



Saltire Area Subsea and Pipelines Infrastructure Comparative Assessment Report

Final

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Terms and Abbreviations

Abbreviation	Explanation
AHP	Analytical Hierarchy Process
BEIS	Department for Business, Energy and Industrial Strategy
CA	Comparative Assessment
dB	Decibels
DP	Decommissioning Programme(s)
DSV	Dive Support Vessel
ENVID	Environmental Identification
FCA	Flotta Catchment Area
FishSAFE	The FishSAFE Information Project and Database
HAZID	Hazard Identification
HazMat	Hazardous Materials
HLV	Heavy Lift Vessel
JNCC	Joint Nature Conservation Committee
m	metres
m²	square metres
MAH	Major Accident Hazards
MCDA	Multi-Criteria Decision Analysis
MFE	Mass Flow Excavator
MS	Much Stronger
MW	Much Weaker
Ν	Neutral
NORM	Normally Occurring Radioactive Material
OD	Outside Diameter
NSTA	North Sea Transition Authority
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
ROV	Remotely Operated Vehicle
OSPAR	Oslo Paris
PLL	Potential for Loss of Life
S	Stronger
SEPA	Scottish Environment Protection Agency



Abbreviation	Explanation
SFF	Scottish Fishermen's Federation
SLV	Single Lift Vessel
Те	tonnes
ТРа	Tera Pascals
UK	United Kingdom
USV	Underwater Safety Valve
VMS	Very Much Stronger
VMW	Very Much Weaker
W	Weaker
WID	Water Injection Development

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EXECUTIVE SUMMARY

Repsol Sinopec Resources UK has conducted a Comparative Assessment (CA) in support of decommissioning of the Saltire Area subsea infrastructure as described in the Decommissioning Programmes (DP). The following steps from the Offshore Energies UK Guidelines have been completed:

5	Scoping	->	Screening	┢	Preparation	•	Evaluation	►	Recommendation	→	Review
							\checkmark				\checkmark

This CA report presents the methodology, decisions which needed to be taken, the preparation works carried out, the outcomes (recommendations) from the internal workshop and the outcomes from the external (with stakeholders) workshop.

The CA for the Subsea Infrastructure of the Saltire Area Decommissioning Project has focused on four decommissioning groups (groups 1, 2, 3 and 4).

The selected decommissioning option for groups 5 and 6 will be subject to a separate assessment and, Groups 7 and 8 were confirmed to be full removal at the CA Scoping and Screening stage, in line with current industry guidance. The outcome of the CA process has made the following recommendations:

Decommissioning Group	Decommissioning Recommendation	Justification
Group 1 – Saltire A to Piper B Bundle	Option 1b - Leave surface laid bundle in situ with ends and free spans remediated using rock dump	Most or close to most attractive from Technical and Safety perspective. Less attractive from Environmental and Societal perspective but overall balanced view indicates a small overall preference. Inclusion of economics strengthens preference.
Group 2 – Saltire A to Saltire WID Bundle	Option 1b - Leave surface laid bundle in situ with ends and free spans remediated using rock dump	Most or close to most attractive from Technical and Safety perspective. Less attractive from Environmental and Societal perspective but overall balanced view indicates a small overall preference. Inclusion of economics strengthens preference.
Group 3 – Chanter Oil/Condensate Flexible Flowline	Option 2a - Leave currently buried flowline in situ with ends and exposures trenched & buried	Most attractive from Safety, Environmental, Technical and Societal perspectives. Inclusion of economics changes preference to rock cover option but trench and bury option retained to comply with BEIS guidelines that economics should not drive outcome.
Group 4 – Trenched & Buried Umbilicals / Power Cables	Option 2a - Leave currently buried items in situ with ends and exposures trenched & buried	Most attractive from Safety, Environmental, Technical and Societal perspectives. Inclusion of economics retains preference.
Group 5 – Subsea Structures	Full Removal	As per industry guidance
Group 6 – Towhead Umbilicals	Full Removal	As per industry guidance
Group 7 – Spools / Jumpers	Full removal as base case – no CA	As per industry guidance.
Group 8 – Mattresses & Grout Bags	Full removal as base case – no CA Note 1	As per industry guidance.

Note 1: Where mattresses / grout bags cannot be safely recovered due to degradation, these shall be buried in situ if this is deemed appropriate following discussion with OPRED.



1 INTRODUCTION

1.1 Purpose

The purpose of this document is to present the Comparative Assessment (CA) for the Subsea Infrastructure in support of the Saltire Decommissioning Programmes (DPs) [Ref. 1]. It is produced in satisfaction of the requirement to perform a CA for subsea equipment as detailed in the BEIS Guidelines [Ref. 2] and the Oil & Gas UK Guidelines [Ref. 3]. Having read and utilised these guidelines, Repsol Sinopec Resources UK Limit believe that this report fully expresses the requirements to perform a CA for subsea equipment.

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

1.2 Background

Repsol Sinopec Resources UK Limited has commenced planning for the decommissioning of the Saltire Area development (a collection of developed fields comprising Saltire, Chanter and Iona) and is undertaking studies to support the preparation of Decommissioning Programmes for these assets through 2018.

The Saltire Area is located in UK block 15/17, approximately 200 kilometres North-East of Aberdeen in 145 metres of water. It forms part of the Flotta Catchment Area (FCA) system. Saltire A is a fixed drilling/production platform, located 7 kilometres South-East of the Piper B platform. Production from Saltire, Chanter and Iona was suspended in August 2014.

Saltire A is a fixed drilling/production platform, located 7 kilometres South-East of the Piper B platform. Prior to production being suspended, oil and gas from the Saltire, Iona and Chanter fields was exported to Piper B via a 40-inch pipeline bundle containing one 10-inch diameter multiphase export line, an 8-inch diameter gas lift line and two 16-inch diameter lines. One of the 16-inch diameter lines was used for sea water injection (previously gas lift service); the other 16-inch diameter line was previously used for sea water injection. In addition, oil and gas from the Chanter field was also exported to the Piper B platform from a single Chanter subsea well via a 6-inch flexible flowline.

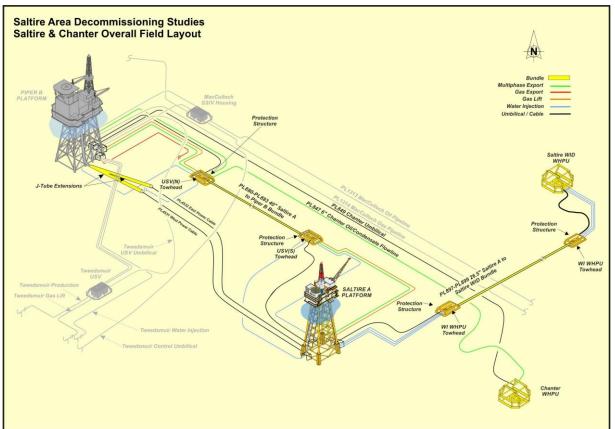
From Piper B, oil was exported through a 30-inch diameter line to the Flotta Terminal facilities in Orkney, while gas was exported to the St Fergus Gas Terminal via a 16-inch diameter gas export line. From 2000, up until the suspension of production, all gas was used for fuel requirements within the Greater Piper Area.

Injection water to support production from the Saltire field was also provided to three subsea wells via the Saltire A to Saltire WID bundle.

Production from Saltire, Chanter and Iona was suspended in August 2014. Formal approval to cease production was requested from the North Sea Transition Authority (NSTA) on the 19th of September 2016, with approval being received by Repsol Sinopec Resources UK Limited on the 11th of November 2016. The Saltire Area field layout is presented in Figure 1.1.







Full technical details of the Saltire Area subsea infrastructure can be found in the Pipeline Status and Historical Review Report **[Ref. 5]** and the Saltire Area Asset and Waste Inventory Report **[Ref. 6]**.

1.3 Report Structure

This CA Report contains the following sections:

- > Section 1 An introduction to the document and project, including acronyms
- > Section 2 An overview of the CA process and methodology adopted
- > Section 3 A summary of the outcome of the scoping phase.
- > Section 4 An overview of the CA conducted for Group 1 Saltire A to Piper B Bundle
- > Section 5 An overview of the CA conducted for Group 2 Saltire A to Saltire WID Bundle
- Section 6 An overview of the CA conducted for Group 3 Chanter Oil / Condensate Flexible Flowline
- Section 7 An overview of the CA conducted for Group 4 Trenched and Buried Umbilicals / Power Cables
- > Section 8 A discussion of the evaluation conducted and the outcome obtained
- > Section 9 A list of documents and other sources referenced in the document
- > Appendix A An explanation of the evaluation methodology adopted
- > Appendix B-E The detailed CA Evaluation outcomes for the Groups
- > Appendix F-I Datasheets describing technical details associated with the decommissioning options examined



2 METHODOLOGY

2.1 Overview

CA studies are conducted widely in engineering to ensure robust and justified decision making; they are not limited to decommissioning. However, industry guidance on the preferred approach to CA for decommissioning is published by Oil & Gas UK **[Ref. 3]**. As such, CA is a core part of the overall decommissioning planning process being undertaken by Repsol Sinopec Resources UK Limited for the Subsea Infrastructure associated with the Saltire Area Decommissioning Project.

Within the guidelines published by Oil & Gas UK **[Ref. 3]**, seven steps to the CA process are recommended. Table 2.1 provides an introduction to each of these steps, along with a status and commentary to demonstrate the current position for the subsea infrastructure associated with the Saltire Area decommissioning project.

Title	Scope	Status	Commentary
Scoping	Decide on appropriate CA method, confirm criteria, identify boundaries of CA (physical and phase).	~	Pipeline Status and Historical Review Report [Ref. 5] and Asset and Waste Inventory Report [Ref. 6] prepared for subsea infrastructure. Battery limits defined; CA methodology and criteria established for Screening and revisited following Screening to ensure appropriate to evaluation phase.
Screening	Consider alternative uses and deselect unfeasible options.	~	Screening workshops held Quarter 2 2018 with internal project team. Screening outcomes documented in Removal Options Screening Report [Ref. 7] .
Preparation	Undertake technical, safety, environmental and other appropriate studies. Undertake stakeholder engagement.	~	Studies identified during screening phase undertaken to inform the evaluation of the remaining options. The studies completed are detailed in Section 2.4.
Evaluation	Evaluate the options using the chosen evaluation methodology.	\checkmark	Internal workshops held during Quarter 2 2018. Evaluation methodology described in Section 2.5 and outcomes detailed in Sections 4, 5, 6 and 7.
Recommendation	Create 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 this CA Report.
Review	Review the recommendation with internal and/or external stakeholders.	~	The Stakeholder Workshop, was held with key external stakeholders (JNCC, SFF, SEPA, BEIS, and NSTA) 24 th June 2019 prior to formal CA submission to provide an opportunity to review emerging recommendations and incorporate stakeholder feedback.
Submit	Submit to BEIS as part of / alongside Decommissioning Programme.	\checkmark	The CA Report has been submitted in support of the DP.

Table 2.1: CA Process Overview and Status



2.2 Scoping

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

- > Boundaries for CA.
- > Physical attributes of equipment.
- > Decommissioning groups and options.

These are addressed in the following sub-sections.

2.2.1 CA Boundaries

The boundaries (battery limits) adopted by Repsol Sinopec Resources UK Limited for the Subsea Infrastructure of the Saltire Area Decommissioning Project are as follows:

- > The subsea riser tie-in flanges at the Saltire A platform.
- > Topside umbilical hang-offs at the Saltire A platform.
- > The subsea riser tie-in flanges at the Piper B platform.
- > Topside umbilical hang-offs at the Piper B platform.

The following equipment is included within the definition of subsea infrastructure:

- > All subsea structures including their foundations.
- > All rigid and flexible subsea pipelines / flowlines.
- > All control and chemical jumpers.
- > All spools.
- > All umbilicals / cables.
- > All mattresses / grout bags and deposits.

2.2.2 Physical Attributes of Equipment

All subsea equipment within the scope of the Saltire Area Field Decommissioning Project is listed in **[Ref. 5]** and **[Ref. 6]** along with the physical attributes that define the equipment. The attributes considered included the following:

- > Structures:
 - o Type.
 - Weight / size / shape.
 - o Materials.
 - o Installation method.
 - o 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 / Cables / Jumpers:
 - Material / diameter / wall thickness / coatings / length.
 - Seabed configuration (trenched / buried / surface laid).
 - Details of crossings / mattresses.
 - As-left cleanliness / ability to clean lines / chemicals used.
 - o Integrity issues.
- > Protection & Support:
 - o Type.
 - Material.
 - Configuration.
 - Dimensions.
 - o Integrity issues.

2.2.3 Decommissioning Groups

Once the equipment items to be decommissioned and their attributes were captured, it was found to be beneficial for the CA process to group similar equipment together. This allows many items to be considered as a single group and can reduce the number of items for consideration, streamlining the process.

For the Subsea Infrastructure of the Saltire Area Decommissioning Project, the decommissioning groups, along with a list of each individual item that makes up the population of those groups, is detailed in full in the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. A brief summary of the decommissioning groups identified is included in Table 3.1.

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 Guidelines **[Ref.** 1] and it is only those decommissioning groups where default full removal is not considered to be the clear optimum solution that alternative decommissioning options are considered.

Alongside full removal options, the following partial removal scenarios should be considered as specified in BEIS Guidelines **[Ref. 1]** and the Oil & Gas UK report into decommissioning of pipelines in the North Sea **[Ref. 8]**:

- > Pipelines:
 - Re-use.
 - o Minimal Intervention, i.e. exposed end removal.
 - o Minor Intervention, i.e. exposed end / free spans / exposure removal.
 - o Major Intervention, i.e. full re-trench or rock placement.



2.3 Screening

The CA screening phase considers each feasible decommissioning option against the main criteria, as defined within the Oil & Gas UK Guidelines **[Ref. 3]**.

- > Safety
- > Environment
- > Technical
- > Societal
- > Economic

For the Saltire Area, the screening phase was carried out during a workshop held in February 2018. The methodology adopted, workshop attendance and outcomes obtained are detailed fully in the Removal Options Screening Report **[Ref. 7]**. The methodology is briefly summarised below:

- 1. Identify decommissioning groups for full removal.
- 2. Review proposed decommissioning options for each remaining group.
- 3. Assess decommissioning options against the main criteria and record assessment and outcome in screening worksheets.
- 4. Record actions required to support retained decommissioning options.
- 5. Compile screening report.

The assessment was performed using a coarse, Red / Amber / Green method, as recommended in the Oil & Gas UK Guidelines **[Ref. 3]**. An additional category of 'showstopper', coloured dark grey was used. These categories are described Table 2.2.

Category	Description
Attractive	The option is considered attractive i.e. it has positive attributes in terms of the criterion being assessed.
Acceptable	The option is considered acceptable i.e. its attributes are not positive or negative in terms of the criterion being assessed.
Unattractive	The option is considered unattractive i.e. it has negative attributes in terms of the criterion being assessed.
Showstopper	The option is considered unacceptable. Should an option be assessed as unacceptable against any of the criteria, it is discounted, and 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, non-binding, ground rules. These were:

- > 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);
- > 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 was considered appropriate to ensure that the worst-case full removal options were compared to the less onerous leave in-situ options. This ensures, during the evaluation phase, that the assessment is not skewed such that leave in-situ options are selected over full removal options.

The outcomes for each group are summarised in Table 4.2, Table 5.2, Table 6.2 and Table 7.2.



2.4 Preparation Phase

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

The studies / analyses conducted during the preparation phase of the CA process for the Saltire Area subsea infrastructure are as follows:

- > Technology Review
 A report into the current technology readiness level of a wide range of equipment / methods to assist in decommissioning of the Saltire Area infrastructure.
- Decommissioning Method
 Statements
 Detailed method statements were developed for options carried forward to ascertain the activities and resources required to deliver each option.
- Emissions Assessment
 Fuel consumption and atmospheric emissions assessment performed for options carried forward based upon activities and resources identified in method statements.
- Environmental Impact Review
 Environmental impact reviews were conducted for options carried forward in areas of planned discharges, unplanned discharges and seabed disturbance based on activities and resources identified in method statements.
- > HAZID Hazard identification workshops were held to consider the risks associated with individual activities and subsequently decommissioning options.
- > ENVID An Environment Identification (ENVID) workshop was held to consider the environmental and social issues aspects (emissions, aqueous discharges, disturbance, noise, interference with other sea users, etc.) of the decommissioning options.
- Fishing Intensity Study
 A Fishing Intensity Study was conducted to understand the extent of fishing operations in the area and to consider the potential fishing activity post decommissioning plus the potential risks to commercial fisheries that could result from options that leave infrastructure in-situ following decommissioning.

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 data sheets, included in Appendix F - Appendix I.



2.5 Evaluation Phase

The evaluation phase of the CA is where the remaining decommissioning options for each group are evaluated against each other in order to select the 'most preferred' decommissioning option. This evaluation process is conducted according to the Oil & Gas UK Guidelines **[Ref. 3]** and employs the data obtained during the preparation phase as summarised in the data sheets, included within Appendix F - Appendix I.

The evaluation phase was conducted during a workshop attended by the decommissioning project team. On a group by group basis, each option was scored against sub-criteria defined by the Project. The definition of each sub-criterion is provided within Appendix A.2.

Options were scored against each other on a pair-wise basis, using the qualitative terms – Neutral, Stronger, Much Stronger, Very Much Stronger, Weaker, Much Weaker and Very Much Weaker. Guidance for the application of these terms is provided within Appendix A.3.

This approach enables the assessment team to debate the strengths and weaknesses of each option at the sub-criterion level, which are then combined to provide an overall preference against each option. Where applicable, the resulting emerging recommendation was subjected to sensitivities to test the robustness of the result.

2.5.1 Criteria and Sub-Criteria Weightings

The primary criteria have been weighted neutrally. Given the differing, and sometimes conflicting, considerations that are represented by the criteria, it was considered appropriate that they be weighted equally to one another to avoid favouring any particular aspect or group. However, it was considered acceptable to weight the sub-criteria toward those areas that had higher importance to the overall impact of the proposed decommissioning options on the main criteria. Weightings are applied to relate the evaluated scores against one criterion to the evaluated scores of another criterion. They reflect the fact that the range from 'worst' to 'best' on one criterion might not be equivalent to the range of another criterion. Weightings also allow a single measure of preference to be derived for each option and highlight the criteria that are the key drivers/differentiators.

More detail of the methodology adopted for the evaluation phase of the Saltire Area Decommissioning Project and the sub-criteria weightings is detailed in Appendix A.

2.6 Review

The outcome from the CA process was reviewed with key external stakeholders during quarter 2 2019. Formal minutes from the stakeholder engagements sessions were recorded and all relevant feedback was captured. Details of the queries raised during the sessions and RSRUK's responses to those queries are included in the Decommissioning Programmes document for the Saltire A Topsides and Saltire Area Subsea Infrastructure **[Ref. 1]**.



3 COMPARATIVE ASSESSMENT - SCOPING OUTCOME

3.1 Decommissioning Groups

The subsea infrastructure was arranged into groups. All feasible decommissioning options for each group were considered and those options that were considered to be sufficiently unattractive were screened out, as detailed within the Removal Options Screening Report **[Ref. 7]**. The groups and the requirement for full CA, or otherwise, are summarised within Table 3.1 below.

Group	Description	Decommissioning Approach
1	Saltire A to Piper B bundle	Subject to full CA
2	Saltire A to Saltire WID bundle	Subject to full CA
3	Chanter oil/condensate flexible flowline	Subject to full CA
4	Trenched & buried umbilicals / power cables	Subject to full CA
5	Subsea structures	Full removal
6	Towhead umbilicals	Full removal
7	Spools / jumpers	Full removal
8	Mattresses & grout bags Note 1	Full removal

Table 3.1: Groups and Decommissioning Recommendation

Note 1: Where mattresses / grout bags cannot be safely recovered due to degradation, these shall be buried in-situ if this is deemed to be appropriate following discussion with OPRED.

The remaining subsea infrastructure groups for full comparative assessment are:

- > Group 1 Saltire A to Piper B bundle
- > Group 2 Saltire A to Saltire WID bundle
- > Group 3 Chanter oil/condensate flexible flowline
- > Group 4 Trenched & buried umbilicals / power cables



4 CA OUTCOME – GROUP 1 – SALTIRE A TO PIPER B BUNDLE

4.1 Group Characteristics

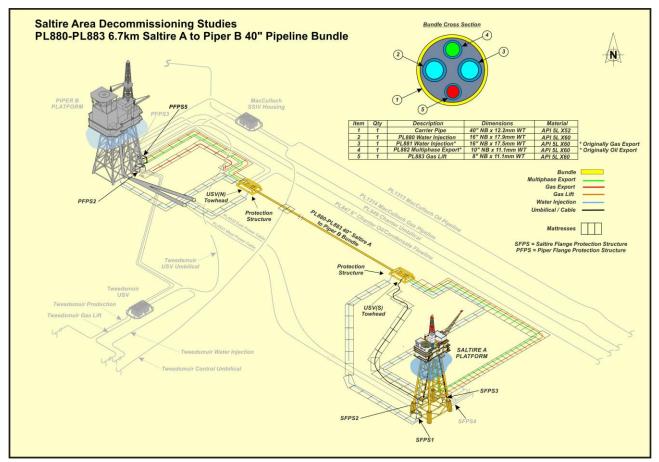
The individual items that make up Group 1 – Saltire A to Piper B Bundle are detailed in full within the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]** the bundle is exposed for 99.2% of its length and contains a total of 8 areas that require remediation, a detailed summary of the pipeline status including historical data is available in the Pipeline Status and Historical Review Report **[Ref. 5]**. By way of summary, the layout is shown in Figure 4.1 and the key characteristics for Group 1 are presented in Table 4.1:

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL880	16-inch water injection pipeline (failed)	Saltire	16		
PL881	16-inch water injection pipeline (previously gas export)	Saltire	16		
PL882	10-inch multiphase export pipeline (previously oil export)	Saltire	10	6,690	5,145
PL883	8-inch gas lift pipeline	Saltire	8		
-	40-inch carrier pipe	Saltire	40		

Table 4.1: Group 1 Items

Note: For clarity, the above pipelines are configured in a bundle arranged within the 40-inch carrier pipe, which is surface laid.

Figure 4.1: Saltire A to Piper B Bundle (PL880-PL883)



The Saltire A to Piper B Bundle is surface laid and is exposed for over 99% of its length with only one section of burial where it is covered by concrete mattresses/grout bags and crossed by the Tweedsmuir umbilical near the Piper B end of the bundle **[Ref. 5]**.



From the most recent survey data **[Ref. 5]**, the bundle has a number of free spans, which would be considered hazardous to other users of the sea, and there is potential for further free spans to develop in the future.

4.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 1 – Saltire A to Piper B Bundle are detailed in Table 4.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are fully detailed within the Removal Options Screening Report **[Ref. 7].**

Prior to decommissioning, the following activities will be required, regardless of the option selected for the bundle:

- > Removal of all associated mattresses and grout bags (over tie-in spools, umbilicals, and at crossings);
- > Disconnection of the tie-in spools and umbilicals from the bundle towheads;
- > Disconnection of the towheads from the bundle;
- > Removal of the tie-in spools and umbilicals;
- > Removal of the towheads and towhead protection structures.

Table 4.2: Group 1 Decommissioning Options

	Group 1 – Saltire A to Piper B Bundle							
Category	Option	Description						
Leave in-situ	1a – Do nothing	Perform no activities to remediate the ends or the free spans of the bundle. This option was not carried forward as it is unacceptable from a safety and societal perspective.						
(minor intervention)	1b – Remediate ends and spans only	Rock placement over the cut ends of the bundle, and at free span locations (may also be required at areas susceptible to free spans). It should be noted that alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at free spans) may be adopted.						
	2a – Trench and bury exposures	Removal of bundle appurtenances (ballast chains and vent valves) followed by a trenching vessel equipped with suitable trenching technology trenching and burying the bundle to a target of 0.6 m depth of cover over the top of the bundle carrier pipe.						
Leave in-situ (major intervention)	2b – Cut and remove exposures	Remove exposed sections of the bundle by cutting into smaller sections and lifting them to the surface prior to removal to shore. As the bundle is fully exposed across the majority of its length, this option is functionally identical to option 3a.						
	2c – Rock cover exposures	Cut ends of bundle to enable towhead removal and then perform rock dump to fully bury the bundle along its entire length.						
Full removal	3a – Cut and lift	ROV cutting of the bundle into short sections and installing end stops (dependent on cutting method). The bundle sections then rigged and lifted to a construction vessel or alternative transport vessel/barge either directly or via subsea baskets and returned to shore for dismantling and recycling.						
	3b – Reverse installation	Remove bundle by re-floating and towing to shore. This option was not carried forward as sufficient integrity of the bundle cannot be confirmed.						



4.3 Decommissioning Options for Evaluation

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

- > Leave in-situ (minor intervention):
 - 1b Remediate ends and free spans only.
- > Leave in-situ (major intervention):
 - 2a Trench and bury exposures.
 - 2c Rock cover exposures.
- > Full removal:
 - \circ 3a Cut and lift.

4.4 **Evaluation Summary**

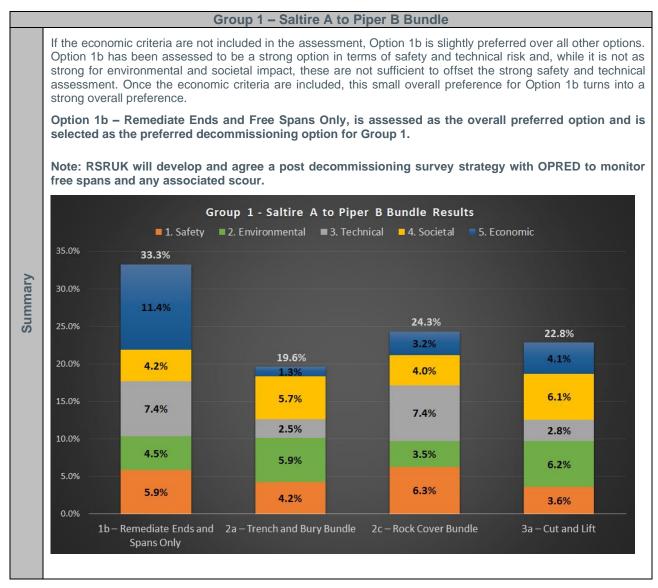
Table 4.3: Summary of CA Evaluation for Group 1

	Group 1 – Saltire A to Piper B Bundle								
Screening		1a – Do nothing	1b – Remediate ends and free spans only		2a – Trench and bury exposures		2b – Cut and remove exposures		
Scree	:	2c – Rock cover expo	osures	3a – C	Cut and lift	3b -	- Reverse installation		
		Note: See /	Appendix E	B for full attribu	utes tables and as	sessm	ent		
uo	Safety	shore Personnel criterion erations from the reduced lift). t the Onshore Personnel antity of material returned exposure was considered ere being no residual risk sociated with Option 2a is ning Operations Offshore ovironmental impact being							
Evaluation	Environment	largely similar. Option All options are equally more material returned preference from an er All options were consi higher quantity of rock the other options. As s criterion. Options 1b and 3a ma term impact on the sea 2a and 2c. Options 2a and 3a are environmental impact seabed (Option 1b) or	3a was marg y preferred a d to shore un ivironmental idered similal < required for such, Option arginally pref- abed environ e equally pref- versus the s applying full the preferre	ginally less prefer gainst the Proce der Option 3a (cu perspective. from a Resource Option 2c was of 1b, 2a and 3a are erred from a Sea ment from trenchi ferred against the ignificant impact rock cover (Option d option against	red. ssing of Returned Ma it and lift), this was co e Consumption persp considered sufficient t e equally preferred ag bed Disturbance pers ing and burying / rock e Loss of Habitat crite from either leaving th on 2c).	aterial considered ective. to expregainst the spective dumpin rion due he bunc	eriterion as, while there is d insufficient to express a However, the significantly ess a small preference for e Resource Consumption . This is due to the short- g associated with Options e to the minimal long-term lle largely in place on the driven by its preference		



	Group 1 – Saltire A to Piper B Bundle
Technical	Options 1b and 2c were equally most preferred against all Technical sub-criteria. This reflects the challenges associated with contracting, scheduling and delivering the trenching or cut and lift options of a bundle with a diameter that is beyond the current limit within the industry. Overall, Options 1b and 2c are assessed as equally preferred against the Technical criterion.
Societal	Option 2c is the least preferred from a political perspective due to it resulting in a significant area of new rock dump along the entire length of the bundle. Options 2a and 3a are preferred over Option 1b from a political perspective as they achieve a clear seabed. Option 3a is the preferred option from a fisheries perspective as it achieves a completely clear seabed with no risk of future exposure of the bundle. Option 2a is next preferred as it will provide a clear seabed, albeit with a small potential for the bundle to become unburied in future. Option 2c is preferred over 1b from a fisheries perspective as it is anticipated that the rock dump associated with Option 2c will be entirely overtrawlable and will not provide the small potential net snagging risk associated with Option 1b. From the perspective of socio-economic impact on communities Option 3a is preferred over the other options, which are assessed as neutral to each other, as this represents the best case for job creation / retention. Overall, Option 3a is the preferred option followed closely by Option 2a .
Economic	Option 1b is the most preferred option against the Cost for Decommissioning / Removal Activities criterion due to it be significantly less expensive than any of the other options. Option 3a is the most preferred option against the Cost for Long-term Monitoring / Remediation Activities criterion as there are no long-term costs associated with the full removal option. Overall, Option 1b is the preferred option from and economic perspective due to the heavier weighting of short-term costs.







