 Results Charts







APPENDIX N PIPE IN PIPE HYBRID COMPONENTS

The pipe-in-pipe hybrids were towed into position by vessels using the towheads located at each end of each section, ref. Figure 15-1. The towheads incorporate manual isolation valves. To aid installation the carrier pipe had vent valves and trim chains attached, these remained following installation however are redundant, ref. Figure 15-2 and Figure 15-3. The inner pipes within the pipe-in-pipe hybrids are supported by centralisers, ref. Figure 15-4.



Figure 15-1 Towhead (example)



Figure 15-2 Vent valve (example)



Figure 15-3 Pipe-in-pipe carrier pipe showing redundant trim chain (right hand side)