5 CA OUTCOME – GROUP 2 – SALTIRE A TO SALTIRE WID BUNDLE

5.1 Group Characteristics

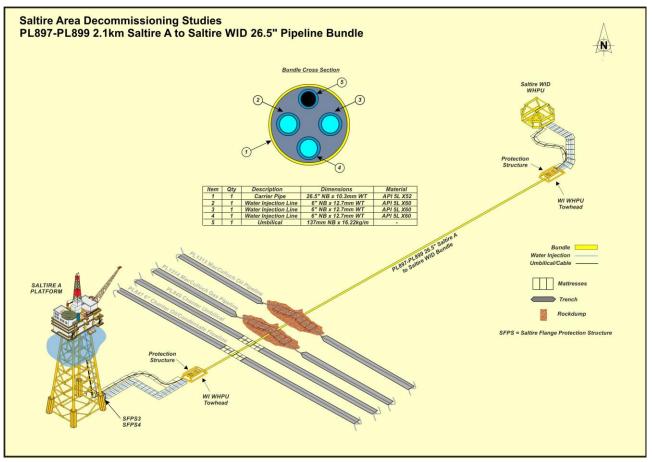
The individual items that make up Group 2 – Saltire A to Saltire WID Bundle are detailed fully within the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. The bundle is exposed for the majority of its length, in the most recent survey the bundle was not surveyed along its length, however, historical survey data shows that there was one free span in 2012 and that the exposed length varies between 98.3% in 2012 and 75.7% in 2015 **[Ref. 5]**. By way of summary, the layout is shown in Figure 5.1 and the key characteristics for Group 2 are presented in Table 5.1:

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)	
PL897	6-inch water injection pipeline	Saltire	6			
PL898	6-inch water injection pipeline	Saltire	6		670	
PL899	6-inch water injection pipeline	Saltire	6	2,106		
PLU4738	Umbilical	Saltire	6			
-	26.5-inch carrier pipe	Saltire	26.5			

Table	5.1:	Group	2 Items
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Note: For clarity, the above pipelines are configured in a bundle arranged within the 26.5-inch carrier pipe, which is surface laid.





The Saltire A to Saltire WID Bundle is surface laid and exposed over almost its entire length. It crosses over the buried 6-inch Chanter Oil/Condensate Flexible Flowline (PL847 in Group 3) and



the buried 6-inch Chanter Umbilical (PL849 in Group 4) and is crossed by two pipelines associated with the MacCulloch field (PL1313 10-inch MacCulloch Oil Pipeline and PL1314 6-inch MacCulloch Gas Pipeline) [Ref. 5].

Decommissioning of the MacCulloch pipelines is outside the scope of the Saltire Area decommissioning project.

Based on the latest data [Ref. 5], the Saltire A to Saltire WID Bundle has a low number of free spans, none of which currently exceed FishSAFE limits (i.e. free spans are less than 10 m in length and 0.8 m in height). However, evidence of potential scour has been identified at numerous locations, which indicates that the bundle may be susceptible to free spans in future if additional scour were to occur [Ref. 5], in the 2007 GIV the areas of potential scour appeared close to the areas of free span, in 2007 and 2012 (GVI survey years) there was one area of free span and indications of 42 potential scour locations in 2007 however in 2012 there were 2 areas of free span and no recorded indications of scour reported.

5.2 **Decommissioning Options & Screening Outcome**

The decommissioning options identified for Group 2 – Saltire A to Saltire WID Bundle are detailed in Table 5.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are detailed within the Removal Options Screening Report [Ref. 7].

Prior to decommissioning, the following activities will be required, regardless of the option selected for the bundle:

- > Removal of all associated mattresses and grout bags (over tie-in spools, umbilicals, and at crossings);
- > Disconnection of the tie-in spools and umbilicals from the bundle towheads;
- > Disconnection of the towheads from the bundle;

- . .

- > Removal of the tie-in spools and umbilicals;
- > Removal of the towheads and towhead protection structures. - - -

Table	5.2:	Grou	up 2	Dec	com	niss	ioning	Opt	ions	
-				-				_		

- -

	Group 2 – Saltire A to Saltire WID Bundle					
Category	Option	Description				
Leave in-situ	1a – Do nothing	Perform no activities to remediate the ends or the free spans of the bundle. This option was not carried forward as it is unacceptable from a safety and societal perspective.				
(minor intervention)	1b – Remediate ends and spans only	Rock placement over the cut ends of the bundle, and at free span locations (may also be required at areas susceptible to free spans). It should be noted that alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at free spans) may be adopted.				
	2a – Trench and bury exposures	Removal of bundle appurtenances (ballast chains and vent valves) followed by a trenching vessel equipped with suitable trenching technology trenching and burying the bundle to a target of 0.6 m depth of cover over the top of the bundle carrier pipe.				
Leave in-situ (major intervention)	(major 2b – Cut and remove	Remove exposed sections of the bundle by cutting into smaller sections and lifting them to the surface prior to removal to shore. As the bundle is fully exposed across the majority of its length, this option is functionally identical to option 3a.				
	2c – Rock cover exposures	Cut ends of bundle to enable towhead removal and then perform rock dump to fully bury the bundle along its entire length.				



	Group 2 – Saltire A to Saltire WID Bundle					
Category Option Description						
Full removal	3a – Cut and lift	ROV cutting of the bundle into short sections and installing end stops (dependent on cutting method). The bundle sections then rigged and lifted to a construction vessel or alternative transport vessel/barge either directly or via subsea baskets and returned to shore for dismantling and recycling.				
	3b – Reverse installation	Remove bundle by re-floating and towing to shore. This option was not carried forward as sufficient integrity of the bundle cannot be confirmed.				

5.3 Decommissioning Options for Evaluation

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

- > Leave in-situ (minor intervention):
 - 1b Remediate ends and free spans only.
- > Leave in-situ (major intervention):
 - \circ 2a Trench and bury exposures.
 - 2c Rock cover exposures.
- > Full removal:
 - \circ 3a Cut and lift.

5.4 Evaluation Summary

Table 5.3: Summary of CA Evaluation for Group 2

	Group 2 – Saltire A to Saltire WID Bundle						
ening			mediate ends and 2a – Trench and I e spans only exposures		1 - C	2b – Cut and remove exposures	
Scree			sures	3a – Cut and lift		3b -	3b – Reverse installation
		Note: See	Append	ix C for full attrib	outes tables and	assessi	ment
Evaluation	Note: See Appendix C for full attributes tables and assessment Option 1b and Option 2c are equally the most preferred options against the Offshore Personnel criterior due to the significantly lower risk exposure from the shorter duration of offshore operations from the reduced number of offshore cut and lift operations when compared to Option 3a (cut and lift). Option 1b and Option 2c are also equally the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3a (cut and lift). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3a is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with the othe options is relatively close given the diameter and length of the bundle.					operations from the reduced d lift). Inst the Onshore Personnel quantity of material returned a exposure was considered there being no residual risk	



		Group 2 – Saltire A to Saltire WID Bundle
		Option 1b, 2a and 2b are equally preferred against the Impact of Decommissioning Operations Offshore criterion. This is due to the duration of the operations and thus the associated environmental impact being largely similar. Option 3a was marginally less preferred.
		All options are equally preferred against the Processing of Returned Material criterion as, while there is more material returned to shore under Option 3a (cut and lift), this was considered insufficient to express a preference from an environmental perspective.
	Environment	All options were considered similar from a Resource Consumption perspective. However, the significantly higher quantity of rock required for Option 2c was considered sufficient to express a small preference for the other options. As such, Options 1b, 2a and 3a are equally preferred against the Resource Consumption criterion.
	Envi	Options 1b and 3a marginally preferred from a Seabed Disturbance perspective. This is due to the short-term impact on the seabed environment from trenching and burying / rock dumping associated with Options 2a and 2c.
		Options 2a and 3a are equally preferred against the Loss of Habitat criterion due to the minimal long-term environmental impact versus the significant impact from either leaving the bundle largely in place on the seabed (Option 1b) or applying full rock cover (Option 2c).
		Overall, Option 3a is the preferred option against the Environment criterion driven by its preference against the Loss of Habitat criterion.
	al	All Options were equally preferred from a Contracting Strategy due to minimal challenges for each option in this area.
	Technical	Options 1b and 2c were equally most preferred against the Technical Maturity and Schedule sub-criteria. This reflects the challenges associated with the extensive works required for the trenching and cut and lift options of a bundle with a diameter that is at the current limit of capability within the industry.
		Overall, Options 1b and 2c are assessed as equally preferred against the Technical criterion.
		Option 2c is the least preferred from a political perspective due to it resulting in a significant area of new rock dump along the entire length of the bundle. Options 2a and 3a are preferred over Option 1b from a political perspective as they achieve a clear seabed.
	Societal	Option 3a is the preferred option from a fisheries perspective as it achieves a completely clear seabed with no risk of future exposure of the bundle. Option 2a is next preferred as it will provide a clear seabed, albeit with a small potential for the bundle to debury in future. Option 2c is preferred over 1b from a fisheries perspective as it is anticipated that the rock dump associated with Option 2c will be entirely overtrawlable and will not provide the small potential net snagging risk associated with Option 1b.
		From the perspective of socio-economic impact on communities, Option 3a is preferred over the other options, which are assessed as neutral to each other, as this represents the best case for job creation / retention.
		Overall, Option 3a is the preferred option followed closely by Option 2a for the Societal criterion.
	mic	Option 1b is the most preferred option against the Cost for Decommissioning / Removal Activities criterion due to it be significantly less expensive than Option 2a and Option 3a and less expensive than Option 2c.
	Economic	Option 3a is the most preferred option against the Cost for Long-term Monitoring / Remediation Activities criterion as there are no long-term costs associated with the full removal option.
	EC	Overall, Option 1b is the preferred option from an economic perspective due to the heavier weighting of short-term costs.







6 CA OUTCOME – GROUP 3 – CHANTER OIL/CONDENSATE FLEXIBLE FLOWLINE

6.1 Group Characteristics

Group 3 – Chanter Oil/Condensate Flexible Flowline consists of a single pipeline that is detailed fully in the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. The flowline is trenched and buried for the majority of its length but is exposed at each midline connection, in the surveys since 2012 the maximum amount of exposure has been 0.5% of the flowline length **[Ref. 5]**. By way of summary, the layout is shown in Figure 6.1 and the key characteristics for Group 3 are presented in Table 6.1:

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL847	Chanter Oil/Condensate Flexible Flowline	Chanter	10	10,675	988

Note: PL847 is trenched and buried for the majority of its length but comes out of its trench at each of the seven midline connections where it is protected by concrete mattress cover.

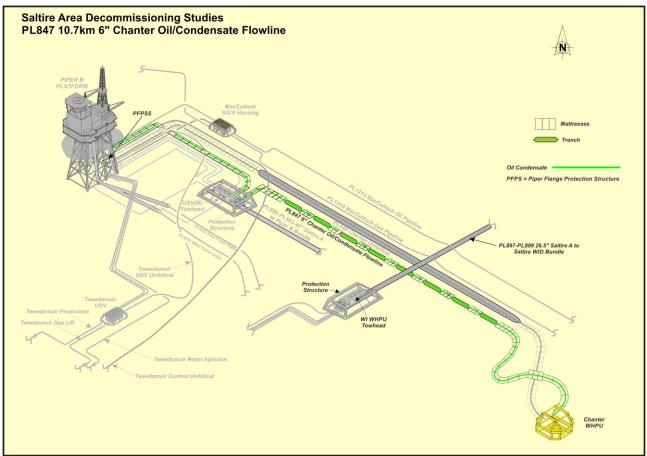


Figure 6.1: Chanter Oil/Condensate Flexible Flowline (PL847)

The Chanter Oil/Condensate Flexible Flowline (PL847) is made up of eight separate flexible flowline sections with seven midline connections. The flowline is trenched and buried for the majority of its length but comes out of its trench at each midline connection where it is protected by concrete mattress cover. The flowline connects the Chanter Wellhead Protection Unit (WHPU) via a towhead and connects to the Piper B platform via a separate towhead and a flexible jumper **[Ref. 5]**.



During installation of the flowline, the exposures associated with the seven midline connections were covered with mattresses. The latest survey data shows that mattresses have also been installed at several other locations, likely to cover areas of free span identified during installation.

A total of 5 free spans were reported in the latest survey **[Ref. 5]** with a total length of 15 m. The free spans can be classified as follows:

- > All free spans had lengths less than 5 metres.
- > The longest span was also the deepest span, measuring 4.1 m long and 0.5 m deep.
- No free spans exceed FishSAFE limits (i.e. all free spans are less than 10 m in length and 0.8 m in height).

As identified in Section 5.1, the Chanter Oil/Condensate Flexible Flowline is crossed by the surface laid Saltire A to Saltire WID Bundle.

6.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 3 – Chanter Oil/Condensate Flexible Flowline are detailed in Table 6.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are fully detailed within the Removal Options Screening Report **[Ref. 7]**.

Prior to decommissioning, the following activities will be required, regardless of the option selected for the flowline:

- > Removal of the Chanter WHPU.
- > Removal of all associated mattresses and grout bags (over tie-in spools and exposures).
- > Disconnection of the tie-in spools.
- > Removal of the tie-in spools.

 Table 6.2: Group 3 Decommissioning Options

	Group 3 – Chanter Oil/Condensate Flexible Flowline					
Category	Option	Description				
Leave in-situ	1a – Do nothing	Perform no activities to remediate the ends or the free spans of the flowline. This option was not carried forward as it is unacceptable from a safety and societal perspective.				
(minor intervention)	1b – Remediate ends only	Rock placement or burial of the ends of the flowline with no remediation of the flowline midline connections or free spans. This option was not carried forward as it is unacceptable from a safety and societal perspective.				
	2a – Trench and bury exposures	Disconnect and remove the flowline ends with subsequent mobilisation of a trenching vessel to trench and backfill the exposed sections of flowline to a sufficient depth below seabed level.				
Leave in-situ (major intervention)	2b – Cut and remove exposures	Disconnect and remove the flowline ends then cut and lift any exposed sections of the flowline and perform local dredging to lower the cut flowline ends and cut out sections. It should be noted that alternative strategies (e.g. rock placement on the cut ends) could be adopted for dealing with the flowline ends and cut out sections.				
	2c – Rock cover exposures	Disconnect, cut and lift the flowline ends with subsequent mobilisation of a fall pipe vessel for rock placement on exposed ends, mid line connections and at other exposures/free spans.				



Group 3 – Chanter Oil/Condensate Flexible Flowline				
Category Option Description				
Full removal	3 – Reverse reeling	Deburial operations of flowline (if required) followed by reverse reeling to a recovery vessel. The recovery vessel would connect onto the line and proceed to reverse reel along the route. The recovered line would be returned to shore for disposal.		

6.3 Decommissioning Options for Evaluation

The decommissioning options for Group 3 that remained after screening and were taken forward to the evaluation phase are:

- > Leave in-situ (major intervention):
 - 2a Trench and bury exposures.
 - 2b Cut and remove exposures.
 - 2c Rock cover exposures.
- > Full removal:
 - \circ 3 Reverse reeling.

6.4 Evaluation Summary

Table 6.3: Summary of CA Evaluation for Group 3

	Group 3 – Chanter Oil/Condensate Flexible Flowline						
Screening		1a – Do nothing	1b – Remediate ends only	2a – Trench and bury exposures			
Scre	2b -	- Cut and remove exposures	2c – Rock cover exposures	3 – Reverse reeling			
		Note: See Appendix	D for full attributes tables and a	ssessment,			
tion	Option 2a, 2b and 2c are equally the most preferred options against the Offshore Personnel criterion due to the significantly lower risk exposure from the shorter duration of offshore operations from the reduced number of offshore operations when compared to Option 3 (reverse reel). Option 2a, 2b and 2c are also equally the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3 (reverse reel). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3 is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with the other options is relatively similar given that all snag hazards would be remediated, and all exposures fully buried or rock covered.						
Evaluation	Environment	 Overall, Options 2a, 2b and 2c are equally preferred against the Safety criterion. All options are equally preferred against the Impact of Decommissioning Operations Offshore and the Processing of Returned Material criteria as, while there are differences in the operational durations and material returned to shore across the options, with Option 3 being higher, this was considered insufficient to express a preference from an environmental perspective. All options were considered similar from a Resource Consumption perspective. However, the higher quantity of rock required for Option 2b and 2c was considered sufficient to express a small preference for the other options. As such, Option 2a and 3 are equally preferred against the Resource Consumption criterion. Options 2a, 2b and 2c are marginally preferred from a Seabed Disturbance perspective due to the short-term impact on the seabed environment associated with the midline connection compared to the deburial operations associated with reverse reeling the full length (Option 3). Options 2a and 3 are equally preferred against the Loss of Habitat criterion due to the higher long-term impact from rock placement with the other options. Overall, Option 2a is the preferred option against the Environment criterion. 					



		Group	o 3 – Chanter Oil/Co	ondensate Flexible Fl	owline	
	Technical	All options were equally preferred against the Contracting Strategy criterion as all options could be delivered by a variety of vendors and thus provide for a flexible contracting strategy. Options 2a, 2b and 2c were equally preferred over Option 3 against the Schedule criterion due to the shorter offshore durations, the largely routine operations and the small potential for integrity failure of the line during reverse reeling.				
	Tec	Options 2a, 2b and 2c due to the routine oper	rations versus the limit	ferred over Option 3 aga ed track record of reverse preferred against the T	0	
-						
		and buried along the assessed as being the	majority of its length, least attractive option	the addition of rock ber	erion. Given that the line is trenched ms associated with Option 2c was	
	-	is therefore the most p			future deburying of the flowline and	
	Societal	Options 2a, 2b and 3 a	are equally most prefer ability, presents a serie	red from a fisheries persp	ective. Option 2c (rock cover), while is less attractive from a commercial	
		From a socio-econom	ic perspective, all options in material being re		g equally preferred as the negative der Option 3 is offset by the benefit	
		Overall, Options 2a, 2	2b and 3 are equally p	preferred against the So	cietal criterion.	
	Economic	due to it being less exp	pensive than Option 2a	a and 2b and significantly	ioning / Removal Activities criterion less than Option 3. Monitoring / Remediation Activities	
	ono	criterion as there are n	io long-term costs asso	ociated with the full remov	al option.	
	Ш	Overall, Option 2c i weighting of short-te		on from an economic	perspective due to the heavier	
	should Expos optior Note:	not be the driving fa sures, is retained as the for Group 3. RSRUK will develop a of the flowline.	nctor for selecting the he overall preferred of nd agree a post deco Group 3 - Chante	e decommissioning optio option and is selected a mmissioning survey str er Flowline - Results	uidance that economic considerations n, Option 2a – Trench and Bury as the preferred decommissioning ategy with OPRED to monitor the	
		1. Safety	2. Environmental	3. Technical 4. Societal	5. Economic	
	35.0%					
>				29.0%		
Summary	30.0%	25.0%		29.0%		
Imu	25.0%	25.8%	24.8%			
Ō		3.9%	3.9%	9.5%	20.5%	
	20.0%	5.4%			2.6%	
		5.470	5.4%	<mark>3.9%</mark>	2.07	
	15.0%	5.3%	5.3%	5.3%	5.4%	
	10.0%	5.6%			4.1%	
	5.0%		4.7%	4.7%	5.1%	
		5.6%	5.6%	5.6%	3.3%	
	0.0%	2a – Trench and Bury Exposures	2b – Cut and Remo Exposures	ve 2c – Rock Cover Expo	sures 3 – Reverse Reeling	



7 CA OUTCOME – GROUP 4 – TRENCHED & BURIED UMBILICALS / POWER CABLES

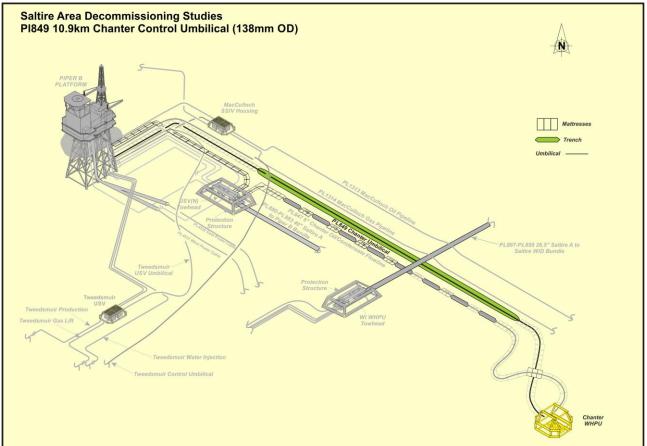
7.1 Group Characteristics

The individual items that make up Group 4 – Trenched & Buried Umbilicals / Power Cables are detailed fully within the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. The umbilical is buried along the majority of its length, there are two sections where there are free spans, since 2012 the amount of exposure on the umbilical varies between 0.2% and 0.3% of the total length **[Ref. 5]**. By way of summary, the layout is shown in Figure 7.1 and Figure 7.2 and the key characteristics for Group 4 are presented in Table 7.1:

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL849	Chanter umbilical	Chanter	6	10,790	361
PL4531	West power cable	Saltire	5	7,241	260
PL4532	East power cable	Saltire	5	7,263	261

Note: The Chanter Umbilical and East and West Power Cables are trenched and buried along almost their entire lengths.





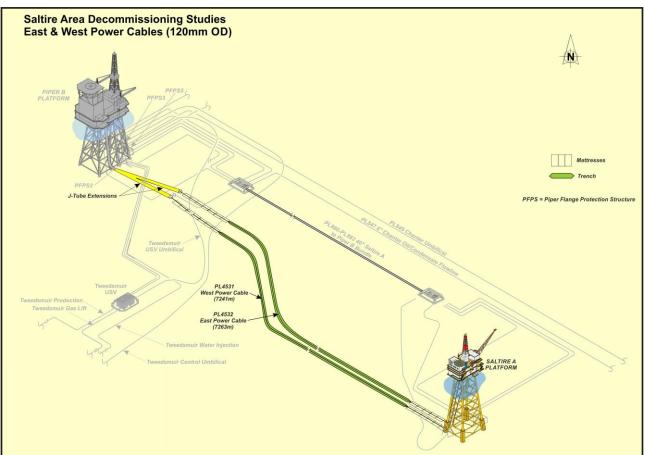
The Chanter Umbilical (PL849) is trenched and buried along almost its entire length, with the ends protected by concrete mattresses. The umbilical is laid from the Chanter WHPU to the Piper B platform [**Ref. 5**].



A total of 5 free spans were reported in the latest survey data **[Ref. 5]** for the Chanter Umbilical with a total length of 15 m. The free spans can be classified as follows:

- > All free span lengths less than 5 metres;
- > The longest free span was also the deepest free span, measuring 4.2 m long and 0.4 m deep.
- > No free spans exceed FishSAFE limits (i.e. all free spans are less than 10 m in length and 0.8 m in height).

As identified in Section 5.1, the Chanter Umibilcal is crossed by the surface laid Saltire A to Saltire WID Bundle. It is also crossed by the Tweedsmuir Control Umbilical local to the Piper B end of the Chanter Umbilical.





The East and West Power Cables are laid in parallel and are trenched and buried over almost their entire length between Piper B and Saltire A with concrete mattresses protecting the untrenched ends. At the Piper B end, the cables enter J-tube extensions on their approach to the platform **[Ref. 5]**.

Based on the latest survey data, the East and West Power Cables are considered to be well buried along their entire length, with no free spans or exposures. The power cables are crossed by the Tweedsmuir Control Umbilical and the Tweedsmuir USV Umbilical as well as a redundant spool associated with the Saltire A to Piper B Bundle, all local to the Piper B ends of the power cables **[Ref. 5]**.



7.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 4 – Trenched & Buried Umbilicals / Power Cables are detailed in Table 7.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are fully detailed within the Removal Options Screening Report **[Ref. 7]**.

Prior to decommissioning, the following activities will be required, regardless of the option selected:

- > Disconnection and removal of all associated jumpers.
- > Removal of all associated mattresses and grout bags (over exposures).

Group 4 – Trenched & Buried Umbilicals / Power Cables					
Category	Option	Description			
Leave in-situ (minor intervention)	1a – Do nothing	Perform no activities to remediate the ends or the free spans of the umbilical / power cables. This option was not carried forward as it is unacceptable from a safety and societal perspective.			
	1b – Remediate ends only	Rock placement or burial of the ends of the umbilical / power cables with no remediation of free spans. This option was not carried forward as it is unacceptable from a safety and societal perspective.			
Leave in-situ (major intervention)	2a – Trench and bury exposures	Disconnect and remove the umbilical / power cable ends with subsequent mobilisation of a trenching vessel to trench and backfill the exposed sections of umbilical / power cables to a sufficient depth below seabed level.			
	2b – Cut and remove exposures	Disconnect and remove the umbilical / power cable ends then cut and lift any exposed sections of the umbilical / power cables and perform local dredging to lower the cut ends and cut out sections. It should be noted that alternative strategies (e.g. rock placement on the cut ends) could be adopted for dealing with the umbilical / power cable ends and cut out sections.			
	2c – Rock cover exposures	Disconnect, cut and lift the umbilical / power cable ends with subsequent mobilisation of a fall pipe vessel for rock placement on exposed ends and at other exposures /free spans.			
Full removal	3 – Reverse reeling	Deburial operations of umbilical / power cable (if required) followed by reverse reeling to a recovery vessel. The recovery vessel would connect onto the umbilical / power cable and proceed to reverse reel along the route. The recovered umbilical / power cable would be returned to shore for disposal.			

Table 7.2: Group 4 Decommissioning Options

7.3 Decommissioning Options for Evaluation

The decommissioning options for Group 4 that remained after screening and were taken forward to the evaluation phase are:

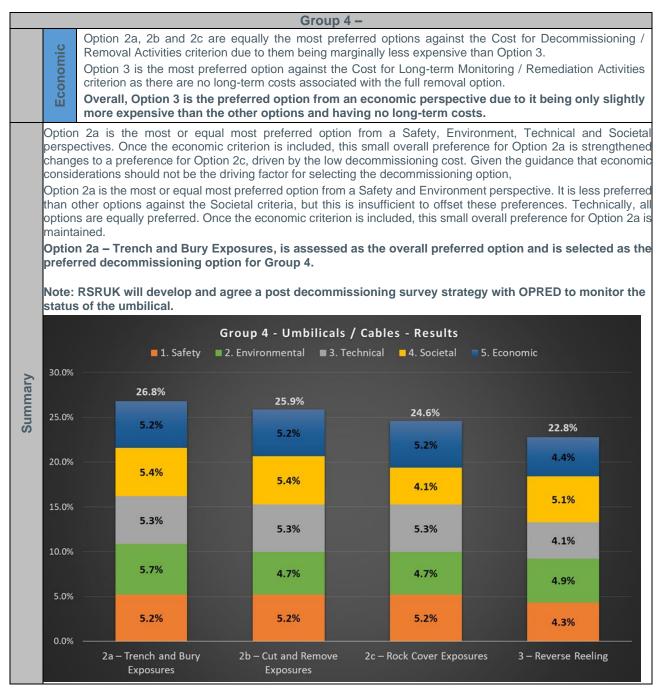
- > Leave in-situ (major intervention):
 - 2a Trench and bury exposures.
 - 2b Cut and remove exposures.
 - \circ 2c Rock cover exposures.
- > Full removal:
 - \circ 3 Reverse reeling.



7.4 Evaluation Summary

Group 4 –						
ß			2a – Trench and hury			
Screening		1a – Do nothing	1b – Remediate ends only	exposures		
Scre	2b	- Cut and remove exposures	2c – Rock cover exposures	3 – Reverse reeling		
		Note: See Appendix E	for full attributes tables and ass	sessment		
Evaluation	Safety	All options were equally preferred against the Offshore Personnel criterion as the risk exposure was considered largely similar across the options. Reverse reeling would involve slightly more offshore working time, but this was not considered significant enough to move the assessment off neutral. Option 2a, 2b and 2c are the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3 (reverse reel). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3 is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with the other options is relatively similar given that all snag hazards would be remediated, and all exposures fully buried or rock covered. Overall, Option 2a, 2b and 2c are equally preferred against the Safety criterion.				
	Environment	 Option 2a, 2b, 2c are equally preferred against the Impact of Decommissioning Operations Offshore criterion. This is due to the duration of the operations and thus the associated environmental impact being largely similar. Option 3 was marginally less preferred. All options are equally preferred against the Processing of Returned Material criteria as, while there are differences in the material returned to shore across the options, with Option 3 being higher, this was considered insufficient to express a preference from an environmental perspective. All options were considered similar from a Resource Consumption perspective. However, the higher quantity of rock required for Option 2b and 2c was considered sufficient to express a small preference for the other options. As such, Option 2a and 3 are equally preferred against the Resource Consumption criterion. Options 2a, 2b and 2c are marginally preferred from a Seabed Disturbance perspective due to the short-term impact on the seabed environment from the deburial operations associated with the full length reverse reeling (Option 3). Options 2a and 3 are equally preferred against the Loss of Habitat criterion due to the higher long-term impact from rock placement with the other options. Overall, Option 2a is the preferred option against the Environment criterion. 				
	Technical	 All options were equally preferred against the Contracting Strategy criterion as all options could be delivered by a variety of vendors and thus provide for a flexible contracting strategy. Options 2a, 2b and 2c were equally preferred over Option 3 against the Schedule criterion due to the shorter offshore durations, the largely routine operations and the small potential for integrity failure of the line during reverse reeling. Options 2a, 2b and 2c were also equally preferred over Option 3 against the Technical Maturity criterion due to the routine operations versus the limited track record of reverse reeling. Overall, Options 2a, 2b and 2c are equally preferred against the Technical criterion. 				
	Societal	 Options 2a, 2b and 3 are equally most preferred against the Political criterion. Given that the line is trenched and buried along the majority of its length, the addition of rock berms associated with Option 2c was assessed as being the least attractive option. Option 3 achieves the clear seabed aspiration with no potential risk of future deburying of the flowline and is therefore the most preferred option from a political perspective. Options 2a, 2b and 3 are equally most preferred from a fisheries perspective. Option 2c (rock cover), while designed for overtrawlability, presents a series of long rock berms that is less attractive from a commercial fishing operations perspective. From a socio-economic perspective, all options are assessed as being equally preferred as the negative impact from the increase in material being returned for processing under Option 3 is offset by the benefit of additional job creation / retention. Overall, Options 2a, 2b and 3 are equally preferred against the Societal criterion. 				







8 **RECOMMENDATIONS**

The outcomes obtained from performing the CA of the decommissioning groups and decommissioning options for the Subsea Infrastructure of the Saltire Area Decommissioning Project are summarised here.

In accordance with the BEIS Guidelines **[Ref. 1]**, there were four groups identified at the scoping stage where full removal was the recommended decommissioning approach without any further consideration. These are:

- > Group 5 Subsea structures
- > Group 6 Towhead umbilicals
- > Group 7 Spools / jumpers
- > Group 8 Mattresses & grout bags Note 1

Note 1: It should be noted that, where mattresses and grout bags are found which have deteriorated to a point where it would be unsafe to attempt to recover them, these will be discussed with OPRED and, where agreed, shall be buried in situ to avoid causing future snagging hazards.

The full CA process was applied to the remaining decommissioning groups. Following a balanced assessment of the criteria, a discussion of the relative merits of the decommissioning options is presented along with the recommended decommissioning option with a short description of the steps to deliver the option.

8.1 Group 1 – Saltire A to Piper B Bundle Discussion and Outcome

The Saltire A to Piper B Bundle is a 40-inch, Surface Laid Bundle and as such, Option 2b – Trench and Bury and Option 3a – Cut and Lift were both assessed as being highly technically challenging. This is due to the diameter of the bundle being beyond the limit of current trenching technology and there being no track record for cutting and lifting a bundle of this diameter. These challenges are exacerbated by the increase in technical risk exposure from the extended offshore operations and the limited contracting options presented by novel activities that need technology development to deliver.

This assessment against the Technical criterion was reflected in the assessment against the Safety criterion due, in the main, to the increased risk exposure from the extended offshore work scopes.

It should be noted that these options were assessed as being more attractive against the Environmental criterion, dominated by the lower long-term environmental impact of the trench and bury / cut and lift options. Similarly, the assessment against the Societal criterion showed these options to be preferred. However, cumulatively, these options were shown to be the least attractive overall.

Option 1b – Remediate Ends and Spans Only and Option 2c – Rock Cover Bundle were both assessed as being preferred against the Safety criterion, again due to the reduced risk exposure from the reduced offshore work scopes and onshore handling of returned material. This is also reflected in the assessment against the Technical criterion where, given the surface laid nature of the large diameter bundle, the remediate ends / rock cover options are considered largely routine subsea activities.

These options are less preferred against the Environmental and Societal criteria due to the impact of leaving the bundle in situ leading to long-term alteration of the seabed and having a continued impact on commercial fishing operations. In both cases, the rock cover option was deemed less attractive than the remediate ends option.

Overall, before the Economics criterion is included, there is a small preference for Option 1b – Remediate Ends and Spans Only over Option 2c – Rock Cover Bundle. This position is strengthened significantly once economic considerations are included due to the rock cover option being 5 times more expensive to deliver than the remediate ends only option.



As such, the selected decommissioning for Group 1 – Saltire A to Piper B Bundle is:

- > Option 1b Remediate Ends and Spans Only
 - Following survey of the bundle, protective mattresses and grout bags shall be removed from the tie-in spools, umbilicals and crossings. Tie-in spools shall be disconnected from the bundle towheads and removed. Towheads and towhead protection structures will be disconnected from the bundle and removed.
 - Rock will be placed over the cut ends of the bundle and at free span locations (may also be required at areas susceptible to free spanning). It should be noted that alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at free span) may be adopted.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 1b – Remediate Ends and Spans Only being the preferred method of decommissioning Group 1 – Saltire A to Piper B Bundle.

8.2 Group 2 – Saltire A to Saltire WID Bundle Discussion and Outcome

The Saltire A to Saltire WID Bundle is assessed in a similar fashion to the Saltire A to Saltire B Bundle from a technical perspective with the key difference being the diameter is 27.5-inch rather than 40-inch. This smaller diameter makes the technical challenges associated with trenching the bundle slightly more manageable in that this is at the limit of existing trenching technology rather than beyond it. However, the technical challenges are still relevant given the lack of track record for trenching a bundle of this diameter or performing full removal via cut and lift. Additionally, the technical aspects relating to the offshore schedule and contracting strategy remain.

As would be expected, these technical challenges are again reflected in the assessment against the Safety criterion due to the risk exposure from the extended and challenging offshore work scopes.

As with the 40-inch bundle in Group 1, Option 1b – Remediate Ends and Spans Only and Option 2c – Rock Cover Bundle were both preferred against the Safety criterion, due to the reduced risk exposure from the reduced offshore work scopes and onshore handling of returned material. Again, this is reflected in the assessment against the Technical criterion where, given the surface laid nature of the bundle, the remediate ends / rock cover options are considered largely routine subsea activities.

The Environmental and Societal criteria assessments of the options available for the Saltire A to Saltire WID bundle were similar to those for the Group 1 Saltire A to Piper B bundle in that there was a preference for the trench / cut and lift options over the remediate / rock cover options. In addition, the rock cover option was judged to be less attractive than the remediate ends / free spans option for similar reasons as the Group 1 bundle.

Overall, this resulted in all options being assessed as relatively close, with a small preference for Option 1b – Remediate Ends and Spans Only. Once economics were included in the consideration, this preference was strengthened, again due to the lower cost of delivering Option 1b.

As such, the selected decommissioning for Group 2 – Saltire A to Saltire WID Bundle is:

- > Option 1b Remediate Ends and Spans Only
 - Following survey of the bundle, protective mattresses and grout bags shall be removed from the tie-ins, umbilicals and crossings. Tie-in spools shall be disconnected from the bundle towheads and removed. Towheads and towhead protection structures will be disconnected from the bundle and removed.
 - Rock will be placed over the cut ends of the bundle, and at free span locations (may also be required at areas susceptible to free spanning). It should be noted that



alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at free span) may be adopted.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 1b – Remediate Ends and Spans Only being the preferred method of decommissioning Group 2 – Saltire A to Saltire WID Bundle.

8.3 Group 3 – Chanter Oil/Condensate Flexible Flowline Discussion and Outcome

Given that the flexible flowline is trenched and buried along the majority of its length, there are challenges associated with the full removal of this line via reverse reeling. Additionally, the benefits from fully removing an already trenched and buried line are much less pronounced.

As such, reverse reeling was the least preferred option against the Technical and Safety criteria due to the extended offshore work scopes. All other options were considered largely similar.

A key differential between the remaining three options of Option 2a – Trench and Bury Exposures, Option 2b – Cut and Remove Exposures and Option 2c – Rock Cover Exposures is the impact from the rock introduced. The introduction of rock cover was sufficient for Option 2b and Option 2c to be assessed as less preferred than Option 2a against the Environmental criterion due to the long-term seabed impact and Option 2c to be less preferred than Options 2a and 2b due to the impact on commercial fishing operations under the Societal criterion.

Overall, this resulted in Option 2a being the preferred option prior to economic considerations being included. Once economics were included, the preference switched to rock cover, due to the lower cost of delivering the rock cover option. However, given the guidelines from BEIS that economic considerations should not be the driver for the selection of the decommissioning option, the preference for Option 2a is retained.

As such, the selected decommissioning for Group 3 – Chanter Oil/Condensate Flexible Flowline is:

- > Option 2a Trench and Bury Exposures
 - Following survey of the line, protective mattresses and grout bags shall be removed from the pipeline ends and exposures. The Chanter wellhead protection unit will be removed. The on-seabed sections of the uncovered flowline between the flowline trench and the associated subsea structure shall be cut/disconnected and removed.
 - A jet trencher will then be deployed to trench and bury the flowline cut ends and the mid-line exposures to a sufficient depth below seabed level.
 - Rock cover shall be used as back-up should difficulties in performing trenching operations or achieving the sufficient depth of cover below seabed be experienced. In this event, Repsol Sinopec Resources UK Limited would liaise with OPRED.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 2a – Trench and Bury Exposures being the preferred method of decommissioning Group 3 – Chanter Oil/Condensate Flexible Flowline.

8.4 Group 4 – Trenched & Buried Umbilicals / Power Cables Discussion and Outcome

As with the flexible flowline in Group 3, the umbilicals and power cables associated with Group 4 are also trenched and buried along the majority of their length. As such, the assessment and outcomes from Group 3 are reflected in Group 4.

The key difference in the assessment is that the costs for delivering the options is more balanced across the options and therefore, once economic considerations are included, the preference for Option 2a is not altered.



As such, the selected decommissioning for Group 4 – Trenched & Buried Umbilicals / Power Cables is:

- > Option 2a Trench and Bury Exposures
 - Following survey of the umbilicals / cables, protective mattresses and grout bags shall be removed from umbilical / cable ends and exposures. The on-seabed sections of the uncovered umbilicals and cables between the trench terminations and the associated platform J-tube/J-tube extension will then be cut and removed.
 - A jet trencher will then be deployed to trench and bury the exposed ends of the cut umbilicals / cables and any existing areas of exposure to a sufficient depth below seabed level.
 - Rock cover shall be used as back-up should difficulties in performing trenching operations or achieving the sufficient depth of cover below seabed be experienced. In this event, Repsol Sinopec Resources UK Limited would liaise with OPRED.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 2a – Trench and Bury Exposures being the preferred method of decommissioning Group 4 – Trenched & Buried Umbilicals / Power Cables.



9 REFERENCES

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APPENDIX A EVALUATION METHODOLOGY

Appendix A.1 CA Evaluation Methodology

Repsol Sinopec Resources UK Limited 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 as part of the Comparative Assessment Methodology Report [Ref. 11] 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' study work (Preparation Phase) to obtain any further information to help inform decision making.
- > Discuss Emerging Recommendations with stakeholders.
- > Recycle process as required prior to decision on the selected options that will be presented in the Decommissioning Programme and assessed in the Environmental Appraisal.

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

Appendix A.2 Differentiating Criteria & Approach to Assessment

A key step in setting up the CA was agreeing and defining the appropriate criteria that differentiates between each of the tabled options. As a starting point, the criteria considered for this CA were taken from the Guidelines for Decommissioning of Offshore Oil and Gas Installations and Pipelines [Ref. 1], which are as follows (in no particular order):

- > Safety
- > Environmental
- > Technical
- > Societal
- > Economic

These differentiating criteria were found to be appropriate for the decommissioning options tabled and were taken forward as the main differentiating criteria for the CA. Additional sub-criteria and definitions were added for clarity and are shown in the Table A.1 alongside the approach used for assessment under each criteria or sub-criteria.



Table A.1: Sub-Criteria Definition

Differentiator	Sub-Criteria	Description	Approach to Assessment
	1.1 Personnel Offshore	This sub-criterion considers elements that impact risk to offshore personnel and includes, project team, project vessel crew, diving teams, supply boat crew, and survey vessel crew. It should be noted that crew changes are performed via port calls. Any requirement for handling HazMat / NORM shall also be addressed here.	A HAZID was conducted as a group activity within a workshop format [Ref. 12] . There were two separate workshops held, Part 1 and Part 2. Part 1 focused on the different activities taking place within the various Screened options.
1. Safety	1.2 Personnel Onshore	This sub-criterion considers elements that impact risk to onshore personnel. Factors such as any requirement for dismantling, disposal operations, material transfer and onshore handling may impact onshore personnel. Any requirement for handling HazMat / NORM shall also be addressed here.	Hazards associated with the activities were identified and any potential Major Accident Hazards (MAH) were identified. An initial risk scoring was applied to each activity / hazard which was further considered within Part 2.
1. Salety	1.3 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, recreational vessels and military vessels are considered.	Part 2 focused on each of the options and applied the results from Part 1 to the circumstances of each option to produce a finalised score for each option that is used directly within the CA Evaluation Phase. The results were provided in
	1.4 Residual Risk	This sub-criterion addresses residual safety risk to other sea users i.e. fishermen, military vessel crews, commercial vessel crews and passengers, other sea users, that is provided by the option. Issues such as residual snag risk, collision risk, etc. may be considered.	the Repsol Sinopec Resources UK Risk Matrix format to allow comparison between options. Fishing intensity [Ref. 13] and risk assessment studies [Ref. 14] were carried out to support the HAZID assessments.
	2.1 Impact of Decommissioning Operations Offshore	This sub-criterion covers elements such as Noise, Energy & Emissions and Aqueous Discharges. Also to consider discharges and emissions associated with the disturbance of cuttings, use of explosives, etc.	A CA ENVID was conducted as a group activity within a workshop format to identify whether there were any differentiators between the decommissioning options for the jacket, and to
2. Environmental	2.2 Processing of Returned Materials	This sub-criterion covers the Processing of Returned Materials resulting in Use of Landfill	determine whether these differences could have a significant environmental or societal impact.
	2.3 Resource Consumption	This sub-criterion relates to the resource consumption for carrying out the decommissioning activity (e.g. Rockdump, but not fuel as that is covered above) and Replacement Materials – e.g. steel).	All aspects identified within the ENVID were tagged against specific related Environmental and Societal sub-criteria with the output of the
	2.4 Disturbance	This sub-criterion relates to the Physical Disturbance to the Seabed during Decommissioning Operations (Short Term).	CA ENVID [Ref. 15] being directly fed into the CA process, providing a clear and auditable trail
	2.5 Loss of Habitat	This sub-criterion relates to the Loss of Habitat (Legacy/Long Term).	of the assessment.



Differentiator	Sub-Criteria	Description	Approach to Assessment
3. Technical	3.1 Contracting Strategy	The focus of this sub-criterion is on the risk to the project of whether the contracting strategy is restricted by a particular option (e.g. if the option involves only one possible vendor).	
	3.2 Schedule schedule required for a particular option may have on the su the project (e.g. an extended offshore decommissioning can running over several seasons), including the potential for sig schedule overruns and the complexity of the overall decomm strategy.		Assessment based on engineering method statements and considers elements such as novelty, risk of failure and availability of technology.
	3.3 Technical Maturity	This sub-criterion relates to the technological "readiness" of an option and the risk that the use of a particular technology (especially if unproven or untested) may have on the success of the project.	
	4.1 Regulatory	This sub-criterion addresses the risk to the success of the project from the regulatory implications of each option, including the potential for issues in gaining government approval of the overall project decommissioning programme and the potential for setting a new precedent in decommissioning activities that other operators may be forced to follow.	A qualitative judgement based upon the experience of the CA workshop team members.
4. Societal	4.2 Impact on Commercial Fisheries	The focus of this sub-criterion is on exclusion zones, inability to fish in areas and if decommissioning will have resulted in a loss of habitat for target species – e.g. through leaving pipelines in place or rock placement)	A CA ENVID was conducted as a group activity within a workshop format to identify whether there were any differentiators between the decommissioning options for the jacket, and to
	4.3 Socio- economic impact on communities and amenities	This sub-criterion addresses the impact from any near-shore and onshore operations and end-points (dismantling, transporting, treating, recycling, land filling) on the health, wellbeing, standard of living, structure or coherence of communities or amenities; e.g. business or jobs creation, increases in noise, dust or odour pollution during the process which has a negative impact on communities, increased traffic disruption due extra-large transport loads. May be positive or negative Jobs created Establishment of track record Improvements to roads, quaysides etc.).	determine whether these differences could have a significant environmental or societal impact. All aspects identified within the ENVID were tagged against specific related Environmental and Societal sub-criteria with the output of the CA ENVID [Ref. 15] being directly fed into the CA process, providing a clear and auditable trail of the assessment.



Differentiator	Sub-Criteria	Description	Approach to Assessment
	5.1 Cost for decommissioning / removal activities	This sub-criterion addresses the total cost of performing the physical decommissioning of the infrastructure. No allowance for time discounting of expenditure is allowed for in this sub-criterion as it is assumed that the decommissioning activities for each option will be carried out over a relatively short timescale (i.e. less than a year).	Quantified in the Pipeline and Subsea Infrastructure Removal Report [Ref. 9].
5. Economic	5.2 Cost for long term monitoring / remediation activities	This sub-criterion addresses the total cost of monitoring any remaining infrastructure following decommissioning plus any potential costs for remediation activities that may be required if the infrastructure degrades. Data should be presented to show the total cost and time discounted cost for monitoring of infrastructure with only the total "as now" cost required for potential remediation activities.	Quantified in the Long-Term Monitoring Assessment Report [Ref. 16] .



Appendix A.3 Differentiator Weighting

The 5 differentiating main criteria all carry a 20% weighting. That is, all criteria are neutral to each other. The figure below shows the pairwise comparison matrix. Repsol Sinopec Resources UK Limited decided that equal weightings for the main criteria offers the most transparency and a balanced view from all perspectives.

Criteria	1. Safety	2. Environmental	3. Technical	4. Societal	5. Economic	Weighting
1. Safety	N	N	N	N	N	20%
2. Environmental	N	N	N	N	N	20%
3. Technical	N	N	N	N	N	20%
4. Societal	N	N	N	N	N	20%
5. Economic	N	N	N	N	N	20%

Table A.2: Example Pairwise Comparison Matrix (N = Neutral)

Weightings for the differentiating sub-criteria were developed using a pair-wise comparison for the sub-criteria. The pair-wise comparison adopted in this case used phrases such as much stronger, stronger, weaker, much weaker, etc. to make qualitative judgements of the relative impact/importance that each of the sub-criteria would have on the overall comparative assessment decision.

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, Repsol Sinopec Resources UK Limited 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. It was agreed that three positions from equal (and their reciprocals) would be sufficient for this CA.



These positions were:

Table A.3: Explanation	of Phrasing	Adopted for I	Pairwise	Comparison
	et t maenig	/ doptod ioi i		oompanoon

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

The pair-wise comparison process for the differentiating sub-criteria resulted in the following sub-criteria weightings **[Ref. 11]**:

1. Safety	1.1 Personnel Offshore	1.2 Personnel Onshore	1.3 Other Users	1.4 Residual Risk	Weighting
1.1 Personnel Offshore	N	N	MS	S	33.6%
1.2 Personnel Onshore	N	N	MS	S	33.6%
1.3 Other Users	MW	MW	N	w	12.0%
1.4 Residual Risk	W	W	S	N	20.8%

Figure A.1: Weighting of Safety Sub-Criteria



2. Environmental	2.1 Impact of Decommissioning Operations Offshore	2.2 Processing of Returned Materials	2.3 Resource Consumption	2.4 Disturbance	2.5 Loss of Habitat	Weighting
2.1 Impact of Decommissioning Operations Offshore	N	S	S	w	MW	15.2%
2.2 Processing of Returned Materials	w	Z	S	MW	MW	11.3%
2.3 Resource Consumption	w	w	N	MW	MW	9.6%
2.4 Disturbance	s	MS	MS	N	W	27.2%
2.5 Loss of Habitat	MS	MS	MS	S	N	36.7%

Figure A.2: Weighting of Environmental Sub-Criteria

Figure A.3: Weighting of Technical Sub-Criteria

3. Technical	3.1 Contracting Strategy	3.2 Schedule	3.3 Technical maturity	Weighting
3.1 Contracting Strategy	N	S	w	30.7%
3.2 Schedule	w	N	MW	18.6%
3.3 Technical maturity	S	MS	N	50.7%



4. Societal	4.1 Regulatory	4.2 Impact on Commercial Fisheries	4.3 Socio-economic impact on communities and amenities	Weighting
4.1 Regulatory	N	S	MS	50.7%
4.2 Impact on Commercial Fisheries	w	N	s	30.7%
4.3 Socio-economic impact on communities and amenities	MW	w	N	18.6%

Figure A.4: Weighting of Societal Sub-Criteria

Figure A.5: Weighting of Economic Sub-Criteria

5. Economic	5.1 Cost for decommissioning / removal activities	5.2 Cost for long term monitoring / remediation activities	Weighting
5.1 Cost for decommissioning / removal activities	N	MS	75.0%
5.2 Cost for long term monitoring / remediation activities	MW	N	25.0%

Based upon the above sub-criteria comparisons and the weighting of 20% applied to each of the main criteria, the weighting for each of the sub-criteria for the overall comparison is as follows:

- > Safety 1.1. Personnel Offshore: 6.72% (i.e. 33.6% of 20%).
- > Safety 1.2 Personnel Onshore: 6.72%.
- > Safety 1.3 Other Users: 2.40%.



- > Safety 1.4 Residual Risk: 4.16%.
- > Environmental 2.1 Impact of Decommissioning Operations Offshore: 3.04%.
- > Environmental 2.2 Processing of Returned Materials: 2.26%.
- > Environmental 2.3 Resource Consumption: 1.92%.
- > Environmental 2.4 Disturbance: 5.44%.
- > Environmental 2.5 Loss of Habitat: 7.34%.
- > Technical 3.1 Contracting Strategy: 6.14%.
- > Technical 3.2 Schedule: 3.72%.
- > Technical 3.3 Technical Maturity: 10.14%.
- > Societal 4.1 Regulatory: 10.14%.
- > Societal 4.2 Impact on Commercial Fisheries: 6.14%.
- > Societal 4.3 Socio-economic Impact on Communities and Amenities: 3.72%.
- > Economic 5.1 Cost for Decommissioning / Removal Activities: 15.00%.
- > Economic 5.2 Cost for Long Term Monitoring / Remediation Activities: 5.00%.



Appendix A.4 Option Attributes

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

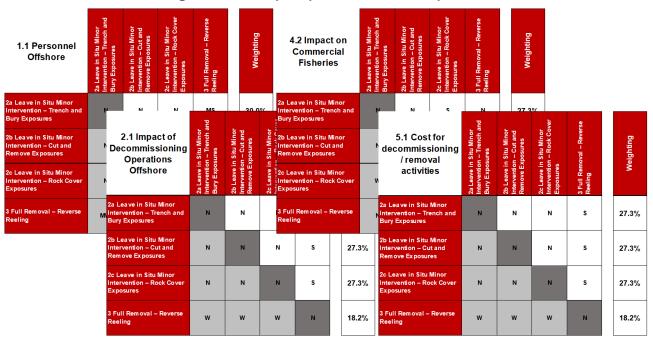
Any additional discussion around the relative merits of the options was also recorded in the attributes matrix. A summary discussion of why options are considered more or less attractive with respect to each of the differentiating criteria was also recorded.

Appendix A.5 Option Pair-wise Comparison

Once the option attributes were compiled and discussed, a pair-wise comparison was performed for each of the differentiating criteria where the proposed options were compared against each other using the same method as was used to develop the weightings for the sub-criteria weightings.

Using this transposed scoring system made it simpler and, more importantly, more effective at capturing the mind-set and feeling of the attendees at the workshops. Phrases such as 'what are the relative merits of pipeline removal on a project versus rock placement 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 below.





Where all options have been assessed to be neutral for a particular sub-criterion, that sub-criterion has been removed from the final assessment to ensure that differences between options are more clearly represented (although the discussion and justification for neutral assessment has been



retained in the relevant attributes table). Where sub-criteria have been removed from the final assessment, the relative pair-wise comparisons for the remaining sub-criteria have been retained as per the original assessment.

Appendix A.6 Visual Output and Sensitivities

The decision-making tool used the above pair-wise 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, an opportunity was provided to fine tune the judgements made to ensure that all attendees were happy to endorse the outcome. The visual outputs from each decision point are included in Appendix C. An example of the visual output obtained is shown below:

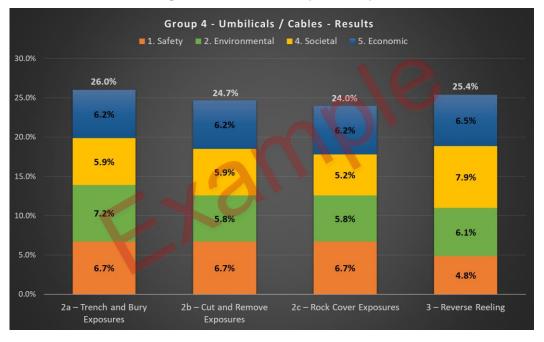


Figure A.7: A Visual Output Example

The CA output was then stress tested by the workshop attendees by undertaking sensitivity analyses where applicable:

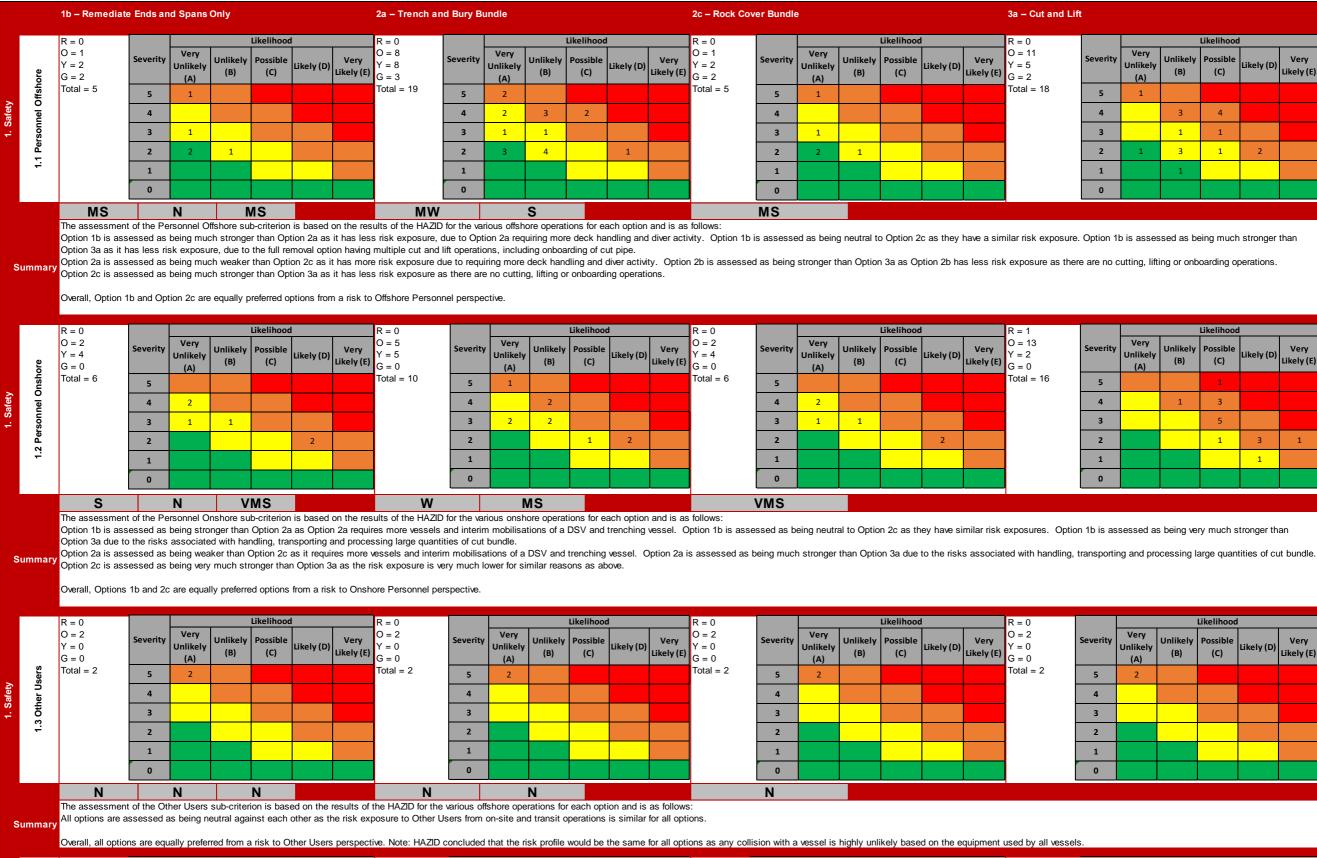
- > By applying a modification to the weighting of the criteria bearing in mind that the base case for this assessment is to have all main criteria equally weighted, and / or
- > Modifying the pair-wise comparison of the options against each other within the criteria where appropriate.

These sensitivities helped inform the workshop attendees as to whether a particular aspect was driving a preferred option, or indeed if the preferred option remains the same when the sensitivities were applied.

A variety of sensitivities were conducted, none of which had any material impact on the selected outcome.

APPENDIX B GROUP 1 – DETAILED EVALUATION RESULTS

Group 1 Attributes Table Appendix B.1

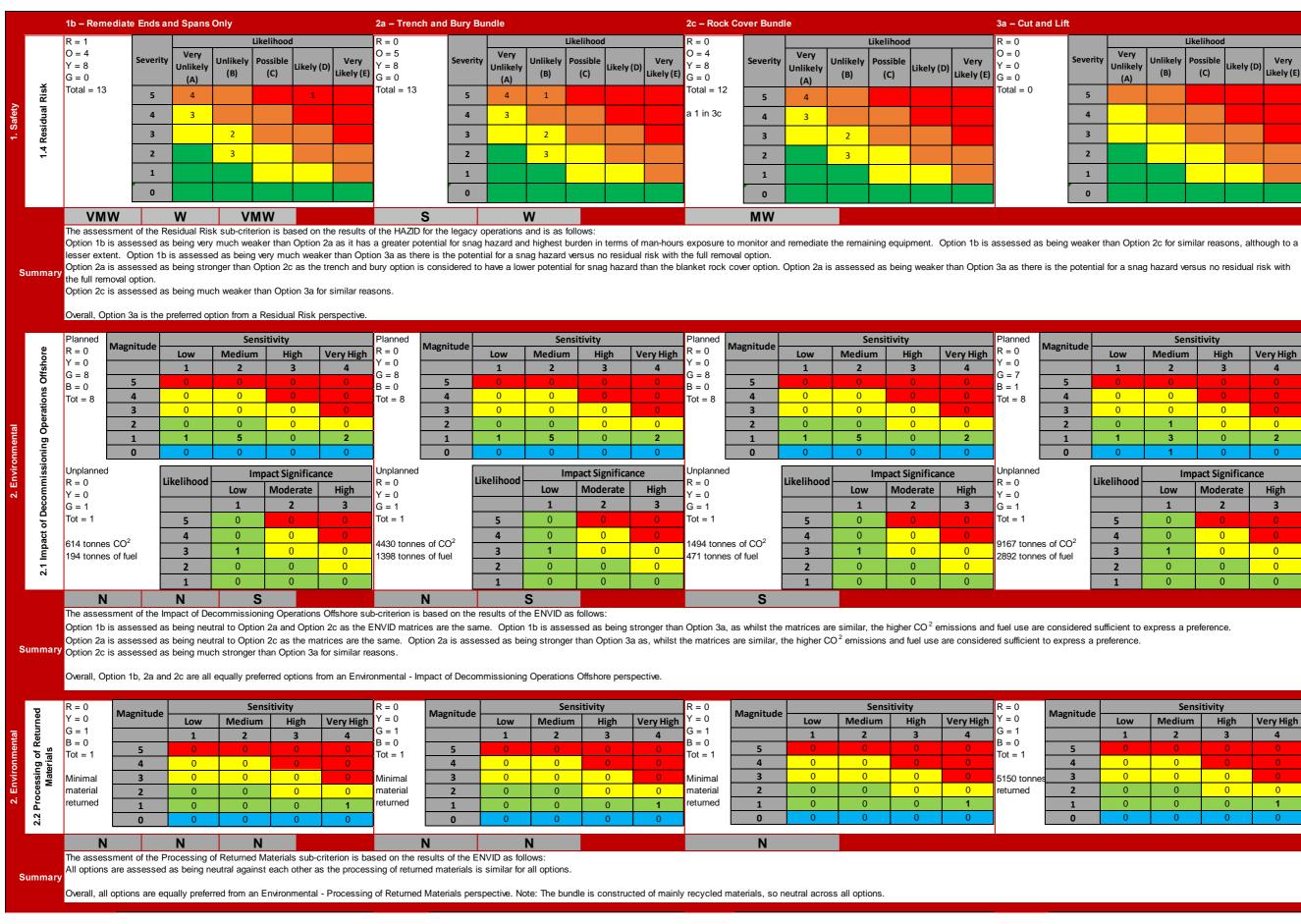




t									
		Likelihood							
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)				
5	1								
4		3	4						
3		1	1						
2	1	3	1	2					
1		1							
0									

			Likelihood		
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5			1		
4		1	3		
3			5		
2			1	3	1
1				1	
0					
1			1		1

			Likelihood		
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					
				•	





	Likelihood										
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)						
5											
4											
3											
2											
1											
0											
	Severity 5 4 3 2 1	Severity Very Unlikely (A) 5 4 4 4 3 1 2 1 1 1	Very Unlikely (A) Unlikely (B) 5 6 4 7 3 6 2 6 1 6	Very Unlikely Unlikely (A) Unlikely (B) Possible (C) 5 4 - 4 - - 3 - - 2 - - 1 - -	Very Unlikely Unlikely (A) Unlikely (B) Possible (C) Likely(D) 5 4 6						

	-								
itude		Sens	itivity						
ntuue	Low	Medium	High	Very High					
	1	2	3	4					
5	0	0	0	0					
4	0	0	0	0					
3	0	0	0	0					
2	0	1	0	0					
1	1	3	0	2					
0	0	1	0	0					
		Impact Significance							
		Imp							
	Likelihood	<u> </u>		lice					
	Likelihood	Low	Moderate	High					
	Likelihood	Low 1							
	Likelihood		Moderate	High					
02		1	Moderate 2	High 3					
	5	1 0	Moderate 2 0	High 3 0					
	5 4	1 0 0	Moderate 2 0 0	High 3 0 0					
O ² Iel	5 4 3	1 0 0 1	Moderate 2 0 0 0	High 3 0 0 0					

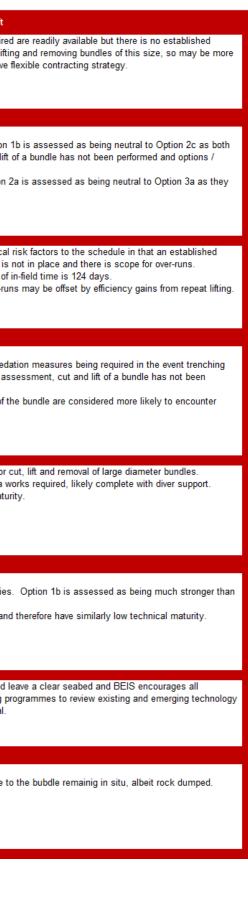
nitude		Sensi	Sensitivity					
gnitude	Low	Medium	High	Very High				
	1	2	3	4				
5	0	0	0	0				
4	0	0	0	0				
3	0	0	0	0				
2	0	0	0	0				
1	0	0	0	1				
0	0	0	0	0				

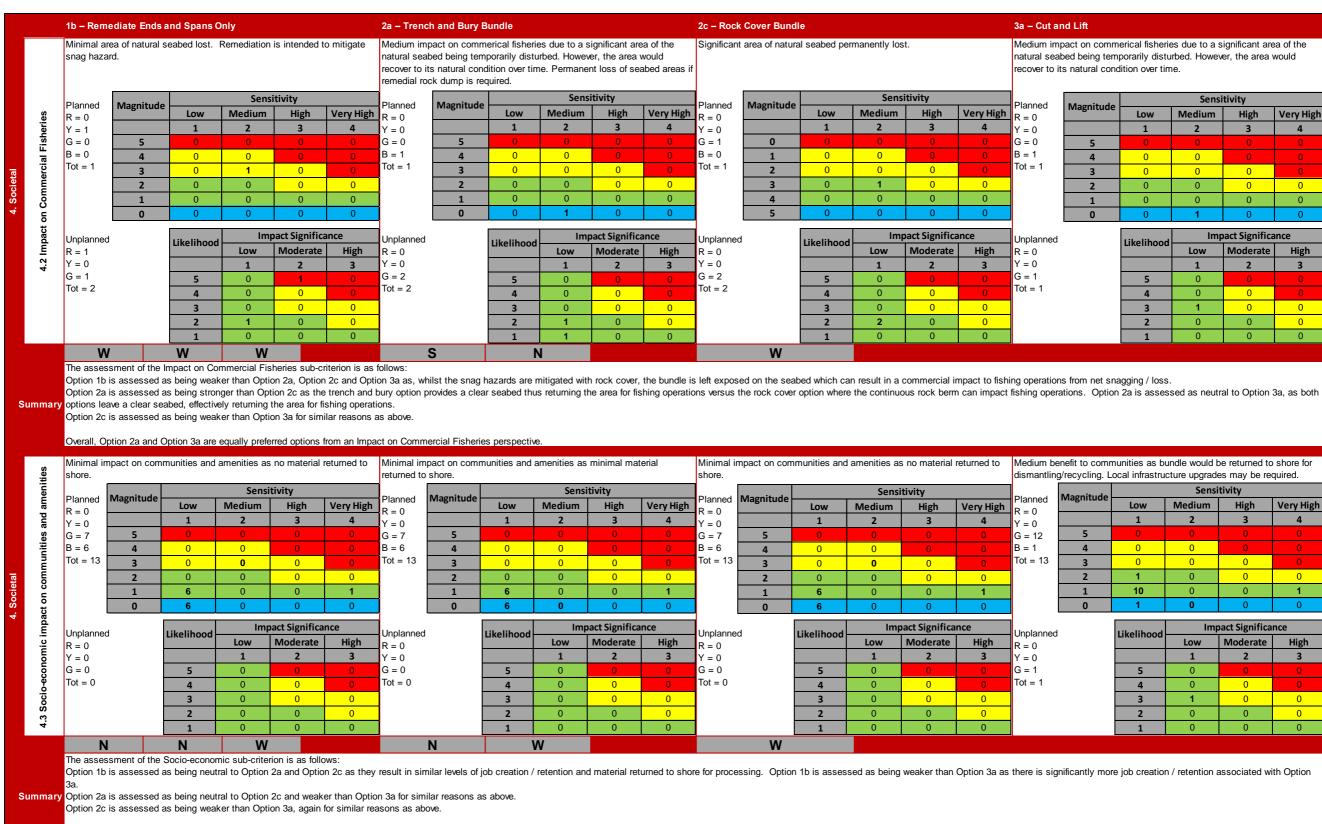
		1b – Remed	liate Ends an	nd Spans O	nly			2a – Trench	and Bury B	undle				2c – Rock	Cover Bundle	;				3a – Cut ar	nd Lift				
	-	R = 0			Sensi	tivity		R = 0			Sensi	tivitv		R = 0			Sensi	tivity		R = 0			Sensiti	vitv	
0	Consumpt	Y = 0 G = 3 B = 0 Tot = 3	Magnitude - 5 4	Low 1 0 0	Medium 2 0 0	High 3 0 0	Very High 4 0 0	Y = 0 G = 3 B = 0 Tot = 3	Magnitude 5 4	Low 1 0 0	Medium 2 0 0	High 3 0 0	Very High 4 0 0	Y = 0 G = 3 B = 0 Tot = 3	Magnitude 5 4	Low 1 0 0	Medium 2 0 0	High 3 0 0	Very High 4 0 0	Y = 0 G = 3 B = 0 Tot = 3	Magnitude 5 4	Low 1 0 0	Vledium 2 0 0	High 3 0 0	Very High 4 0 0
	2.3 Resource	1700 tonnes of rockdump	3 2 1 0	0 0 3 0	0 0 0	0 0 0	0 0 0 0	200 tonnes of rockdump	3 2 1 0	0 0 3 0	0 0 0 0	0 0 0 0	0 0 0 0	155000 tonnes of rockdum	0	0 1 2 0	0 0 0 0	0 0 0 0	0 0 0 0	0 tonnes of rockdump	3 2 1 0	0 0 3 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0	0 0 0 0
Sum	mary	Option 1b is bundle. Option 2a is Option 2c is		being neutra being strong being weak	al to Option 2 ger than Optio er than Optic	2a and Optic ion 2c, agair ion 3a, again	on 3a as they n due to the ro due the large	have similar r ock required fo amount of roo	e ENVID and esource cons or Option 2c. ck required to	Option 2a is cover the bu	option 1b is a assessed a				W n 2c as, whist have similar re			the same, th	is assessme	ent reflects th	e large quantity	of rock requi	red for Optic	n 2c to cov	er the
	nce	R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude 5 4 3 2 1 0	Low 1 0 0 0 0 0 0 0	Sens Medium 2 0 0 0 0 1 0	itivity High 3 0 0 0 0 0 0 0 0	Very High 4 0 0 0 0 0 0 0 0	R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude 5 4 3 2 1 0	Low 1 0 0 0 0 0 0 0	Sensi Medium 2 0 0 1 1 0 0 0	High High 3 0 0 0 0 0 0 0 0	Very High 4 0 0 0 0 0 0 0 0	R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude 5 4 3 2 1 0	Low 1 0 0 0 0 0 0 0 0	Sensi Medium 2 0 0 0 0 1 1 0	tivity High 3 0 0 0 0 0 0	Very High 4 0 0 0 0 0 0	R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude - 5 4 3 2 1 0	Low 1 1 0 0 0 0 0 0 0 0 0	Sensiti Medium Image: Constraint of the sensition of the sense sensensition of the sense sensitis and the sense sensi		Very High 4 0 0 0 0 0 0
Sum	mary	Option 1b is surface laid l Option 2a is Option 2c is	oundle is cons	being strong sidered mini being neutra being weak	ger than Opti mal. al to Option 2 er than Optic	on 2a and C 2c as the im on 3a as the	pption 2c as the pact from trer impact of cut	here is less sl aching and roo and lift opera	s: hort-term sea ck placement tions are exp	of the line is	nce compare	similar. Op	tion 2a is ass								e seabed distur		ated with the	e cut and lif	t of the
		R = 0			6			R = 0			Const	itivity		R = 0			Sensi	ale dan a					Sensiti		
. Environ	abitat	Y = 0 Y = 1 G = 0 B = 0 Tot = 1	Magnitude 5 4 3 2 1 0	Low 1 0 0 0 0 0 0 0	Medium 2 0 1 0 0 0 0 0 0	itivity High 3 0 0 0 0 0 0	Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0	Y = 0 G = 0 B = 1 Tot = 1	Magnitude 5 4 3 2 1 0	Low 1 0 0 0 0 0 0 0 0 0	Medium 2 0 0 0 0 0 0 1	High 3 0 0 0 0 0 0 0	Very High 4 00 00 00 00 0 0 0	Y = 0 Y = 1 G = 0 B = 0 Tot = 1	Magnitude 5 4 3 2 1 0	Low 1 0 0 0 0 0 0	Medium 2 0 0 1 0 0 0	High 3 0 0 0 0 0 0 0 0	Very High 4 0 0 0 0 0 0 0	R = 0 Y = 0 G = 0 B = 1 Tot = 1	Magnitude - 5 4 3 2 1 0	Low 1 0 0 0 0 0 0 0 0 0 0 0 0	Medium 2 0 0 0 0 0 0 0 0 0 1		Very High 4 0 0 0 0 0 0 0
Sum	moni	Option 1b is than Option 2 for the long-t	2c as blanket erm, whereas	being much rock cover the original	weaker thar will impact a habitat will r	ng-term) sul o Option 2a a larger area o ecover post	as the bundle of seabed tha cut and lift op	will remain or n spot rock co erations unde	n the seabed over, which pe er Option 3a.	ermanently al	b and theref ters the origi	inal habitat.	Option 1b is	assessed a	MW for the long-te as being much being neutral to	weaker than	n Option 3a as	s the bundle	will remain o	n the seabed	ry under Option d with Option 1b s of habitat.	2a. Option 1 and therefore	b is assess e the origina	ed as being I habitat wil	stronger I be altered
		Option 2c is		being much	weaker Opt	ion 3a as the	ere will be no	long-term imp	act / loss of						a of permanen					-					



		1b – Remediate I	Ends and Spans	Only		2a – Trench and Bury	Bundle		2c – Rock Cover Bundle		3a – Cut and Lift
3. Technical	3.1 Contracting Strategy		ailable decommiss		irements that would Good flexibility in		of current technology, t	e but bundle outside herefore likely to be limited	Established methods and technology. limit number of available decommissio terms of contracting strategy.		The vessels require methodology for lifti challenging to have
		MS	N	MS		MW	N		MS		
9	Gummary	Option 1b is assess options consist of flexibility in terms Option 2a is assess both consist of sin Option 2c is assess	ssed as being mu similar, largely ro of contracting stra ssed as being mu nilar, largely routir ssed as being mu	utine activities which ategy are likely to b ch weaker than Op ne activities which a ch stronger than O	ption 2a due to the o h are likely to have r e limited. tion 2c, due to the o rre likely to have more	more options / greater fle uter diameter of the bund re options / greater flexib ne of the assessment, cu	xibility in terms of contr le being at the limit of c ility in terms of contract	racting strategy. Option 1b is current trenching technology ting strategy.	and therefore likely to have fewer option s assessed as being much stronger tha and therefore likely to have fewer option ontracting options / flexibility are likely to	n Option 3a as, at the time of the ass s / less flexibility in terms of contracti	sessment, cut and lift
3. Technical	le	No particular techr schedule. In field time of 20 d	-	r major risk factors	that could extend	High chance of multi-pa trench depth. High risk additional time for alten In field time of 87 days.	of failure to achieve tre native method, e.g. rock		No particular technological factors or schedule. In field time of 43 days.	major risk factors that could extend	Major technological lifting technology is Current estimate of Potential for over-ru
		MS	N	S	_	MW	W		S		
3. Technical	Gummary	does not acheive t performed, therefo Option 2a is asses schedule over-runs Option 2c is asses	he required burial re there is a great ssed as being mu s than the cut and ssed as being stro and Option 2c are	depth. Option 1b i er likelihood of sch ch weaker than Op lift operations. onger than Option 3 e equally preferred f	s assessed as being edule over-runs than tion 2c due to over-ru	g neutral to Option 2c as for routine operations. uns from trenching versus ne operations versus cut spective. This is a routine subsea large diameter bundles. Bundle is at the limit of diameter. Achieving a depth of co	they both consist of sir s routine operations. O and lift of a bundle whic a operation but there is current track record in ver of 0.6 metres along hallenging with a high ri	milar, routine activities over s ption 2a is assessed as bein		d as being stronger than Option 3a as and bury operations at the limit of the therefore more likley to experience sc	, at the time of the as outside diameter of t
		MS	N	MS	_	MW	N In these areas.		MS		
Societal		The assessment of Option 1b is assess Option 3a due to r Option 2a is assess Option 2c is assess Overall, Option 1b	f the Technical M ssed as being mu outine operations ssed as being mu ssed as being mu and Option 2c are	aturity sub-criterior ch stronger than O versus cut and lift o ch weaker than Op ch stronger than O	otion 2a due to routir of a bundle which has tion 2c due to no tra- otion 3a due to routir rom a Technical Mat	ne operations versus no t s never been performed. ck record of trenching lar ne operations versus no t turity perspective.	ge diameter bundles ve rack record of performir ve a clear seabed. How	rsus routine operations. Opt ng cut and lift of bundles.	otion 1b is assessed as being neutral to ion 2a is assessed as being neutral to (Seabed would be left with rock dump	Option 3a as neither option have been	
4. Sc	, Regu	W	S	W	we-	S	N		W		
9		Option 1b is asses Option 2a is asses Option 2c is asses	ssed as being wea ssed as being stro ssed as being wea	aker than Option 2a onger than Option 2 aker than Option 3a	and Option 3a as th	a clear seabed. Option 2a It in a clear seabed.			rench & bury and cut & lift options. Opt both result in a clear seabed.	ion 1b is assessed as being stronger	than Option 2c due t







Overall, Option 3a is the preferred option from a Socio-economic impact on communities and amenities perspective.



Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.

gnitude		Sensi	tivity	
gnitude	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Likelihood	Impact Significance							
LIKEIIIIOOU	Low	Moderate	High					
	1	2	3					
5	0	0	0					
4	0	0	0					
3	1	0	0					
2	0	0	0					
1	0	0	0					

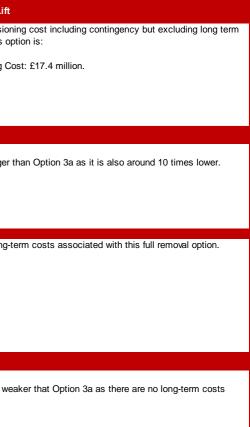
dismantling/recycling. Local infrastructure upgrades may be required.

nitude		Sensi	tivity	
intude	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	1	0	0	0
1	10	0	0	1
0	1	0	0	0

Likelihood	Impact Significance							
LIKEIIIIOOu	Low	Moderate	High					
	1	2	3					
5	0	0	0					
4	0	0	0					
3	1	0	0					
2	0	0	0					
1	0	0	0					

	1b – Remediate	Ends and Spans O	Only		2a – Trench and Bury B	Bundle		2c – Rock Cover Bundle		3a – Cut and Lif
r r ing / ties		ning cost including option is:	contingency but ex	cluding long term	The decommissioning co liabilities for this option is	0 0 ,	but excluding long term	The decommissioning cost including c liabilities for this option is:	ontingency but excluding long term	The decommission liabilities for this of the decommission of the d
 Economic Cost for Cost for decommissioning / removal activities 	Decomissioning C	ost: £1.9 million.			Decomissioning Cost: £1	9.7 million.		Decomissioning Cost: £10.0 million.		Decomissioning (
5.7 decorr remov										
	VMS	VMS	VMS		MW	N		MS		
Summary	Option 2a is asses Option 2c is asses	ssed as being weak	er than Option 2c a ger than Option 3a	as it is around doub as the costs are a	le the cost. Option 2a is a round half.		• •	nan Option 2c as it is around 5 times low ts are similar.	ver. Option 1b is assessed as being	very much stronge
omic ong term ing / activities	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are:				The long-term costs inclu Net Present Cost (NPC) this option are:	, ,		The long-term costs included survey & Net Present Cost (NPC) terms) and pot this option are:	There are no long	
5. Economic : Cost for long term monitoring / nediation activities	Survey & Monitoring Cost: £3.2 million Survey & Monitoring NPC: £0.5 million				Survey & Monitoring Cost: £3.2 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £9.4 million			Survey & Monitoring Cost: £3.2 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £5.0 million		
5.2 rem										
	N	MW	VMW		MW	VMW		MW		
Summary	Option 1b is assest associated with the	e full removal optior	ral to Option 2a due n.	e to the long term c	osts being similar. Option			n 2c as the long-term costs are £5 millio veaker that Option 3a as there are no lo	0	0







Appendix B.2 Group 1 Pair-wise Comparison Matrices - Safety												
1.1 Personnel Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift		Weighting	1.2 Personnel Onshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS		37.5%	1b – Remediate Ends and Spans Only	N	S	N	VMS	37.1%
2a – Trench and Bury Bundle	мw	N	MW	s		13.8%	2a – Trench and Bury Bundle	w	N	w	MS	20.8%
2c – Rock Cover Bundle	N	MS	N	MS		37.5%	2c – Rock Cover Bundle	N	S	N	VMS	37.1%
3a – Cut and Lift	мw	w	MW	N		11.3%	3a – Cut and Lift	VMW	MW	VMW	N	4.9%
									1	1		

div B 2 8.4 0

1.3 Other Users	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

1.4 Residual Risk	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	vмw	w	VMW	5.7%
2a – Trench and Bury Bundle	VMS	N	s	w	32.6%
2c – Rock Cover Bundle	S	w	N	MW	14.3%
3a – Cut and Lift	VMS	s	MS	N	47.5%



Weighting

25.0%

25.0%

25.0%

25.0%

2.1 Impact of Decommissioning Operations Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	s	27.3%
2a – Trench and Bury Bundle	N	N	N	s	27.3%
2c – Rock Cover Bundle	N	N	N	s	27.3%
3a – Cut and Lift	w	w	w	N	18.2%

Group 1 Pair-wise Comparison Matrices - Environment Appendix B.3

2.3 Resource Consumption	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting	
– Remediate Ends and ans Only	N	N	s	N	27.3%	
– Trench and Bury ndle	N	N	s	N	27.3%	
– Rock Cover Bundle	w	w	N	w	18.2%	
– Cut and Lift	N	N	S	N	27.3%	

2.4 Disturbance	1b – Remediate Ends an Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	s	s	N	30.0%
2a – Trench and Bury Bundle	w	N	N	w	20.0%
2c – Rock Cover Bundle	w	N	N	w	20.0%
3a – Cut and Lift	N	s	s	N	30.0%

1b – Remediate Ends and Spans Only

Ν

N

Ν

N

2.2 Processing of

Returned Materials

1b – Remediate Ends and Spans Only

2a – Trench and Bury

c – Rock Cover Bundle

3a – Cut and Lift

2a – Trench and Bury Bundle

Ν

Ν

Ν

Ν

2c – Rock Cover Bundle

Ν

Ν

Ν

N

3a - Cut and Lift

Ν

Ν

Ν

N

2.5 Loss of Habitat	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	мw	s	MW	13.8%
2a – Trench and Bury Bundle	MS	N	MS	N	37.5%
2c – Rock Cover Bundle	w	MW	N	MW	11.3%
3a – Cut and Lift	MS	N	MS	N	37.5%



Appendix B.4 Group 1 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	37.5%
2a – Trench and Bury Bundle	MW	N	мw	N	12.5%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%
3a – Cut and Lift	MW	N	MW	N	12.5%

3.2 Schedule	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	s	33.6%
2a – Trench and Bury Bundle	MW	N	мw	w	12.0%
2c – Rock Cover Bundle	N	MS	N	s	33.6%
3a – Cut and Lift	w	S	w	N	20.8%

3.3 Technical maturity	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	37.5%
2a – Trench and Bury Bundle	MW	N	мw	N	12.5%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%
3a – Cut and Lift	MW	N	MW	N	12.5%

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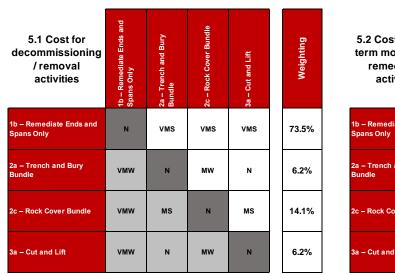
4.1 Regulatory	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift		Weighting
1b – Remediate Ends and Spans Only	z Span	A 2a - Sa - Buno	s 2c -			22.1%
2a – Trench and Bury Bundle	S	N	s	N	-	29.9%
2c – Rock Cover Bundle	w	w	N	w		18.0%
3a – Cut and Lift	s	N	s	N		29.9%

Appendix B.5 Group 1 Pair-wise Comparison Matrices – Societal

4.2 Impact on Commercial Fisheries	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	w	w	w	18.0%
2a – Trench and Bury Bundle	S	N	s	N	29.9%
2c – Rock Cover Bundle	S	w	N	w	22.1%
3a – Cut and Lift	s	N	s	N	29.9%

4.3 Socio- economic impact on communities and amenities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	w	22.2%
2a – Trench and Bury Bundle	N	N	N	w	22.2%
2c – Rock Cover Bundle	N	N	N	w	22.2%
3a – Cut and Lift	S	S	S	N	33.3%



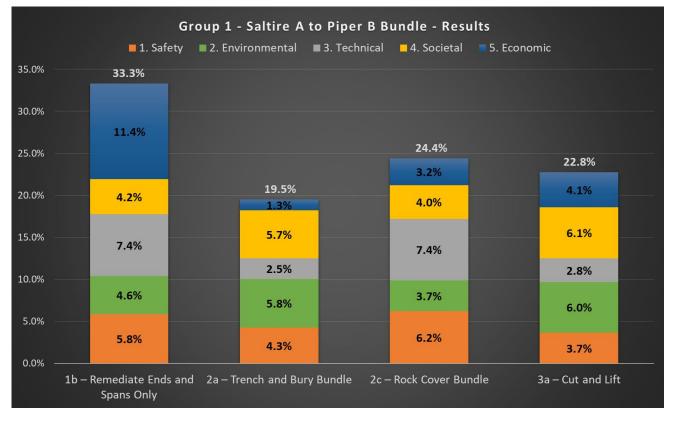


Appendix B.6 Group 1 Pair-wise Comparison Matrices – Economic

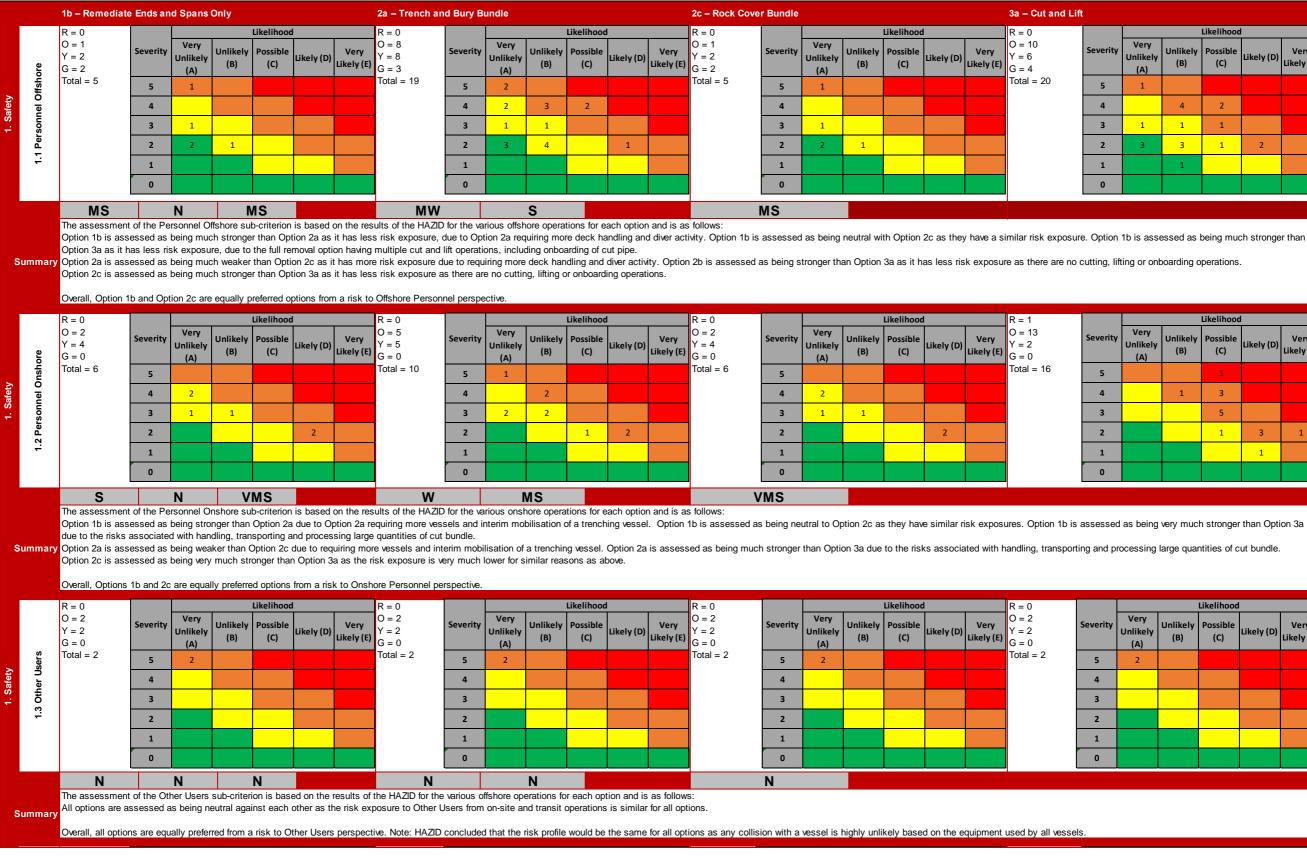
5.2 Cost for long term monitoring / remediation activities	1b – Remediate Ends ar Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	MW	vмw	7.1%
2a – Trench and Bury Bundle	N	N	MW	vмw	7.1%
2c – Rock Cover Bundle	MS	MS	N	MW	21.4%
3a – Cut and Lift	VMS	VMS	MS	N	64.3%

Appendix B.7

Group 1 Results Chart



APPENDIX C GROUP 2 – DETAILED EVALUATION RESULTS



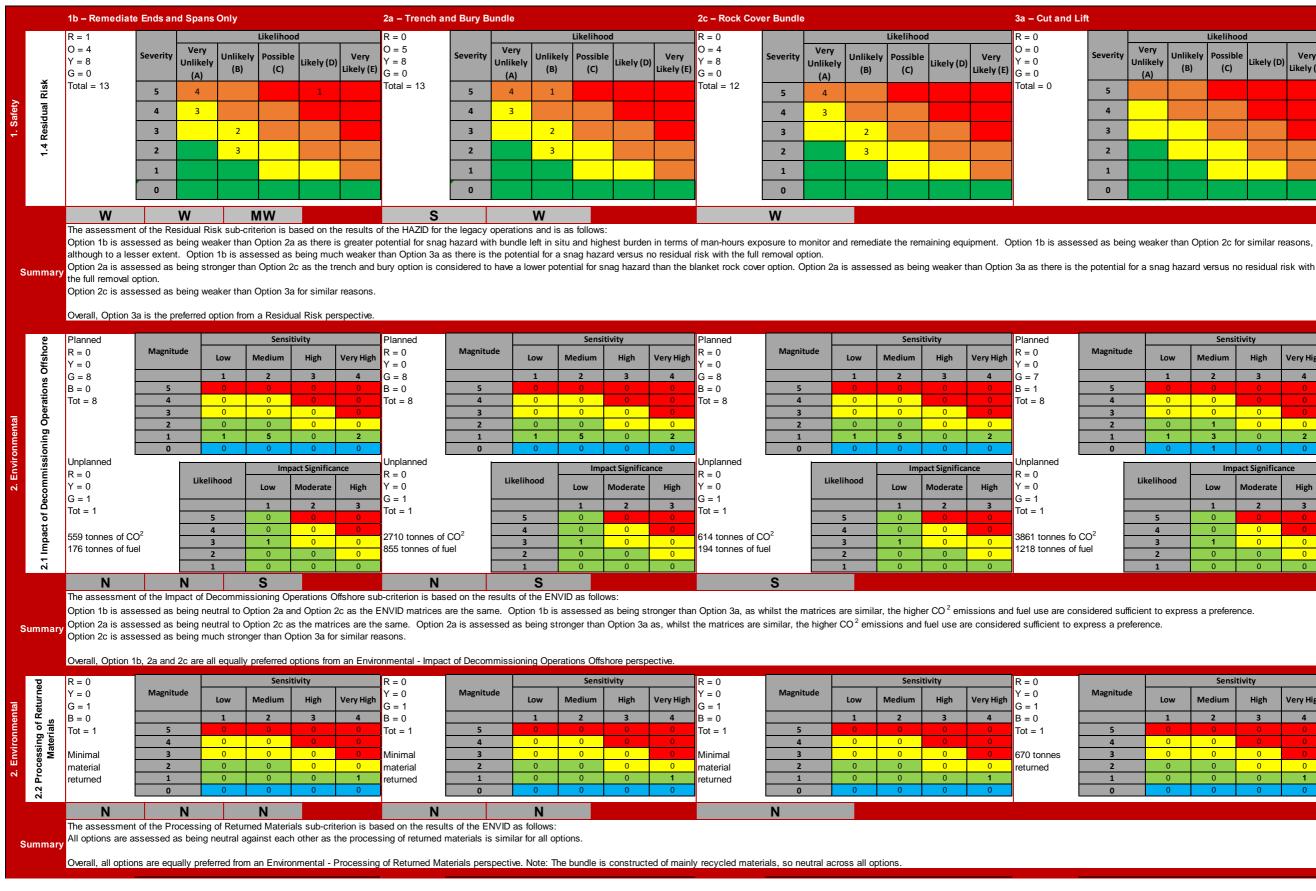
Group 2 Attributes Table Appendix C.1



ft											
		Likelihood									
	Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)					
	5	1									
	4		4	2							
	3	1	1	1							
	2	3	3	1	2						
	1		1								
	0										

	Likelihood								
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)				
5			1						
4		1	3						
3			5						
2			1	3	1				
1				1					
0									

		Likelihood										
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)							
5	2											
4												
3												
2												
1												
0												
s.												
_												





it						
I				Likelihood		
	Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
	5					
	4					
	3					
	2					
	1					
	0					

	Sensitivity									
Magnitude	Low	Medium	High	Very High						
	1	2	3	4						
5	0	0	0	0						
4	0	0	0	0						
3	0	0	0	0						
2	0	1	0	0						
1	1	3	0	2						
0	0	1	0	0						

		Impact Significance						
	Likelihood	Low	Moderate	High				
		1	2	3				
	5	0	0	0				
2	4	0	0	0				
CO ² Jel	3	1	0	0				
lel	2	0	0	0				
	1	0	0	0				

1 2 5 0 0	ligh Very High
5 0 0 4 0 0 0 3 0 0 0	
4 0 0 3 0 0	3 4
3 0 0	0 0
3 0 0 2 0 0	0 0
2 0 0	0 0
	0 0
1 0 0	0 1
0 0 0	

		1b – Remediat	e Ends and Sp	ans Only				2a – Trench a	and Bury Bund	le				2c – Rock Cov	er Bundle					3a – Cut and L
	uo	R = 0			Sensi	tivity		R = 0			Sens	itivity		R = 0			Sens	itivity		R = 0
ସ୍ଥ	Consumption	Y = 0 G = 3	Magnitude	Low	Medium	High V	/ery High	Y = 0 G = 3	Magnitude	Low	Medium	High	Very High	Y = 0 G = 3	Magnitude	Low	Medium	High	Very High	Y = 0 G = 3
Environmental	nsu	B = 0		1	2	3		B = 0		1	2	3	4	B = 0		1	2	3	4	B = 0
ronr		Tot = 3	5	0	0	0	0	Tot = 3	5 4	0	0	0 0	0	Tot = 3	5	0	0	0	0	Tot = 3
Envi	2.3 Resource	300 tonnes of	3	0	0	0	0	4500 tonnes	3	0	0	0	0	31000 tonnes	3	0	0	0	0	300 tonnes
~i	Res	rockdump	2	0 3	0	0	0	of rockdump	2	0	0	0	0	of rockdump	2	1	0	0	0	of rockdump
	2.3		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0	
		Ν	S		Ν			S		Ν					W					
		The assessment									ion 1h is as	sessed as	beina stron	ger the Option 20	c as whist the F	NVID matri	ices are the	same thi	s assessme	ont reflects the la
		bundle.	0				,						0	0				ourro, un		
Su		Option 2a is ass Option 2c is ass										being neutr	al to Optior	n 3a as they have	e similar resource	e consump	tions.			
							•													
		Overall, Option 1	lb, 2a and 3a ar	e all equal	ly preferred	options from a			n perspective.											
		R = 0 Y = 0	Magnitude		Sensi	itivity		R = 0 Y = 0	Magnitude		Sens	itivity	1	R = 0 Y = 0	Magnitude		Sens	itivity 	1	R = 0 Y = 0
멻	8	G = 1	Magintauc	Low	Medium	High V	/ery High	G = 1	magintauc	Low	Medium	High	Very High	G = 1	magintauc	Low	Medium	High	Very High	G = 1
men	bano	B = 0 Tot = 1	5	1	2	3	4	B = 0 Tot = 1	5	1	2	3	4	B = 0 Tot = 1	5	1	2	3	4	B = 0 Tot = 1
Environmental	Disturbance	101 = 1	4	0	0	0	0		4	0	0	0	0	101 = 1	4	0	0	0	0	101 = 1
	4		3	0	0	0	0		3	0	0	0	0		3	0	0	0	0	
°i	ri N		1	0	1	0	0		1	0	0	0	0		1	0	0	0	0	
			0	0	0	0	0		0	0	0	0	0		0	0	0	0	0	
		S The assessment	S	Disturbons	N (abort tor	m impost) sul	h oritorior	N is as follows:		W					W					
						• •			ort-term seabed	disturbance	compared	to trenching	g or rock pl	acment of the en	tire line. Option	1b is asse	ssed as be	ing neutral	to Option 3	a due as the sea
Su	mmanu	surface laid bun			Ontion 2c a	e the impact	from trop	ching and rock	placement of th	o lino is co	neidorod sir	nilar Onti	on 2a is as	sessed as being	wookor than On	tion 20 the	impact from	tronching	ic highor th	on out and lift of
00		Option 2c is ass			•			•	•					sessed as being	weaker than op		impact iron	rtienening	is nighter ti	
		Overall, Option 1	Ib and Option 3	a are equal	lly preferred	options from	a Seabe	d Disturbance p	perspective.											
-		R = 0			Sensi			R = 0			Sens	itivity		R = 0			Sens	itivity		R = 0
		Y = 1	Magnitude	Low	Medium		/ery High	Y = 0	Magnitude	Low	Medium	High	Very High	Y = 1	Magnitude	Low	Medium	High	Very High	Y = 0
enta		G = 0 B = 0		1	2	3		G = 0 B = 1		1	2	3	4	G = 0 B = 0		1	2	3	4	G = 0 B = 1
Environmental	đ	Tot = 1	5	0	0	0	0	Tot = 1	5	0	0	0	0	Tot = 1	5	0	0	0	0	Tot = 1
nvird	Loss		4	0	0	0	0		4	0	0	0	0		4	0	0	0	0	
2. EI	2.5 L		2	0	0	0	0		2	0	0	0	0		2	0	0	0	0	
			0	0	0	0	0		0	0	1	0	0		0	0	0	0	0	
		MW	S		MW			MS		N		• •			MW					
		The assessmen	-	Habitat (le		term) sub-crite	terion is a													
		•								•		•		vill be altered for the sassessed as be	•		•		•	
Su	mmary	for the long-term	, whereas the o	riginal habi	itat will reco	ver post cut a	and lift op	erations under	Option 3a.	-	-		-		-	-				
00	, initial y													ssessed as bein sus large area of						impact / loss of
					·			.						g	,,,,,					
		Overall, Option 2	2a and 3a are eo	qually prefe	erred options	s from a Loss	of Habita	it perspective.												
_	gn	Established met							ning/backfill equ	-					ethods and techn					The vessels req
nica	acti	limit number of a terms of contract		missioning	contractors	. Good flexibi			oaching the limi				flexibility	limit number of terms of contra	available decom	missioning	contractors	. Good flex	kibility in	methodology for if such a techno
Technical	Contracting Strategy		ang strategy.					may be some			tracting stra	itegy.		terms of contra	cung strategy.					ii Suoii a teoliila
ŝ	3.1 C S																			
		N	N		Ν			N		Ν					Ν					
		The assessmen								4h 4h -			- 41-			41				
Su	mmary	All options are a	issessed as bei	ng neutral	against eacl	n otner as, wi	mist there	e are challenge	s associated wi	in the trenc	ing / cut and	a lift option:	s, these are	e unlikley to influe	ence the contrac	ting strate	JY.			
		Overall, all optio	ns are equally p	preferred fro	om a Contra	cting Strategy	y perspec	tive.												



ft										
	Sensitivity									
Magnitude	Low Medium		High	Very High						
	1	2	3	4						
5	0	0	0	0						
4	0	0	0	0						
3	0	0	0	0						
2	0	0	0	0						
1	3	0	0	0						
0	0	0	0	0						

rge quantity of rock required for Option 2c to cover the

		Sensi	tivity		
Magnitude	Low	Medium	High	Very High	
	1	2	3	4	
5	0	0	0	0	
4	0	0	0	0	
3	0	0	0	0	
2	0	0	0	0	
1	0	1	0	0	
0	0	0	0	0	

bed disturbance associated with the cut and lift of the the surface laid bundle.

	Sensitivity								
Magnitude	Low	w Medium High		Very High					
	1	2	3	4					
5	0	0	0	0					
4	0	0	0	0					
3	0	0	0	0					
2	0	0	0	0					
1	0	0	0	0					
0	0	1	0	0					

nder Option 2a. Option 1b is assessed as being stronger th Option 1b and therefore the original habitat will be altered

nabitat.

uired are readily available but there is no established r lifting and removing bundles of this size, so it is likely that, ology is developed, it will be single source.

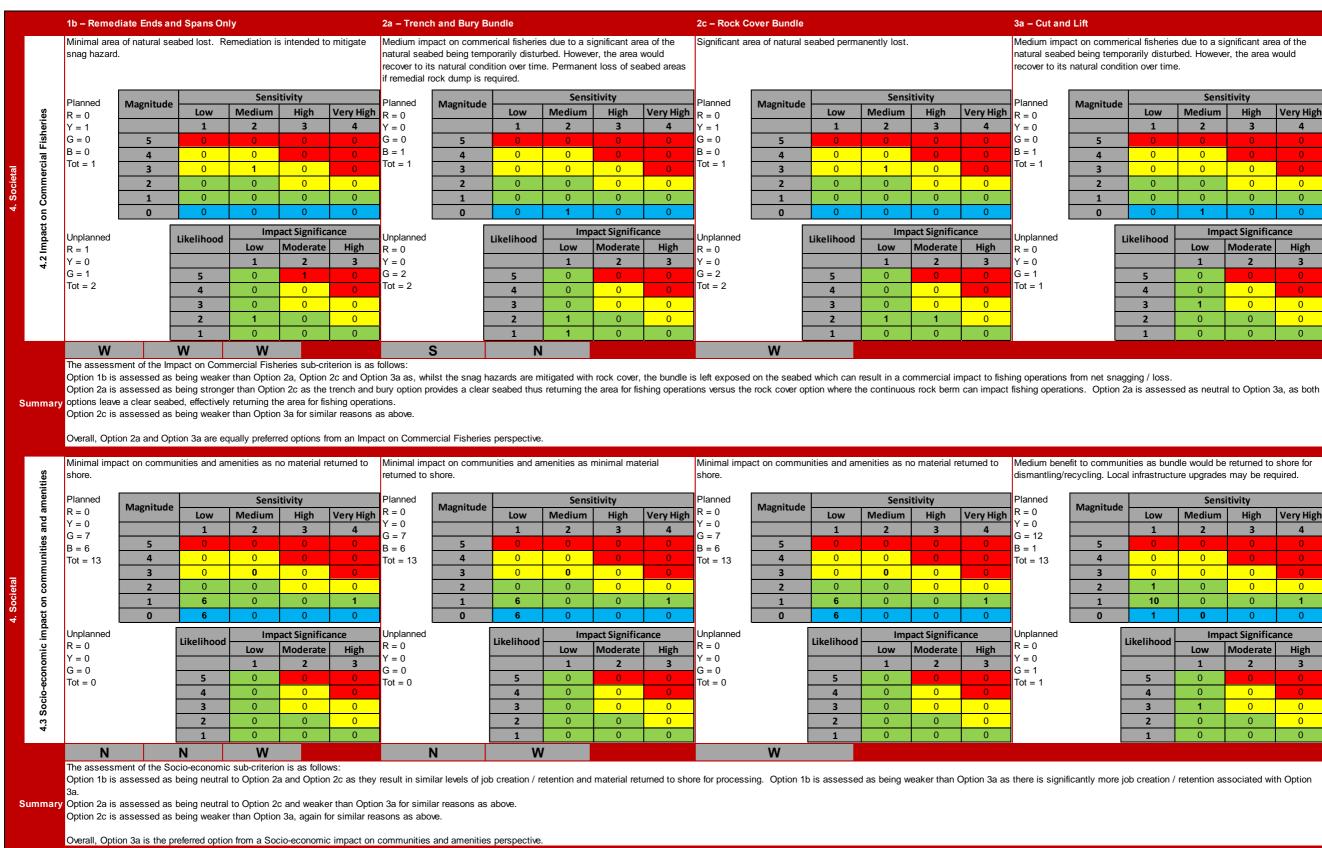
		1b – Remediate I	Ends and Spans (Only		2a – Trench and Bury I	Bundle		2c – Rock Cover Bundle		3a – Cut and Lift
3. Technical	3.2 Schedule	No particular techr schedule. In field t		major risk factors tl	hat could extend	trench depth. Moderate r	ss trenching being required risk of failure to achieve tre ative method, e.g. rock dur	ench depth resulting in	No particular technological factors or schedule. In field time of 20 days.	major risk factors that could extend	Major technologica lifting technology is Current estimate of
5	MS N S MW W S The assessment of the Contracting Strategy sub-criterion is as follows: Option 1b is assessed as being much stronger than Option 2a, due to the bundle being at the limit of current trenching technology in terms of outer diameter, there is a high probability of additional trenching passes being required uses not acheive the required burial depth. Option 1b is assessed as being nuch stronger than Option 2a, due to over-runs from trenching versus routine operations. Option 2a is assessed as being much weaker than Option 2c due to over-runs from trenching versus routine operations. Option 2a is assessed as being stronger than Option 3a as these are routine operations versus cut and lift of a bundle which, at the time of the assessment, has never been performed and is therefore more likley to experience sch Overall, Option 1b and Option 2c are equally preferred from a Schedule perspective.										ormed to date for a b ely to encounter sch
3. Technical	3.3 Technical maturity	Established methods and technology. Fully mature.				This is a routine subsea operation but has no track record of trenching large diameter bundles. However, bundle is within the limit of current track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in the area of failure.			Established methods and technology	. Fully mature.	No track record for Extensive subsea v Low technical matu Likely to be hydrau
		S	N	S		W	W		S		
s	Gummary	Option 1b is asses Option 2a is asses Option 2c is asses	ssed as being stror ssed as being weal ssed as being stror	ker than Option 2c a	, due to the technic and Option 3a due as cut and lift has	to the the technical challe not been performed to dat		of trenching or cut and	ter bundles. Option 1b is assessed as lift of large diameter bundles. maturity.	being neutral to Option 2c as they bo	th consist of similar a
4. Societal	4.1 Regulatory	Seabed would be I	left with rock dump	of spans, exposure	es and ends.		e a clear seabed. Moderat equiring additional material	•	Seabed would be left with rock dump	over entire bundle length.	Full removal would decommissioning p for bundle removal.
S	ummary	Option 1b is asses Option 2a is asses Option 2c is asses	ssed as being weal ssed as being stror ssed as being weal		and Option 3a as th as it would leave a as it does not resul	a clear seabed. Option 2a i It in a clear seabed.			W rench & bury and cut & lift options. Op both result in a clear seabed.	tion 1b is assessed as being stronger	than Option 2c due t
		Overall, Option 2a	and Option 34 ale	equally pretened of		cal perspective.					



ift ical risk factors to the schedule in that an established y is not in place and there is major scope for overruns. e of in-field time is 65 days. alternative remedation measures in the event trenching a bundle, therefore there is a greater likelihood of schedule schedule over-runs than the cut and lift operations. for lift and removal of large diameter bundles. ea works required, likely complete with diver support haturity. Iraulic shears for cutting. lar activities.

d leave a clear seabed and BEIS encourages all programmes to review existing and emerging technology I.

e to the bubdle remainig in situ, albeit rock dumped.





Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.

agnitude		Sensi	tivity				
agnitude	Low	Medium	High	Very High			
	1	2	3	4			
5	0	0	0	0			
4	0	0	0	0			
3	0	0	0	0			
2	0	0	0	0			
1	0	0	0	0			
0	0	1	0	0			
	Likelihood	Impact Significance					

	Likelihood									
	Likeimoou	Low	Moderate	High						
		1	2	3						
	5	0	0	0						
	4	0	0	0						
	3	1	0	0						
	2	0	0	0						
	1	0	0	0						
_										

dismantling/recycling. Local infrastructure upgrades may be required.

	_						
agnitude		Sens	itivity				
agiiituue	Low	Medium	High	Very High			
	1	2	3	4			
5	0	0	0	0			
4	0	0	0	0			
3	0	0	0	0			
2	1	0	0	0			
1	10	0	0	1			
0	1	0	0	0			
	Likelihood	Impact Significance					
	Likeimood	Low	Moderate	High			
		1	2	3			
	5	0	0	0			
	4	0	0	0			
	3	1	0	0			
	2	0	0	0			
		0	0	0			

		1b – Remediate	Ends and Spans	Only		2a – Trench and Bury	Bundle		2c – Rock Cover Bundle		3a – Cut and Lif
0	ng/ ies	The decommissio liabilities for this o	· ·	g contingency but ex	cluding long term	The decommissioning co liabilities for this option i	• • • •	but excluding long term	The decommissioning cost including c liabilities for this option is:	contingency but excluding long term	The decommissio liabilities for this o
	Decomissioning Cost: £1.8 million.				Decomissioning Cost: £8.9 million.			Decomissioning Cost: £2.8 million.		Decomissioning C	
		VMS	S	VMS		MW	W		MS		
The assessment of the Cost for decommissioning sub-criterion is as follows: Option 1b is assessed as being very much stronger than Option 2a and Option 3a due to the significant reduction in total decommissioning cost. Option 1b is assessed as being stronger than Option 2c as the costs are slightly lower. Option 2a is assessed as being much weaker than Option 2c due to the significantly higher cost. Option 2a is also assessed as being weaker than Option 3a as the costs are slightly higher. Option 2c is assessed as being much stronger than Option 3a as the costs are much lower. Overall, Option 1b is the preferred options from a total cost of decommissioning perspective.											ower.
	_	The long-term cos	ts included survey	& monitoring costs	(in both total and	The long-term costs incl	uded survey & monitoring	n costs (in both total and	The long-term costs included survey &	monitoring costs (in both total and	There are no long
ic	Cost for long term monitoring / ediation activities			potential future reme		The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are:			Net Present Cost (NPC) terms) and po this option are:		incre ale ne iong
conomic	st for long onitoring ation acti	Current 8 Manitari	na Conti C2 0 milli	~~		Currey & Monitoring Cos	at C2.0 million		Supply & Manitoring Coats C2.0 million		
Eco	st for I onitor ation	Survey & Monitori Survey & Monitori				Survey & Monitoring Cos Survey & Monitoring NP			Survey & Monitoring Cost: £2.8 million Survey & Monitoring NPC: £0.5 million		
5.	5.2 Cos mo remedia	Remediation Cost	: £2.8 million			Remediation Cost: £4.5	million		Remediation Cost: £1.4 million		
		S	W	MW		MW	MW		MW		
s	S W WW WW WW WW The assessment of the Cost for long term monitoring / remediation sub-criterion is as follows: Option 1b is assessed as being stronger than Option 2a due to the significant reduction in total net present cost. Option 1b is assessed as being neutral with Option 2c due to their similar net present cost. Option 1b is assessed as being much weaker than Option 2c and Option 3a due to the increased net present cost. Summary Option 2a is assessed as being stronger than Option 2c and Option 3a due to the increased net present cost.										
		Overall, Option 3a	is the preferred op	otions from a cost fo	r long term monitori	ing / remediation perspect	ive.				



 ft

 oning cost including contingency but excluding long term option is:

 Cost: £7.5 million.

 g-term costs associated with this full removal option.

 than Option 3a due to the reduction in total net present



Appendix C.2 Group 2 Pair-wise Comparison Matrices – Safety											
1.1 Personnel Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting	ទីរដ្ឋមន្ត្រី 1.2 Personnel Onshore		2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	1b – Remediate Ends and Spans Only		N	S	N	VMS	37.1%
2a – Trench and Bury Bundle	MW	N	MW	s	13.8%	2a – Trench and Bury Bundle	w	N	w	MS	20.8%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%	37.5% 2c – Rock Cover Bundle		S	N	VMS	37.1%
3a – Cut and Lift	MW	w	MW	N	11.3%	3a – Cut and Lift		MW	VMW	N	4.9%
1.3 Other Users	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting	1.4 Residual Risk	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%	1b – Remediate Ends and Spans Only	N	w	w	MW	14.6%
2a – Trench and Bury Bundle	N	N	N	N	25.0%	2a – Trench and Bury Bundle	S	N	S	w	26.1%
2c – Rock Cover Bundle	N	N	N	N	25.0%	2c – Rock Cover Bundle	S	w	N	w	21.3%
3a – Cut and Lift	N	N	N	N	25.0%	3a – Cut and Lift	MS	S	S	N	38.0%

Appendix C.2 Group 2 Pair-wise Comparison Matrices – Safety



2.1 Impact of Decommissioning Operations Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	s	27.3%
2a – Trench and Bury Bundle	N	N	N	S	27.3%
2c – Rock Cover Bundle	N	N	N	s	27.3%
3a – Cut and Lift	w	w	w	N	18.2%

Appendix C.3 Group 2 Pair-wise Comparison Matrices – Environment

2.3 Resource Consumption	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	Ν	s	N	27.3%
2a – Trench and Bury Bundle	N	N	s	N	27.3%
2c – Rock Cover Bundle	w	w	N	w	18.2%
3a – Cut and Lift	N	N	S	N	27.3%

					,
2.5 Loss of Habitat	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MW	s	MW	13.8%
2a – Trench and Bury Bundle	MS	N	MS	N	37.5%
2c – Rock Cover Bundle	w	MW	N	MW	11.3%
3a – Cut and Lift	MS	N	MS	N	37.5%

2.2 Processing of Returned Materials	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

2.4 Disturbance	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	s	s	N	30.0%
2a – Trench and Bury Bundle	w	N	N	w	20.0%
2c – Rock Cover Bundle	w	N	N	w	20.0%
3a – Cut and Lift	N	S	S	N	30.0%



Appendix C.4 Group 2 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

3.2 Schedule	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	s	33.6%
2a – Trench and Bury Bundle	MW	N	MW	w	12.0%
2c – Rock Cover Bundle	N	MS	N	S	33.6%
3a – Cut and Lift	w	S	w	N	20.8%

3.3 Technical maturity	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	s	N	s	29.9%
2a – Trench and Bury Bundle	w	N	w	w	18.0%
2c – Rock Cover Bundle	N	S	N	s	29.9%
3a – Cut and Lift	w	S	w	N	22.1%



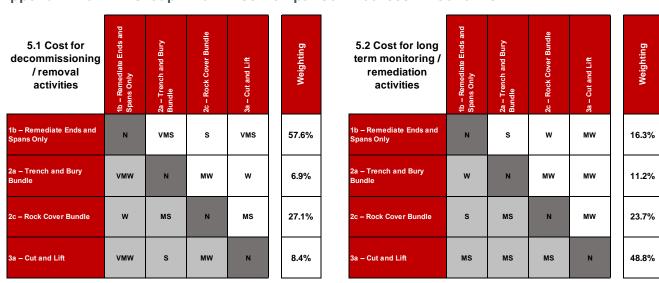
	and		<u>e</u>		
4.1 Regulatory	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	w	s	w	22.1%
2a – Trench and Bury Bundle	s	N	s	N	29.9%
2c – Rock Cover Bundle	w	w	N	w	18.0%
3a – Cut and Lift	s	N	s	N	29.9%

Appendix C.5 Group 2 Pair-wise Comparison Matrices – Societal

4.2 Impact on Commercial Fisheries	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	w	w	w	18.0%
2a – Trench and Bury Bundle	S	N	s	N	29.9%
2c – Rock Cover Bundle	S	w	N	w	22.1%
3a – Cut and Lift	S	N	S	N	29.9%

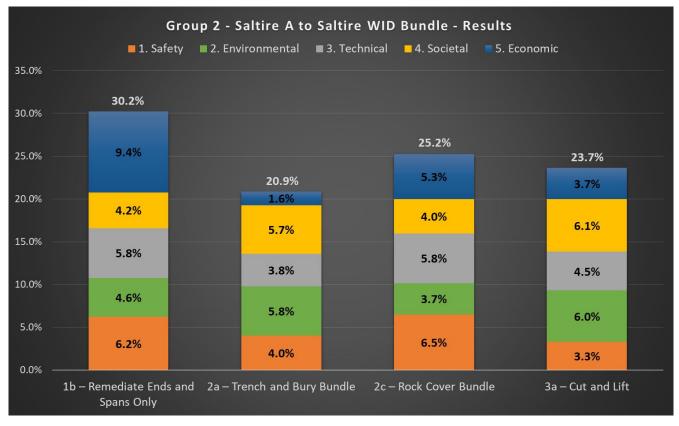
4.3 Socio- economic impact on communities and amenities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	w	22.2%
2a – Trench and Bury Bundle	N	N	N	w	22.2%
2c – Rock Cover Bundle	N	N	N	w	22.2%
3a – Cut and Lift	S	S	S	N	33.3%





Appendix C.6 Group 2 Pair-wise Comparison Matrices – Economic

Appendix C.7 Group 2 Results Chart



APPENDIX D GROUP 3 – DETAILED EVALUATION RESULTS

2b – Cut and Remove Exposures 2c – Rock Cover Exposures 2a – Trench and Bury Exposures 3 - Reverse Re Likelihood Likelihood Likelihood R = 0R = 0R = 0R = 0O = 9 Very 0 = 7Very ר = T Very O = 14 Severity Unlikelv Verv Severity Unlikely Possibl Verv Severity Unlikely ossibl Verv Possib Y = 8 ′ = 6 (= 6 Y = 13 Unlikel Unlikel kelv (D) Likely (D) Unlikel ikely (D (B) (C) Likely (E) (B) (C) Likely (E) (C) Offshore (B) Likely (E) G = 1 G = 3 G = 3 G = 1 (A) (A) (A) Total = 18Total = 16Total = 16Total = 285 5 5 1 4 2 4 4 3 4 Personnel 3 3 3 1 2 1 1 2 3 1 2 1 2 3 1 2 2 1 2 2 1 2 1 1 Ξ 1 1 1 1 1 1 0 0 0 Ν MS Ν MS MS Ν The assessment of the Personnel Offshore sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows Option 2a is assessed as being neutral to Option 2b and Option 2c as the risk exposure is similar. Option 2a is assessed as being much stronger than Option 3 as it has a lower risk exposure than reverse reeling due to pipe being on the deck under tension and significantly more deck working. Option 2b is assessed as being neutral to Option 2c as the risk exposure is similar. Option 2b is assessed as being much stronger than Option 3 as it has a lower risk exposure than reverse reeling due to pipe being on the deck under tension and significantly more deck working. Summary Option 2c is assessed as being much stronger than Option 3 for similar reasons. Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a risk to Offshore Personnel perspective. Likelihood R = 0 Likelihood Likelihood R = 0R = 0 R = 0O = 2 O = 2) = 2 O = 9 Verv Verv Verv Severity Inlikel Very Severit Inlike ossib Very Severity Unlikel ossibl Very Y =11 Y =11 (=11 Y = 6 Unlikel kely (E Unlikel kely (D Unlikel kely (D (B) (C) Likelv (E (B) (C) Onshore Likely (E (B) (C) Likely (E) G = 2 (A) G = 2(A) G = 2G = 0(A) Total = 15 Total = 15 Total = 15 Total = 15 5 5 5 4 4 4 4 4 4 Personnel 3 2 3 2 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 1 1 1 0 0 0 Ν MS MS MS Ν Ν The assessment of the Personnel Onshore sub-criterion is based on the results of the HAZID for the various onshore operations for each option and is as follows: Option 2a is assessed as being neutral to Option 2b and Option 2c due to the onshore handling requirements of returned material being largely similar. Option 2a is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of pipe to be handled, transported and recycled for Option 3. Summary Option 2b is assessed as being neutral to Option 2c as the onshore handling requirements are similar. Option 2b is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of pipe recovered for Option 3. Option 2c is assessed as being much stronger than Option 3 as the risk exposure is lower for similar reasons as above. Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a risk to Onshore Personnel perspective. R = 0Likelihood Likelihood R = 0R = 0Likelihood R = 0O = 2 Very) = 2 Very O = 2 Very O = 2 Severity Unlikelv Possible Verv Severity Unlikely Possible Verv Severity Unlikelv Possibl Verv Y = 0 ′ = 0 ['] = 0 Unlikely = 0 Unlikel Unlikel kelv (D Likely (D) ikely (D) (B) (C) Likely (E (B) (C) Likely (E) (B) (C) Likely (E) G = 0 $\dot{a} = 0$ G = 0(A) (A) (A) G = 0Users Total = 2 Total = 2Total = 2Total = 25 5 5 2 2 4 4 4 Other 3 3 3 ñ 2 2 2 1 1 1 0 0 0 Ν Ν Ν Ν Ν Ν The assessment of the Other Users sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows: All options are assessed as being neutral against each other as the risk exposure to Other Users from on-site and transit operations is similar for all options. Overall, all options are equally preferred from a risk to Other Users perspective. Note: HAZID concluded that the risk profile would be the same for all options as any collision with a vessel is highly unlikely based on the equipment used by all vessels

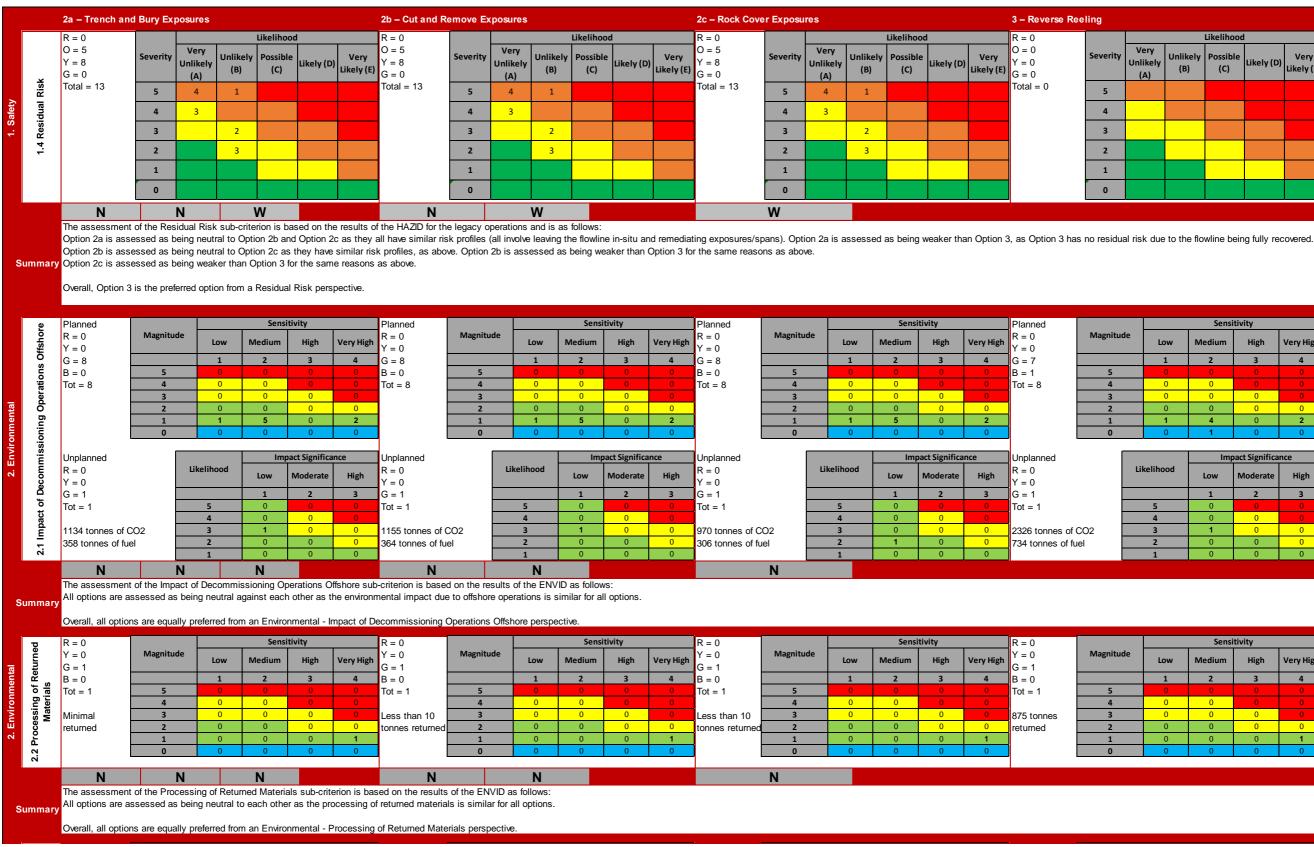
Appendix D.1 **Group 3 Attributes Table**



ling						
			Likelihood			
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)	
5	2					
4		5	4			
3		5	2			
2	1	4	3	1		
1			1			
0						
	Severity 5 4 3 2 1	Severity Very Unlikely (A) 5 2 4 3 2 1 1 1	Very Unlikely (A) Unlikely (B) 5 2 5 4 - 5 3 - 5 2 1 4 1 - 4	Very Unlikely Unlikely (B) Very Unlikely (B) 5 2 (C) 4 5 4 3 5 2 2 1 4 3 1 4	Image: Im	

		l	Likelihood		
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5		1			
4	2	1			
3		2	3		
2		1		3	1
1				1	
0					

			Likelihood		
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					
S.					





əl	ing						
Ī		Likelihood					
	Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)	
	5						
	4						
	3						
	2						
	1						
	0						
ſ							

		Sensi	tivity	
Magnitude	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	4	0	2
0	0	1	0	0

	Impact Significance				
Likelihood	Low	Moderate	High		
	1	2	3		
5	0	0	0		
4	0	0	0		
3	1	0	0		
2	0	0	0		
1	0	0	0		

	Sensitivity									
Magnitude	Low	Medium	High	Very High						
	1	2	3	4						
5	0	0	0	0						
4	0	0	0	0						
3	0	0	0	0						
2	0	0	0	0						
1	0	0	0	1						
0	0	0	0	0						

	2a – Tre <u>nch a</u>	nd Bury Exposu	ıres			2b – <u>Cut and F</u>	Remove Exposu	res			2c – Rock Co	ver Exposures				3 – Reverse F	Reeling			
Ę	R = 0			Sensi	itivity	R = 0			Sensitivity		R = 0			Sensitivity		R = 0		Sen	itivity	
onmental Consumption	Y = 0	Magnitude	Low	Medium	High Very High	Y = 0	Magnitude	Low N	Aedium High	Very High	Y = 0	Magnitude	Low M	ledium Hig	n Very High	Y = 0	Magnitude	Low Medium	High \	Very High
sum	G = 3 B = 0		1	2	3 4	G = 3 B = 0		1	2 3	4	G = 3 B = 0		1	2 3	4	G = 3 B = 0		1 2	3	4
Sing	B = 0 Tot = 3	5	0	0	0 0	B = 0 Tot = 3	5	0	0 0	0	B = 0 Tot = 3	5	0	0 0	0	B = 0 Tot = 3	5	0 0	0	0
		4	0	0	0 0		4	0	0 0	0		4		0 0	0		4	0 0	0	0
2. Envir Resource	Minimal	3	0	0	0 0	1900 tonnes	3	0	0 0	0	1900 tonnes	3		0 0		Minimal	3	0 0	0	0
kese is	rockdump	2	0	0	0 0 0 0	of rockdump	2	0 3	0 0 0 0	0	of rockdump	2	0 3	0 0 0 0	0	rockdump	2	0 0 3 0	0	0
2.3 F		0	0	0	0 0		0	0	0 0	0	1	0	0	0 0			0	0 0	0	0
	S	S		N		N		W				W						• •	•	
	-	_	ce Consum		iterion is based on the		NVID as follows:													
					2b and Option 2c as t							•			imal rockdump					
Summa	v ·			•	s the rock required is for similar reasons.	the same. Optio	on 2b is assessed	d as being we	aker than Option	3 as there is	sufficient rockd	dump required to ex	press a smal	Il preference.						
	Option 20 is as	sessed as being) weaker that	an Option 3	ior similar reasons.															
	Overall, Option	2a and Option 3	are equally	y preferred fr	rom an Environmental	- Resource Cons	sumption perspect	tive.												
	R = 0			Sons	itivity	R = 0			Sensitivity		R = 0			Sensitivity		R = 0		Sen	itivity	
	K = 0 Y = 0	Magnitude				Y = 0	Magnitude				$\mathbf{X} = 0$ $\mathbf{Y} = 0$	Magnitude				$\mathbf{K} = 0$ $\mathbf{Y} = 0$	Magnitude			
o 👼	G = 1		Low	Medium	High Very High	G = 1	-	Low M	Aedium High	Very High	G = 1		Low M	Iedium Higl	n Very High	G = 1		Low Medium	High \	Very High
anc	B = 0		1	2	3 4	B = 0		1	2 3	4	B = 0		1	2 3	4	B = 0		1 2	3	4
nvironmenta Disturbance	Tot = 1	5	0	0	0 0	Tot = 1	5 4	0	0 0	0	Tot = 1	5 4	0	0 0 0 0	0	Tot = 1	5	0 0 0 0	0	0
Vird		3	0	0	0 0		3	0	0 0	0		3	0	0 0		•	3	0 0	0	0
. En		2	0	0	0 0		2	0	0 0	0]	2	0	0 0	0	j	2	0 1	0	0
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		0	0	0	0 0	4	0	0	0 0	0		0	0	0 0	0	J	0	0 0	0	0
	Ν	N		S		N		S				S								
			Disturbanc	-	m impact) sub-criterio			3				3								
					nd Option 2c as they		ed seabed distur	bance. Optio	n 2a is assessed	as being stro	onger than Optic	on 3, as Option 3 w	ill involve sea	abed disturband	e along the en	tire flowline rout	e from the deburia	al operations.		
Summa	Option 2b is as	sessed as being	, neutral to	Option 2c a	s the seabed disturba					•	•				•					
Gainia	Option 2c is as	sessed as being	stronger th	han Option 3	3 for similar reasons.															
	Overall, Option	2a. Option 2b ar	nd Option 2	c are equal	y preferred options fro	m a Seabed Dist	turbance perspec	tive.												
									Constitution		la a			Constaliates				Com.	11.11.	
	R = 0 Y = 0	Magnitude	-	Sens	itivity	R = 0 Y = 0	Magnitude		Sensitivity		R = 0 Y = 0	Magnitude		Sensitivity		R = 0 Y = 0	Magnitude	Sen	itivity	
iai a	G = 0		Low	Medium	High Very High	G = 0		Low 1	Aedium High	Very High	G = 1		Low M	ledium Higl	n Very High	G = 0		Low Medium	High \	Very High
mental Habitat	B = 1		1	2	3 4	B = 1		1	2 3	4	B = 0		1	2 3	4	B = 1		1 2	3	4
of h	Tot = 1	5	0	0	0 0	Tot = 1	5	0	0 0	0	Tot = 1	5 4	0	0 0	0	Tot = 1	5	0 0 0 0	0	0
vir oss		3	0	0	0 0		3	0	0 0	0		3	0	0 0		•	3	0 0	0	0
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	S	S		Ν		N		W				W								
					erm) sub-criterion is a					(0-+ 0			the Ordina Or	Ontine On in						the standard
	both.	sessed as being	stronger tr	nan Option 2	2b and Option 2c as t	ne permanent nat	bit change from t	ne rock place	ment is the same	e for Option 2	b and Option 2c	c and very limited w	ith Option 2a	. Option 2a is	assessed as b	eing neutral to	Option 3 as there	is limited rock placer	nent associat	.ed with
Summa		sessed as being	neutral to	Option 2c a	s the permanent habi	change from the	e rock placement	is the same.	Option 2b is as	essed as be	ing weaker than	Option 3 there is n	nore habitat i	impact from the	e greater rock p	lacement.				
		sessed as being																		[
		22 and Ontion 2	are oqually	oroforrad a	ptions from a Loss of	Habitat paragast	ive													
. Technical Contracting Strategy	Established tec	hnology with a w	vide range (of vendors. F	Flexible contracting		chnology with a w	ide range of v	endors. Flexible	contracting		echnology with a wid	de range of ve	endors. Flexible	e contracting			required. Vessels an		
nic: acti	strategy.					strategy.					strategy.					nom a number	or vendors. Reas	onably flexible contra	cung strategy	<i>'</i> •
ech ontr rate																				
ы КС Ч																				
3. 3.1																				
	N	N		Ν		N		Ν				N								
					rion is as follows:					_										
Summa	All options are	assessed as bei	ng neutral a	against each	h other, with the differ	ences between op	ptions not deeme	ed significant	enough to expres	s a preferenc	e.									
	Overall, all optic	ons are equally r	preferred fro	om a Contrac	cting Strategy perspe	ctive.														
	s terail, an optic				enalogy polopo															



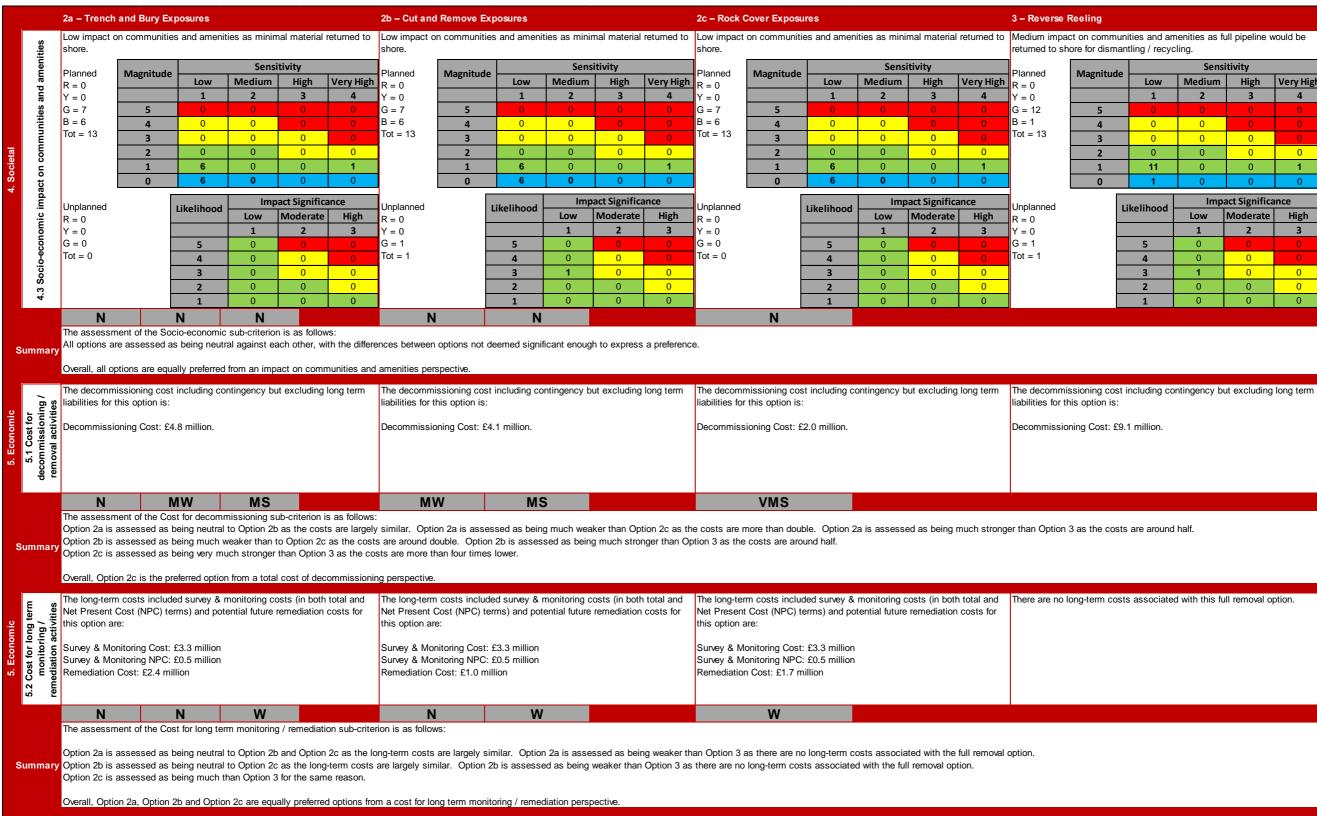
		2a – Trench	and Bury E	xposures				2b – Cut and	l Remove E	xposures				2c – Rock C	over Expos	ures				3 – Reverse Reel
3. Technical	3.2 Schedule	In field time o	of 30 days.	or major opera	ation risk facto	ors.		In field time o No particular		or major opera	tion risk fac	tors.		In field time (No particular		or major opera	ation risk fact	tors.		In field time of 40 o Potential for exten reverse reeling. Ti operational duratio line deburied prior
		N		Ν	S			N		S					S					
s	ummary	Options 2a, 2 pipeline integ	2b and 2c are grity failure du		s being neutra reeling.	II against ea			ations are si	milar and the o	perations a	re considere	d largely rou	tine. All optic	ons are asses	ssed as stron	ger than Opti	on 3 due to	the longer d	uration of infield ope
3. Technical	3.3 Technical maturity	additional roo While suitab particular act	ckdump in the le trenching e tivity.	g 0.6 m depth at area. equipment doe ke this achiev	es exist, it isr		-	Technically m	nature. Stan	dard subsea o	perations.			Technically r	mature. Stan	dard subsea (operations.			Reel installation of limited track recor There may small o
		N		N	S			N	I	S					S					
4. Societal	4.1 Regulatory	Overall, Options 2a, 2b and 2c are equally preferred from a Technical Maturity per Given that the line is trenched and buried along the majority of its length, there is likley to be little political impact from this option despite it being left in situ.							Given that the line is trenched and buried along the majority of its length, there is likley to be little political impact from this option despite it being left					Given that th	e line is tren tion where th	ched and buri ere is signific	ed along the	majority of i	ts length, to	Whilst this option positive political in significant preferer
		N		S	N			S		N					W					
s	ummary	Option 2a is Option 2b is Option 2c is Overall, Optio	assessed as assessed as assessed as ons 2a, 2b ar of natural se	 being strong being weake bd 3 are equal abed tempora 	I to Option 2b er than Option r than Option Ily preferred fr	and Option n 2c as rock 3 as rock o om a Politio	k dumping a tre dumping a tre cal perspectiv	trenched and t inched and bur	buried line is ried line is d	e deemed likely deemed likely to	/ to have a r o have a neg	negative polit	cal impact.	Option 2b is a	assessed as		to Option 3 a		-	have a negative pol cal impact is deem Significant area of natural condition o this time.
		Planned			Const	+1		Planned						Planned			fanc	141.24.		
		R = 0 Y = 0	Magnitud	e Low	Sensi Medium	High	Very High	R = 0	Magnitud	de law	Sens Medium	sitivity	Maray Lillarh	R = 0	Magnitud	le Low	Medium	itivity High	Very High	Planned Ma
Societal	Commercial Fisheries	G = 0 B = 1 Tot = 1	5 4 3 2 1	1 0 0 0 0 0 0	Niccham 2 0 0 0 0 0 0 0 0 0 0	3 0 0 0 0 0 0	4 0 0 0 0 0 0 0	G = 0 B = 1 Tot = 1	5 4 3 2 1	Low 1 0 0 0 0 0 0	2 0 0 0 0 0 0	High 3 0 0 0 0 0 0 0	Very High 4 0 0 0 0 0 0 0	G = 0 B = 0 Tot = 1	5 4 3 2 1	1 0 0 0 0 0 0	2 0 0 1 0 0 0 0	3 0 0 0 0 0 0	4 0 0 0 0 0 0	Y = 0 G = 0 B = 1 Tot = 1
4. S			0	0	1	0	0		0	0	1	0	0	1	0	0	0	0	0	
4. 4.2 Impact on		Unplanned R = 0 Y = 0 G = 2 Tot = 2		Likelihood 5 4 3 2	<u> </u>	act Signific Moderate 2 0 0 0 0		Unplanned R = 0 Y = 0 G = 2 Tot = 2		Likelihood 5 4 3 2		Moderate 2 0 0 0 0 0 0		Unplanned R = 0 Y = 0 G = 2 Tot = 2		Likelihood 5 4 3 2		act Significa Moderate 2 0 0 0 0 0	High 3 0 0 0 0 0	Unplanned R = 0 Y = 0 G = 1 Tot = 1
				1	0	0	0		[1	0	0	0	<u> </u>		1	0	0	0	
s	ummary	Option 2a is Option 2b is Option 2c is	assessed as assessed as assessed as	being strong being weake	I to Option 2b er than Option r than Option	and Option 2c as then 3 as there	n 3 as there v re is small ar is small area	vill be minimal	impact on c lost due to st due to roo	rock placemer ck placement.	it. Option 2									an Option 2c due to erations as essenti





Impact Significance								
Low	Moderate	High						
1	2	3						
0	0	0						
0	0	0						
1	0	0						
0	0	0						
0	0	0						

o the small areas of seabed lost due to rock placement. ially these options provide a clear seabed.





returned to shore for dismantling / recycling.

agnitud			Sens	itivity								
agintuu	e	Low	Medium	High	Very High							
		1	2	3	4							
5		0	0	0	0							
4		0	0	0	0							
3		0	0	0	0							
2		0	0	0	0							
1		11	0	0	1							
0		1	0	0	0							
[Impact Significance									
	ш	kelihood	Low	Moderate	High							
			1	2	3							
		5	0	0	0							
	4		0	0	0							
	3		1	0	0							
		2	0	0	0							
		1	0	0	0							



Appendix D.2	Gr	oup 3	Pair-w	ise Co	mpariso	on Matrices – Sa	fety				
1.1 Personnel Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting	1.2 Personnel Onshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	MS	30.0%	2a – Trench and Bury Exposures	N	N	N	MS	30.0%
2b – Cut and Remove Exposures	N	N	N	MS	30.0%	2b – Cut and Remove Exposures	N	N	N	MS	30.0%
2c – Rock Cover Exposures	N	N	N	MS	30.0%	2c – Rock Cover Exposures	N	N	N	MS	30.0%
3 – Reverse Reeling	MW	MW	MW	N	10.0%	3 – Reverse Reeling	MW	MW	MW	N	10.0%
			ŷ						ő		
1.3 Other Users	ch and Bury ss	and Remove ss	< Cover Exposures	se Reeling	Veighting	1.4 Residual Risk	nch and Bury es	and Remove es	k Cover Exposures	se Reeling	Veighting

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1.3 Other Users	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposure	3 - Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

1.4 Residual Risk	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	w	22.2%
2b – Cut and Remove Exposures	N	N	N	w	22.2%
2c – Rock Cover Exposures	N	N	N	w	22.2%
3 – Reverse Reeling	S	S	S	N	33.3%



Appendix D.3	Group 3 Pair-wise	Comparison M	latrices – Environment
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2.1 Impact of Decommissioning Operations Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

2.3 Resource Consumption	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	s	s	N	30.0%
2b – Cut and Remove Exposures	w	N	N	w	20.0%
2c – Rock Cover Exposures	w	N	N	w	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

2.5 Loss of Habitat	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	s	s	N	30.0%
2b – Cut and Remove Exposures	w	N	N	w	20.0%
2c – Rock Cover Exposures	w	N	N	w	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

2.2 Processing of Returned Materials	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

2.4 Disturbance	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%
2b – Cut and Remove Exposures	N	N	N	s	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	w	W	W	N	18.2%



Appendix D.4 Group 3 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

3.2 Schedule	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%
2b – Cut and Remove Exposures	N	N	N	s	27.3%
2c – Rock Cover Exposures	N	N	N	s	27.3%
3 – Reverse Reeling	w	w	w	N	18.2%

3.3 Technical maturity	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	s	27.3%
3 – Reverse Reeling	w	w	w	N	18.2%



Appendix D.5 Group 3 Pair-wise Comparison Matrices – Societal

4.1 Regulatory	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	s	N	27.3%
2b – Cut and Remove Exposures	N	N	s	N	27.3%
2c – Rock Cover Exposures	w	w	N	w	18.2%
3 – Reverse Reeling	N	N	s	N	27.3%

4.2 Impact on Commercial Fisheries	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	s	N	27.3%
2b – Cut and Remove Exposures	N	N	s	N	27.3%
2c – Rock Cover Exposures	w	w	N	w	18.2%
3 – Reverse Reeling	N	N	S	N	27.3%

4.3 Socio- economic impact on communities and amenities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

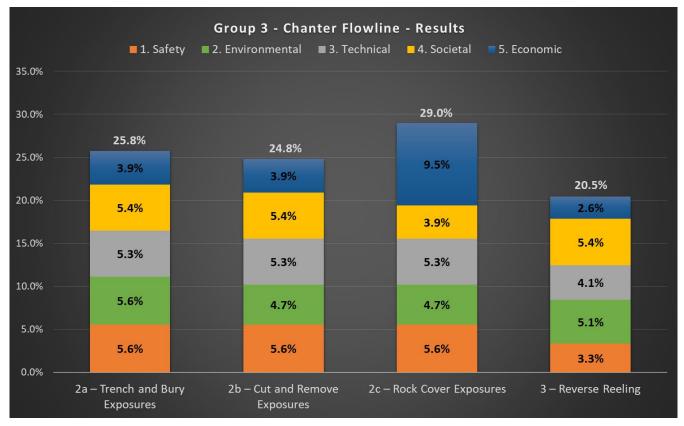
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5.1 Cost for decommissioning / removal activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting	5.2 Cost for long term monitoring / remediation activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	MW	MS	18.8%	2a – Trench and Bury Exposures	N	N	N	w	22.2%
2b – Cut and Remove Exposures	N	N	MW	MS	18.8%	2b – Cut and Remove Exposures	N	N	N	w	22.2%
2c – Rock Cover Exposures	MS	MS	N	VMS	56.3%	2c – Rock Cover Exposures	N	N	N	w	22.2%
3 – Reverse Reeling	MW	MW	VMW	N	6.3%	3 – Reverse Reeling	S	S	s	N	33.3%

Appendix D.6 Group 3 Pair-wise Comparison Matrices – Economic

Appendix D.7 Group 3 Results Chart



APPENDIX E GROUP 4 – DETAILED EVALUATION RESULTS

2a – Trench and Bury Exposures 2b - Cut and Remove Exposures 2c – Rock Cover Exposures 3 - Reverse Re R = 0 R = 0 R = 0 Likelihood R = 0 Likelihood Likelihood O = 9 Very) = 7 Very 0 = 7 Very 0 = 8Severity Unlikelv Possible Very Severity Unlikelv Possible Verv Severity Unlikely ossible Verv Y = 8 ′ = 5 Unlikel Y = 5 (= 9 Unlike kely (D) ikely (D) Unlikel ikely (D (B) (C) Likely (E) (B) (C) Likely (E) (C) Offshore (B) Likely (E) G = 1 G = 3 G = 3 G = 1 (A) (A) (A) Total = 18Total = 18Total = 15Total = 155 5 5 1 Personnel 4 2 4 4 3 4 3 3 2 3 1 1 1 2 3 1 2 1 2 3 1 2 2 1 2 2 1 2 1 1 Ξ 1 1 1 1 0 0 0 Ν Ν Ν Ν Ν Ν The assessment of the Personnel Offshore sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows: All options are assessed as being neutral against each other as the risk exposure is considered similar for all options due to less risk associated with reverse reeling small diameter umbillicals and cables. Summar Overall, all options are equally preferred from a risk to Offshore Personnel perspective. Likelihood Likelihood R = 0 R = 0= 0 Likelihood S = 0 O = 2 Very 2 = 20 = 2Very O = 9 Verv Very Unlikelv Severity Possible Severit Jnlikelv ossibl Very Severity Unlikelv Possible Verv Y = 11 Unlikely ikely (D) ′ =11 ′ = 11 ′ = 6 Unlikely Likely (D) Unlikely ikely (D) Likely (E) G = 0 (B) (C) Likely (E) (B) (C) Onshore (C) (B) Likely (E) G = 2 G = 2 G = 2 (A) (A) (A) Total = 15 Total = 15 Total = 15 Total = 15 5 5 5 4 4 4 4 1.2 Personnel 4 4 3 2 3 3 3 2 3 2 3 2 2 2 2 2 2 2 2 2 1 1 1 0 0 0 MS Ν Ν MS Ν MS The assessment of the Personnel Onshore sub-criterion is based on the results of the HAZID for the various onshore operations for each option and is as follows: Option 2a is assessed as being neutral to Option 2b and Option 2c due to the onshore handling requirements of returned material being largely similar. Option 2a is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of umbilical / cable to be handled, transported and recycled for Option 3. Summary Option 2b is assessed as being neutral to Option 2c as the onshore handling requirements are similar. Option 2b is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of umbilical / cable recovered for Option 3. Option 2c is assessed as being much stronger than Option 3 as the risk exposure is lower for similar reasons as above. Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a risk to Onshore Personnel perspective. R = 0 = 0 Likelihood R = 0 Likelihoo R = 0 O = 2 0 = 2 O = 2 O = 2 Very Very Very Unlikely Unlikely Unlikely Severity Possibl Very Severit Possib Very Severity Possibl Very Y = 0(= 0)Y = 0Unlikely ikely (D) Unlikely Unlikely Likely (D) (= 0)kely (D (B) (C) (C) (B) (C) Likely (E) (B) Likely (E) Likely (E) G = 0 (A) G = 0 (A) G = 0 (A) G = 0Total = 2 Total = 2 Total = 2 Total = 2 · Users 5 5 5 2 2 2 4 4 4 Other 3 3 3 ς. 2 2 2 1 1 1 0 0 0 Ν Ν Ν Ν Ν Ν The assessment of the Other Users sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows: All options are assessed as being neutral against each other as the risk exposure to Other Users from on-site and transit operations is similar for all options. Summar Overall, all options are equally preferred from a risk to Other Users perspective. Note: HAZID concluded that the risk profile would be the same for all options as any collision with a vessel is highly unlikely based on the equipment used by all vessels

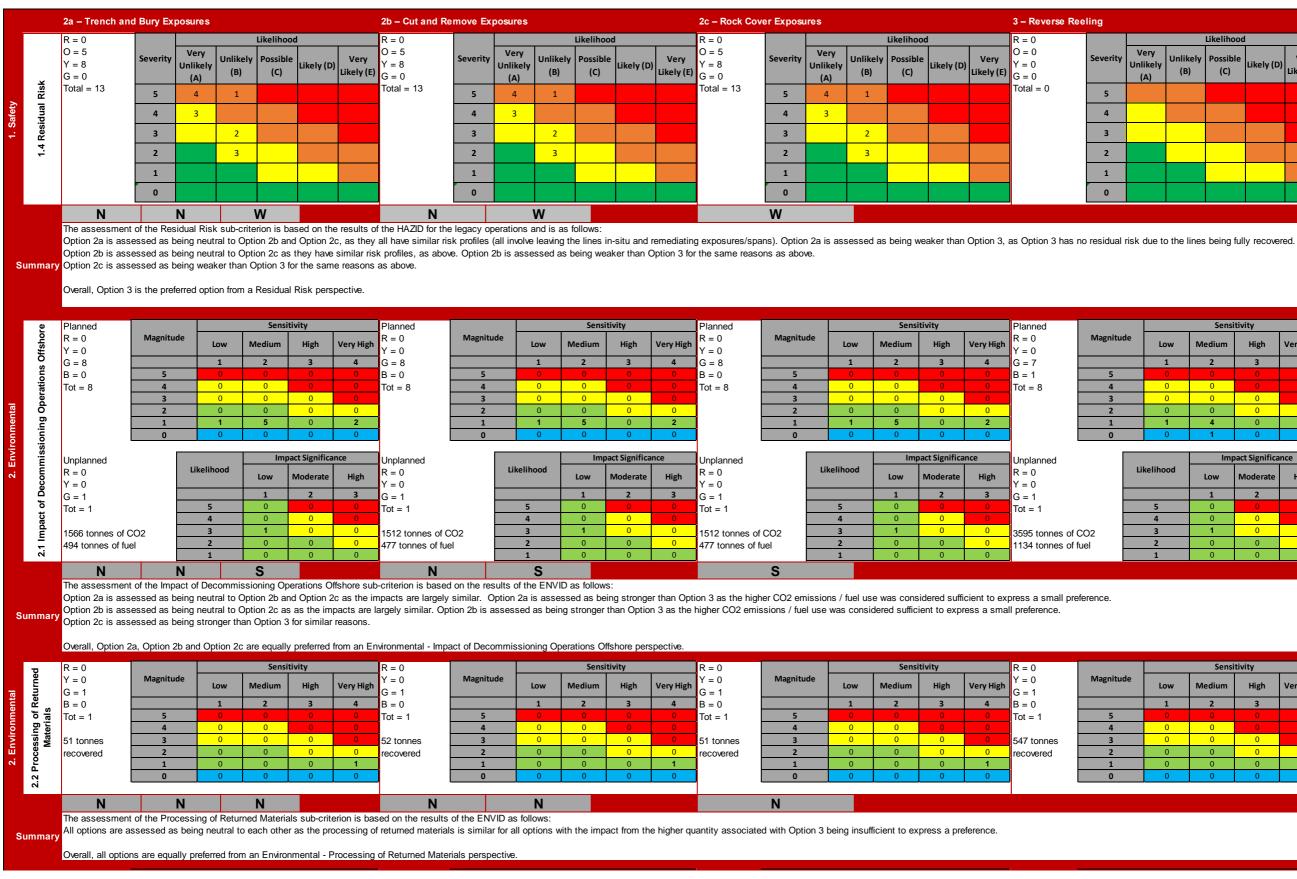
Appendix E.1 **Group 4 Attributes Table**



e	ling										
I			Likelihood								
	Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)					
	5	2									
	4		5	1							
	3		4								
	2	1	3	2							
	1										
	0										
l											

			Likelihood		
Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5		1			
4	2	1			
3		2	3		
2		1		3	1
1				1	
0					

			Libeliheed		
Severity	Very Unlikely (A)	Unlikely (B)	Likelihood Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					
s.					





əl	ing												
Ī		Likelihood											
	Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)							
	5												
I	4												
I	3												
ĺ	2												
	1												
	0												
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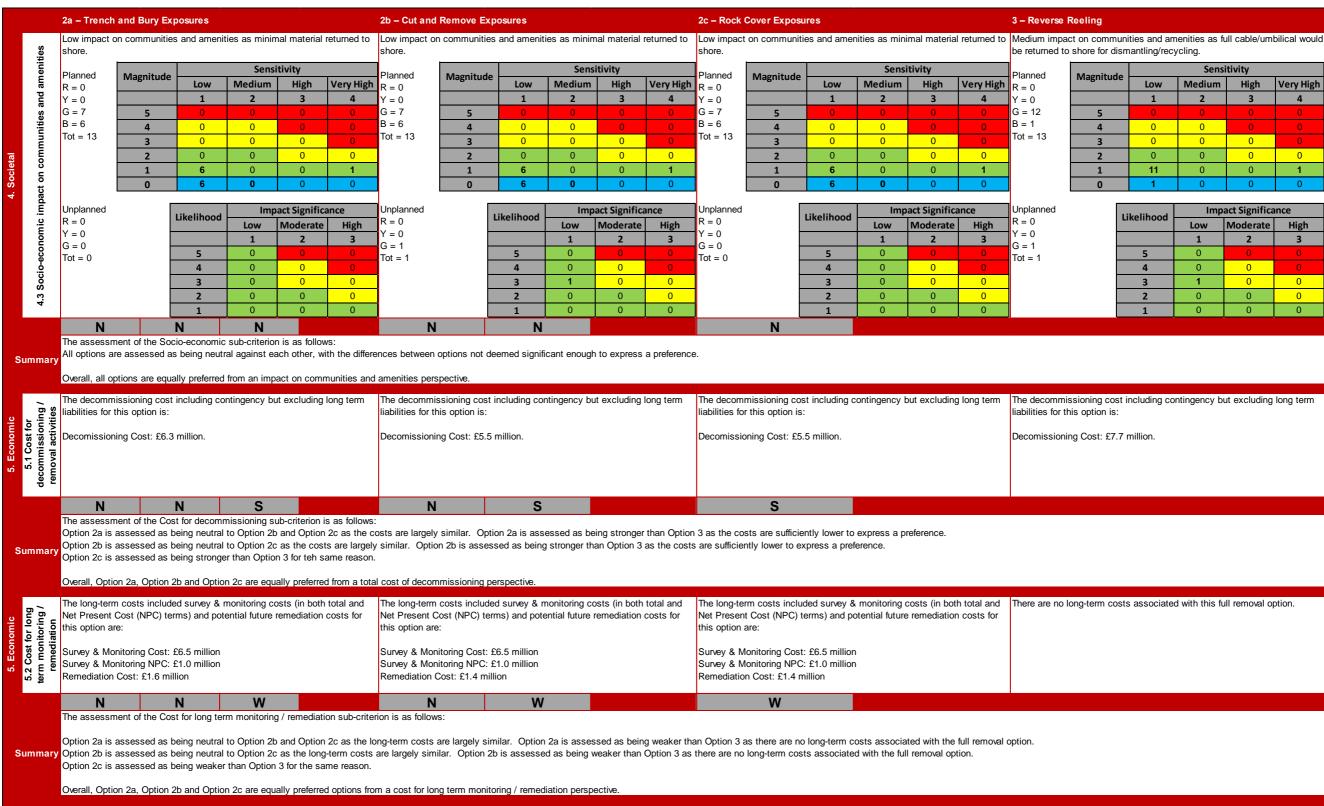
	Sensitivity									
Magnitude	Low	Medium	High	Very High						
	1	2	3	4						
5	0	0	0	0						
4	0	0	0	0						
3	0	0	0	0						
2	0	0	0	0						
1	1	4	0	2						
0	0	1	0	0						

		Imp	oact Significa	nce
	Likelihood	Low	Moderate	High
		1	2	3
	5	0	0	0
	4	0	0	0
02	3	1	0	0
el	2	0	0	0
_	1	0	0	0

	Sensitivity									
Magnitude	Low	Medium	High	Very High						
	1	2	3	4						
5	0	0	0	0						
4	0	0	0	0						
3	0	0	0	0						
2	0	0	0	0						
1	0	0	0	1						
0	0	0	0	0						

	2a – Trench a	nd Bury Exposu	res				2b – Cut and	Remove Exposu	ures			2c – Rock Co	over Exposures				3 – Reverse	Reeling			
uo	R = 0			Sensit	tivity		R = 0			Sensitivit	y	R = 0			Sensitivity		R = 0			Sensitivity	y I
Consumption	Y = 0 G = 3	Magnitude	Low	Medium	High	Verv High	Y = 0 G = 3	Magnitude	Low	Medium I	High Very Hig	Y = 0 G = 3	Magnitude	Low Me	dium High	Very High	Y = 0 G = 3	Magnitude	Low	Medium H	ligh Very
uns	B = 0		1	2	3		B = 0		1	2	3 4	B = 0		1	2 3	4	B = 0		1	2	3
Son	Tot = 3	5	0	0	0	0	Tot = 3	5	0		0 0	Tot = 3	5		0 0	0	Tot = 3	5	0		0
e	Minima el	4	0	0	0	0	000 +	4	0	-	0 0 0 0	000 44444	4		0 0 0 0	0	Minimal	4	0		0 () 0 ()
our	Minimal rockdump	2	0	0	0		800 tonnes of rockdump	2	0		0 0	800 tonnes of rockdump	2		0 0	0	Minimal rockdump	2	0		0 0
Resource	rookaamp	1	3	0	0	0	orroondamp	1	3	0	0 0	or rookdump	1		0 0	0	roondamp	1	3	0	0 0
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	S	S		Ν			N		W				W								
	-	nt of the Resourc	e Consum	ption sub-crit	terion is ba	ased on the r		ENVID as follows:	••				••								
mmary	All options are	assessed as bein	ng neutral	against each	other as t	he resource	consumption i	is similar for all op	ptions.												
	Overall, all opti	ons are equally p	referred fro	m an Enviror	nmental - F	Resource Co	nsumption per	rspective.													
										a					o 111 11					6 111 11	
	R = 0 Y = 0	Magnitude		Sensit	tivity		R = 0 Y = 0	Magnitude		Sensitivit		R = 0 Y = 0	Magnitude		Sensitivity		R = 0 Y = 0	Magnitude		Sensitivity	,
0	G = 1	Magintude	Low	Medium	High	Von High	G = 1		Low	Medium I	High Very Hig	G = 1		Low Me	dium High	Very High	G = 1		Low	Medium H	ligh Very
anci	B = 0		1	2	3		B = 0		1		3 4	B = 0			2 3		B = 0		1		3
urb	Tot = 1	5	0	0	0	0	Tot = 1	5	0	0	0 0	Tot = 1	5		0 0 0 0	0	Tot = 1	5	0	Ű	0
Dist		4	0	0	0	0		3	0		0 0 0 0		3		0 0 0 0	0		3	0		0
2.4 Disturbance		2	0	0	0	0		2	0		0 0		2	0	0 0	0		2	0	1	0
~		1	0	1	0	0		1	0		0 0		1		1 0	0		1	0		0
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	N	N		S			N		S				S				1				
			neutral to	Option 2c as	s the seabe	ed disturban				sed as being		otion 3 again due	e to the seabed dis	isturbance from t	ne deburial oper	rations.					
	Option 2b is as Option 2c is as Overall, Option	ssessed as being ssessed as being	neutral to stronger t	Option 2c as han Option 3 c are equally	s the seabe for similar y preferred	ed disturband reasons. options from	ce is limited ar a Seabed Dis		n 2b is asses		stronger than O			isturbance from t			R - 0			Consitivity	
mmary	Option 2b is as Option 2c is as	ssessed as being ssessed as being	neutral to stronger t d Option 2	Option 2c as han Option 3 tc are equally Sensit	s the seabe for similar y preferred tivity	ed disturband reasons. options from	ce is limited ar	nd similar. Option	n 2b is asses	Sensitivit	stronger than O	R = 0			Sensitivity		R = 0 Y = 0	Magnitude		Sensitivity	
mmary	Option 2b is as Option 2c is as Overall, Option R = 0 Y = 0 G = 0	ssessed as being ssessed as being 2a, Option 2b an	neutral to stronger t d Option 2	Option 2c as han Option 3 tc are equally Sensit Medium	s the seabe for similar y preferred tivity High	ed disturband reasons. options from Very High	ce is limited an a Seabed Dis R = 0 Y = 0 G = 0	nd similar. Option	Low	Sensitivit Medium I	stronger than Op y High Very Hig	R = 0 h Y = 0 G = 1	e to the seabed dis	Low Me	Sensitivity Jium High	Very High	Y = 0 G = 0	Magnitude	Low	Medium H	ligh Very
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of Habitat	Option 2b is as Option 2c is as Overall, Option R = 0 Y = 0 G = 0	ssessed as being ssessed as being 2a, Option 2b an	neutral to stronger t d Option 2	Option 2c as han Option 3 tc are equally Sensit Medium	s the seabe for similar y preferred tivity High	ed disturbance reasons. options from Very High 4	ce is limited an a Seabed Dis R = 0 Y = 0 G = 0	nd similar. Option	Low	Sensitivit Medium I 2 0	y High Very Hig 3 4	R = 0 h Y = 0 G = 1	e to the seabed dis	Low Med 1 0	Sensitivity Jium High	Very High	Y = 0 G = 0	Magnitude 5 4		Medium H	ligh Very
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Contracting 2.5 Loss of Habitat 2.5 Loss of Habitat	Option 2b is as Option 2c is as Overall, Option R = 0 Y = 0 G = 0 B = 1 Tot = 1 Tot = 1 S The assessme Option 2a is as both. Option 2b is as Option 2b is as Option 2c is as Overall, Option Established te strategy.	Assessed as being seessed as being 2a, Option 2b an Magnitude 5 4 3 2 1 0 Seessed as being seessed as being	neutral to stronger t d Option 2 Low 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Option 2c as han Option 3 ic are equally Sensit Medium 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	s the seabe of or similar y preferred tivity High 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ed disturband reasons. options from Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ce is limited ar a Seabed Dis R = 0 Y = 0 G = 0 B = 1 Tot = 1 N follows: a permanent has change from the labitat perspect	Magnitude Magnitude 5 4 3 2 1 0 abit change from the rock placement stive.	h 2b is asses	Sensitivit Medium I 2 0 0 0 0 0 0 1 2 0 0 0 1 2 0 0 0 1 2 0 0 0 0	y High Very Hig 3 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	R = 0 $Y = 0$ $G = 1$ $B = 0$ $Tot = 1$ 2b and Option 2c eing weaker than Established to	Magnitude S 4 3 2 1 0 W c and very limited in Option 3 there is	Low Me 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Sensitivity tium High 2 3 0 0 0 0 0 0 1 0	Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Y = 0 G = 0 B = 1 Tot = 1 eing neutral to lacement.	5 4 3 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 0 0 0 0 0 0	Medium H	tigh Very 3 4 0 6 <t< td=""></t<>
3.1 Contracting 2.5 Loss of Habitat Strategy AL	Option 2b is as Option 2c is as Overall, Option R = 0 Y = 0 G = 0 B = 1 Tot = 1 Tot = 1 S The assessme Option 2b is as Option 2c is as Difference of the set of th	Assessed as being assessed as being 2a, Option 2b an Magnitude 5 4 3 2 1 0 Seessed as being assessed	Incutral to stronger t d Option 2 Low 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Option 2c as han Option 3 Ic are equally Sensit Medium 2 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 0	s the seabe for similar y preferred tivity High 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ed disturband reasons. options from Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ce is limited and a Seabed Disconstruction $R = 0$ Y = 0 G = 0 B = 1 Tot = 1 Tot = 1 N follows: a permanent has change from the labitat perspect Established te strategy. N	Magnitude Magnitude 5 4 3 2 1 0 abit change from the rock placement stive.	h 2b is asses ctive. Low Low 0 0 0 0 0 0 0 0 0 0 0 0 0	Sensitivit Medium I 2 0 0 0 1 1 ement is the s . Option 2b is vendors. Flexi	y tigh Very Hig 3 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	R = 0 Y = 0 G = 1 B = 0 Tot = 1 2b and Option 2c eing weaker than Established to strategy.	Magnitude Magnitude 5 4 3 2 1 0 W c and very limited an Option 3 there is echnology with a filled	Low Me 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Sensitivity tium High 2 3 0 0 0 0 0 0 1 0	Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Y = 0 G = 0 B = 1 Tot = 1 eing neutral to lacement.	5 4 3 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 0 0 0 0 0 0	Medium H	tigh Very 3 4 0 6 <t< td=""></t<>
3.1 Contracting 2.5 Loss of Habitat Strategy Atammatication of Management of Managemen	Option 2b is as Option 2c is as Overall, Option R = 0 Y = 0 G = 0 B = 1 Tot = 1 Tot = 1 S The assessme Option 2b is as Option 2b is as Option 2b is as Option 2c is as Overall, Option Established ter strategy.	Assessed as being assessed as being 2a, Option 2b an Magnitude 5 4 3 2 1 0 Seessed as being assessed	neutral to stronger t d Option 2 Low 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Option 2c as han Option 3 tc are equally Sensit Medium 2 0 0 0 0 0 0 1 N gacy / long-te han Option 2c as potion 3 for sir / preferred op of vendors. F	s the seabe for similar y preferred tivity High 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ed disturband reasons. options from Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ce is limited and a Seabed Dis R = 0 Y = 0 G = 0 B = 1 Tot = 1 N follows: a permanent has change from the labitat perspece Established te strategy. N acces between of	Magnitude Magnitude 5 4 3 2 1 0 abit change from the rock placement ctive.	h 2b is asses ctive. Low Low 0 0 0 0 0 0 0 0 0 0 0 0 0	Sensitivit Medium I 2 0 0 0 1 1 ement is the s . Option 2b is vendors. Flexi	y tigh Very Hig 3 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	R = 0 Y = 0 G = 1 B = 0 Tot = 1 2b and Option 2c eing weaker than Established to strategy.	Magnitude Magnitude 5 4 3 2 1 0 W c and very limited an Option 3 there is echnology with a filled	Low Me 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Sensitivity tium High 2 3 0 0 0 0 0 0 1 0	Very High 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Y = 0 G = 0 B = 1 Tot = 1 eing neutral to lacement.	5 4 3 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 0 0 0 0 0 0	Medium H	High Ver 3 0 0 0 <td< td=""></td<>







be returned to shore for dismantling/recycling.

1agnitude		Sensitivity										
agintuue	Low	Medium	High	Very High								
	1	2	3	4								
5	0	0	0	0								
4	0	0	0	0								
3	0	0	0	0								
2	0	0	0	0								
1	11	0	0	1								
0	1	0	0	0								

Likelihood	Impact Significance							
Likeimoou	Low	Moderate	High					
	1	2	з					
5	0	0	0					
4	0	0	0					
3	1	0	0					
2	0	0	0					
1	0	0	0					



Appendix E.2	Gr	oup 4	Pair-w	-wise Comparison Matrices – Safety								
1.1 Personnel Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	guing Reverse Reeling View Presenter Oushore		2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting		
2a – Trench and Bury Exposures	N	N	N	N	25.0%	2a – Trench and Bury Exposures	N	N	N	MS	30.0%	
2b – Cut and Remove Exposures	N	N	N	N	25.0%	2b – Cut and Remove Exposures	N	N	N	мѕ	30.0%	
2c – Rock Cover Exposures	N	N	N	N	25.0%	2c – Rock Cover Exposures	N	N	N	мѕ	30.0%	
3 – Reverse Reeling	N	N	N	N	25.0%	3 – Reverse Reeling	MW	MW	MW	N	10.0%	
1.3 Other Users	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting	1.4 Residual Risk	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 - Reverse Reeling	Weighting	
2a – Trench and Bury Exposures	N	N	N	N	25.0%	2a – Trench and Bury Exposures	N	N	N	w	22.2%	
2b – Cut and Remove Exposures	N	N	N	N	25.0%	2b – Cut and Remove Exposures	N	N	N	w	22.2%	

Appendix E.2 Group 4 Pair-wise Comparison Matrices – Safety

1.3 Other Users	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposu	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

1.4 Residual Risk	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	w	22.2%
2b – Cut and Remove Exposures	N	N	N	w	22.2%
2c – Rock Cover Exposures	N	N	N	w	22.2%
3 – Reverse Reeling	S	S	S	N	33.3%



ghting

1.1.						
2.1 Impact of Decommissioning Operations Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting	2.2 Processing of Returned Materials
2a – Trench and Bury Exposures	N	N	N	S	27.3%	2a – Trench and Bury Exposures
2b – Cut and Remove Exposures	N	N	N	s	27.3%	2b – Cut and Remove Exposures
2c – Rock Cover Exposures	N	N	N	s	27.3%	2c – Rock Cover Exposures
3 – Reverse Reeling	w	w	w	N	18.2%	3 – Reverse Reeling

Appendix E.3 Group 4 Pair-wise Comparison Matrices – Environment

Materials	2a – Trench a Exposures	2b – Cut and Exposures	2c – Rock Cov	3 – Reverse R	Weiç
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%
2.4 Disturbance	nch and Bury res	t and Remove res	ck Cover Exposures	arse Reeling	Weighting

and Bury

2.3 Resource Consumption	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposure	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	s	s	N	30.0%
2b – Cut and Remove Exposures	w	N	N	w	20.0%
2c – Rock Cover Exposures	w	N	N	w	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

2.4 Disturbance	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposur	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%
2b – Cut and Remove Exposures	N	N	N	s	27.3%
2c – Rock Cover Exposures	N	N	N	s	27.3%
3 – Reverse Reeling	w	w	w	N	18.2%

2.5 Loss of Habitat	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	s	s	N	30.0%
2b – Cut and Remove Exposures	w	N	N	w	20.0%
2c – Rock Cover Exposures	w	N	N	w	20.0%
3 – Reverse Reeling	N	s	s	N	30.0%



Appendix E.4 Group 4 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

3.2 Schedule	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	s	27.3%
3 – Reverse Reeling	w	w	w	N	18.2%

3.3 Technical maturity	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	w	w	N	18.2%



4.1 Regulatory	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	s	N	27.5%
2b – Cut and Remove Exposures	N	N	N	s	27.5%
2c – Rock Cover Exposures	w	N	N	w	20.3%
3 – Reverse Reeling	N	w	s	N	24.8%

Appendix E.5 Group 4 Pair-wise Comparison Matrices – Societal

4.2 Impact on Commercial Fisheries	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	s	N	27.3%
2b – Cut and Remove Exposures	N	N	s	N	27.3%
2c – Rock Cover Exposures	w	w	N	w	18.2%
3 – Reverse Reeling	N	N	s	N	27.3%

4.3 Socio- economic impact on communities and amenities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%



Appendix E.6 Group 4 Pair-wise Comparison Matrices – Economic

5.1 Cost for decommissioning / removal activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting	5.2 Cost for long term monitoring / remediation activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling		Weighting
2a – Trench and Bury Exposures	N	N	N	s	27.3%	2a – Trench and Bury Exposures	N	N	N	w		22.2%
2b – Cut and Remove Exposures	N	N	N	s	27.3%	2b – Cut and Remove Exposures	N	N	N	w	Ī	22.2%
2c – Rock Cover Exposures	N	N	N	s	27.3%	2c – Rock Cover Exposures	N	N	N	w	Ī	22.2%
3 – Reverse Reeling	w	w	w	N	18.2%	3 – Reverse Reeling	S	S	S	N	Ī	33.3%

Appendix E.7 Group 4 Results Chart

Group 4 - Umbilicals / Cables - Results ■ 1. Safety ■ 2. Environmental ■ 3. Technical ■ 4. Societal ■ 5. Economic 30.0% 26.8% 25.9% 24.6% 25.0% 5.2% 22.8% 5.2% 5.2% 4.4% 20.0% 5.4% 5.4% 4.1% 5.1% 15.0% 5.3% 5.3% 5.3% 4.1% 10.0% 5.7% 4.7% 4.7% 4.9% 5.0% 5.2% 5.2% 5.2% 4.3% 0.0% 2a – Trench and Bury 2b – Cut and Remove 2c – Rock Cover Exposures 3 – Reverse Reeling Exposures Exposures



APPENDIX F GROUP 1 – SALTIRE A TO PIPER B BUNDLE – OPTION DATASHEETS

Appendix F.1 Option 1b - Minor Intervention - Remediate Ends and Spans Only

Decision / Group		Group 1: Saltire A to Piper	B Bundle			
ption			Remediate Ends and Spans	Only		
equence of Works		Perform as-found survey	is to remove snagging hazard			
ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed
SAFETY						
		1.1 Personnel Offshore 1.2 Personnel Onshore		Refer to HAZID Report Refer to HAZID Report		
fety CA Sub-Criteria		1.3 Other Users		Refer to HAZID Report		
		1.4 Residual Risk		Refer to HAZID Report		
ditional Safety Data for Info	ormation:					
ffshore Personnel			mber	116	Man Hours	10,848
ver Requirement			mber	0	Man Hours	0
nshore Personnel		Nu	mber	10	Man Hours	1,952
pact to Other Users of the	Sea	Number of N	Vessels Used	3	Duration of Operations	20
				1		1
otential for High Consequer	nce Events	Refer to H	AZID Report			
ENVIRONMENTAL						
		2.1 Impact of Decommissi	oning Operations Offshore	Refer to ENVID Report		
				Refer to ENVID Report		
vironmental CA Sub-Criter	ria					
		2.3 Resource Consumptio	n	Refer to ENVID Report Refer to ENVID Report		
		2.5 Loss of Habitat		Refer to ENVID Report		
dditional Environmental Dat	a for Information:					
		Vess	еі Туре	Number off	Duration	Activity
			/ Pipehaul	0	0	N/A
			SV	0	0	N/A
			DSV Reel Vessel Rockdump Vessel		0	N/A
arine Impact (Vessels)					0 6	N/A Rock Placement
			y Vessel	1	9	Survey Works
			awler	1	5	Trawl Sweep
			ng Vessel	0	0	N/A
nerav llee		F	uel	CO ₂	NOx	SO ₂
nergy Use			3.6 Te	613.6 Te	11.4 Te	2.3 Te
fe Cycle Emissions			CO ₂	CO ₂ (Credit)	-	
			335 Te	Not Evaluated	Deseures	
			tivity dumping	Area (m ²) 850	Resources 1700Te of rockdump	-
arine Impact (Seabed)			MFE	N/A	N/A	-
			nching	N/A	N/A	
			ent / Material	Parameter	Weight (Te)	Length (m)
		Carbo	on Steel	Recovered	0.0	0
		Carbo		Remaining	5111.5	6,637
aterials		Coa	atings	Recovered	0.0	0
				Remaining Recovered	14.8	6,637 N/A
		Alumin	ium Alloy	Recovered	0.0	N/A N/A
		Т	уре	Left In-Situ	Returned	DVA
			Scale	N/A	N/A	
siduals		Hydro	ocarbon	Flushed & Cleaned	Flushed & Cleaned	
		Contr	ol Fluids	N/A	N/A	
FECHNICAL						
		3.1 Contracting Strategy		Established methods and technology. No sp flexibility in terms of contracting strategy.	ecial requirements that would limit number of available	able decommissioning contractors. C
chnical CA Sub-Criteria		3.2 Schedule			risk factors that could extend schedule. In field tim	e of 20 days
		3.3 Technical Maturity		TRL 7. Established methods and technology		o or 20 uayo.
		ore recommon muturity			· ·	
SOCIETAL						
		4.1 Political		Seabed would be left with rock dump of sp	ans, exposures and ends.	
ocietal CA Sub-Criteria		4.2 Impact on Fisheries		Minimal area of natural seabed disturbed.		
		4.3 Impact on Communitie	\$	Minimal impact on communities and amenitie	s as no material returned to shore.	
CONOMIC						
CONOMIC		E 4 Total Abandarmant F	panditura	£1.92M		
conomic CA Sub-Criteria		5.1 Total Abandonment Ex 5.2 Net Present Cost	penunure	£1.92M		

Economic CA Sub-Criteria	5.2 Net Present Cost	N/A		
	5.3 Cashflow	N/A		
Potential for Future Remediation			Bundle is left in situ and exposed.	



Appendix F.2 Option 2a - Major Intervention - Trench and Bury Exposures

Area		Saltire							
Decision / Group		Group 1: Saltire A to F	Group 1: Saltire A to Piper B Bundle						
ption		Option 2a: Leave in Si	Option 2a: Leave in Situ Major Intervention – Trench and Bury Exposures						
Sequence of Works		Perform as-found surve Prepare for trenching (r Trench and backfill pipel Rockdump end transitior Perform as-left survey	Perform as-found survey Prepare for trenching (remove vent valves and ballast chains) Trench and backfill pipeline Rockdump end transitions						
ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status			
880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed			
SAFETY									
		1.1 Personnel Offsho	re	Refer to HAZID Report					
fety CA Sub-Criteria		1.2 Personnel Onsho	re	Refer to HAZID Report					
iciy ex sus-entena		1.3 Other Users		Refer to HAZID Report					
		1.4 Residual Risk		Refer to HAZID Report					
lditional Safety Data for Info fshore Personnel	ormation:	Ni	umber	212	Man Hours	65,232			
ver Requirement			umber	6	Man Hours	8,208			
shore Personnel			umber	10	Man Hours	16,360			
pact to Other Users of the	Sea	Number of	Vessels Used	5	Duration of Operations	87			
tential for High Consequen	ice Events	Refer to H	AZID Report	1		l			
			··						
ENVIRONMENTAL									
		2.1 Impact of Decomm	nissioning Operations	Defects FNV/D Devent					
		Offshore		Refer to ENVID Report					
vironmental CA Sub-Criteri	ia	2.2 Processing of Ret		Refer to ENVID Report					
		2.3 Resource Consun 2.4 Disturbance	nption	Refer to ENVID Report Refer to ENVID Report					
		2.5 Loss of Habitat		Refer to ENVID Report					
Iditional Environmental Data	a for Information:								
		Vess	sel Type	Number off	Duration	Activity			
		-	/ Pipehaul	0	0	N/A			
			CSV	0	0	N/A			
rine Impact (Veccele)			DSV I Vessel	0	57	Subsea Works N/A			
arine Impact (Vessels)			mp Vessel	1	5	Rock Placement			
			y Vessel	1	9	Survey Works			
			awler	1	5	Trawl Sweep			
		Trench	ing Vessel	1	11	Trench / Backfill			
ergy Use			Fuel	CO ₂	NOx	SO ₂			
			97.6 Te	4430.3 Te	82.5 Te	16.8 Te			
e Cycle Emissions			CO ₂ 152 Te	CO ₂ (Credit) Not Evaluated	-				
			tivity	Area (m ²)	Resources				
ring Impact (Cash - 4)			dumping	100	200Te of rockdump	1			
arine Impact (Seabed)			MFE	N/A	N/A				
			nching	6637	Trenching Spread				
		Compone	ent / Material	Parameter	Weight (Te)	Length (m)			
		Carb	on Steel	Recovered Remaining	0.0 5111.5	6,637			
iterials				Recovered	0.0	0,057			
		Co	atings	Remaining	14.8	6,637			
		Alizente	nium Allov	Recovered	0.0	N/A			
			nium Alloy	Remaining	18.4	N/A			
			уре	Left In-Situ	Returned				
siduals			A Scale ocarbon	N/A Flushed & Cleaned	N/A Flushed & Cleaned				
		-	ocarbon rol Fluids	N/A	N/A	1			
		contra							
ECHNICAL									
		3.1 Contracting Strate	egy	Suitable trenching/backfill equipment available but bundle outside diameter is at the limit of current technology, therefore likely to be limited flexibility in terms of contracting strategy.					
Technical CA Sub-Criteria		3.2 Schedule			g required to achieve sufficient trench depth. High nethod, e.g. rock dump. In field time of 87 days.	risk of failure to achieve trench depth			
		3.3 Technical Maturity	1	resulting in additional time for alternative method, e.g. rock dump. In field time of 87 days. TRL 5. This is a routine subsea operation but has no track record of trenching large diameter bundle, and bundle is at the limit of currer track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in the area of failure.					
				· · · · · · · · · · · · · · · · · · ·					
SOCIETAL									
		4.1 Political		If successful, would leave a clear seabed	d. However high risk of not achieving required de	pth of cover requiring additional material			
		4.1 Political		rockdump)					

Societal CA Sub-Criteria

rockdump) Medium impact on commarical fichariae due to a significant area of the natural seabed being temporarily disturbed. However, the area

4.2 Impact on Fisheries	would recover to its natural condition over time. Permanent loss of seabed areas if remedial rock dump is required.
4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.

5. ECONOMIC						
	5.1 Total Abandonment Expenditure	£19.68M				
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A				
	5.3 Cashflow	N/A				
Potential for Future Remediation		Low	Bundle is left in situ buried below seabed and not exposed.			



Appendix F.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	Saltire
Decision / Group	Group 1: Saltire A to Piper B Bundle
Option	Option 2c: Leave in Situ Major Intervention – Rock Cover Exposures
	Perform as-found survey
	Blanket rockdump bundle
Commence of Works	Perform as-left survey
Sequence of Works	Perform trawl sweep of site

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed

1. SAFETY							
	1.1 Personnel Offshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.3 Other Users	Refer to HAZID Report					
	1.4 Residual Risk	Refer to HAZID Report					
Additional Safety Data for Information:							
Offshore Personnel	Number	116	Man Hours	16,368			
Diver Requirement	Number	0	Man Hours	0			
Onshore Personnel	Number	10	Man Hours	8,208			
Impact to Other Users of the Sea	Number of Vessels Used	3	Duration of Operations	43			
Potential for High Consequence Events	Refer to HAZID Report						

2. ENVIRONMENTAL					
	2.1 Impact of Decommissioning Operations	Refer to ENVID Report			
	Offshore				
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENV/ID Report			
Invironmental CA Sub-Criteria	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Safety Data for Information:					
	Vessel Type	Number off	Duration	Activity	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	0	0	N/A	
larine Impact (Vessels)	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	29	Rock Placement	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
	Fuel	CO ₂	Nox	SO ₂	
nergy Use	471.3 Te	1494.1 Te	27.8 Te	5.7 Te	
ife Cuele Emissions	CO ₂	CO ₂ (Credit)			
ife Cycle Emissions	11,216 Te	Not Evaluated			
	Activity	Area (m²)	Resources		
	Rockdumping	77737	154700Te of rockdump		
Aarine Impact (Seabed)	MFE	N/A	N/A		
	Trenching	N/A	N/A		
	Component / Material	Parameter	Weight (Te)	Length (m)	
	Carbon Steel	Recovered	0.0	0	
	Carbon Steel	Remaining	5111.5	6,637	
/aterials	Coatings	Recovered	0.0	0	
	Coatings	Remaining	14.8	6,637	
	A huminium Alley	Recovered	0.0	N/A	
	Aluminium Alloy	Remaining	18.4	N/A	
	Туре	Left In-Situ	Returned		
esiduals	LSA Scale	N/A	N/A		
esiduais	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		
TECHNICAL					
echnical CA Sub-Criteria	3.1 Contracting Strategy	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Go flexibility in terms of contracting strategy.			
connear on sub-orneria	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 43 days.			
	3.3 Technical Maturity	TRL 7. Established methods and technology. F	Fully mature.		
. SOCIETAL					

	4.1 Political	Seabed would be left with rock dump over entire bundle length.			
Societal CA Sub-Criteria	4.2 Impact on Fisheries	Significant area of natural seabed permanently disturbed.			
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.			
5. ECONOMIC					
	5.1 Total Abandonment Expenditure	£10.01M			
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A			

5.3 Cashflow	N/A	
Potential for Future Remediation	Low	Bundle is left in situ covered by rock and not exposed.



Appendix F.4 Option 3 - Full Removal - Cut and Lift

Area	Saltire
Decision / Group	Group 1: Saltire A to Piper B Bundle
Option	Option 3a: Full Removal – Cut and Lift
	Perform as-found survey
	Cut pipe in to 24m lengths using hydraulic shears
	Recover pipeline sections to pipehaul barge
Sequence of Works	Rockdump cut ends at crossing location
	Perform as-left survey
	Perform trawl sweep of site

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed

SAFETY							
	1.1 Personnel Offshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report					
Salety CA Sub-Chiefia	1.3 Other Users	Refer to HAZID Report					
	1.4 Residual Risk	Refer to HAZID Report					
Additional Safety Data for Information:							
Offshore Personnel	Number	268	Man Hours	90,240			
Diver Requirement	Number	6	Man Hours	4,176			
Onshore Personnel	Number	16	Man Hours	24,928			
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	124			
Potential for High Consequence Events	Refer to HAZID Report						

NVIRONMENTAL					
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report			
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report	•		
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
dditional Environmental Data for Information:					
	Vessel Type	Number off	Duration	Activity	
	Barge / Pipehaul	1	29	Material Transport	
	CSV	1	52	Subsea Works	
	DSV	1	29	Subsea Works	
	HLV	0	0	N/A	
	Large Deck CSV	0	0	N/A	
arine Impact (Vessels)	Light CSV	0	0	N/A	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	0	0	N/A	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	Fuel	CO ₂	Nox	SO ₂	
	2891.8 Te	9167.1 Te	170.6 Te	34.7 Te	
in Cuelo Emissione	CO ₂	CO ₂ (Credit)			
e Cycle Emissions	14,333 Te	Not Evaluated			
	Activity	Area (m²)	Resources		
unin a lange at (Sachad)	Rockdumping	N/A	N/A	1	
arine Impact (Seabed)	MFE	N/A	N/A	1	
	Trenching	N/A	N/A		
	Component / Material	Parameter	Weight (Te)	Length (m)	
	Carbon Steel	Recovered	5111.5	6,637	
	Carbon Steel	Remaining	0.0	0	
iterials	Coatings	Recovered	14.8	6,637	
	Coatings	Remaining	0.0	0	
	Aluminium Allow	Recovered	18.4	N/A	
	Aluminium Alloy	Remaining	0.0	N/A	
	Туре	Left In-Situ	Returned		
- iduala	LSA Scale	N/A	N/A		
siduals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	1	
	Control Fluids	N/A	N/A	1	

	3.1 Contracting Strategy	The vessels required are readily available but there is no established methodology for lifting and removing bundles of this size, so may be more challenging to have flexible contracting strategy.			
Technical CA Sub-Criteria	3.7 Schedule	Major technological risk factors to the schedule in that an established lifting technology is not in place and there is major scope for overruns. Current estimate of in-field time is 124 days.			
	3 3 Technical Maturity	TRL 5. No track record for lift and removal of large diameter bundles. Extensive subsea works required, likely complete with diver support. Low technical maturity.			

SOCIETAL		
	4.1 Political	Full removal would leave a clear seabed and BEIS encourages all decommissioning programmes to review existing and emerging technology for bundle removal.

Societal CA Sub-Criteria	4.2 Impact on Fisheries	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.
	4.3 Impact on Communities	Medium benefit to communities as bundle would be returned to shore for dismantling/recycling. Local infrastructure upgrades may be required.

ECONOMIC				
	5.1 Total Abandonment Expenditure	£17.41M		
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A		
	5.3 Cashflow	N/A		
Potential for Future Remediation		None	Bundle is fully removed.	



APPENDIX G GROUP 2 – SALTIRE A TO SALTIRE WID BUNDLE – OPTION DATASHEETS

Option 1b - Minor Intervention - Remediate Ends and Spans Only

Appendix G.1

Societal CA Sub-Criteria

Area			Saltire Group 2: Saltire A to Saltire WID Bundle					
Decision / Group								
Option			Option 1b: Leave in Situ – Remediate Ends and Spans Only					
		Perform as-found survey						
			spans to remove snagging h	azard				
Sequence of Works		Perform as-left survey						
sequence of Horks		Perform trawl sweep of s	site					
ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status		
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed		
. SAFETY								
		1.1 Personnel Offshore		Refer to HAZID Report				
afety CA Sub-Criteria		1.2 Personnel Onshore	;	Refer to HAZID Report				
		1.3 Other Users		Refer to HAZID Report				
dditional Safety Data for Inf	formation	1.4 Residual Risk		Refer to HAZID Report				
offshore Personnel	iormation:	Nu	mber	116	Man Hours	10,608		
Diver Requirement			mber	0	Man Hours	0		
Onshore Personnel			mber	10	Man Hours	1,808		
manore rersonnel		Nu	mod	10	man nours	1,000		
mpact to Other Users of the	e Sea	Number of \	Vessels Used	3	Duration of Operations	19		
				1	1	1		
Potential for High Conseque	ence Events	Refer to H	AZID Report					
. ENVIRONMENTAL								
		2.1 Impact of Decommi	issioning Operations	Refer to ENVID Report				
		Offshore						
invironmental CA Sub-Crite	ria	2.2 Processing of Returned Materials		Refer to ENVID Report				
Invironmental CA Sub-Crite		2.3 Resource Consum	ption	Refer to ENVID Report				
		2.4 Disturbance		Refer to ENVID Report				
		2.5 Loss of Habitat		Refer to ENVID Report				
Additional Environmental Da	ita for Information:							
			el Type	Number off	Duration	Activity		
			Pipehaul	0	0	N/A		
		CSV		0	0	N/A		
			SV	0	0	N/A		
Marine Impact (Vessels)		Reel	Vessel	0	0	N/A		
Marine Impact (Vessels)		Reel Rockdur	Vessel np Vessel	0	0 5	N/A Rock Placement		
Marine Impact (Vessels)		Reel Rockdur Survey	Vessel mp Vessel y Vessel	0 1 1	0 5 9	N/A Rock Placement Survey Works		
Aarine Impact (Vessels)		Reel Rockdur Survey Tra	Vessel mp Vessel y Vessel wler	0 1 1 1	0 5 9 5	N/A Rock Placement Survey Works Trawl Sweep		
Marine Impact (Vessels)		Reel Rockdur Survey Tra Trenchir	Vessel mp Vessel y Vessel wler ng Vessel	0 1 1 1 1 0	0 5 9 5 0	N/A Rock Placement Survey Works Trawl Sweep N/A		
		Reel Rockdur Survey Tra Trenchir	Vessel mp Vessel y Vessel weler ng Vessel uel	0 1 1 1 0 CO ₂	0 5 9 5 0 Nox	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂		
		Reel Rockdur Survey Tra Trenchir Fr 176	Vessel mp Vessel y Vessel weler ng Vessel uel 3.3 Te	0 1 1 1 0 CO ₂ 559 Te	0 5 9 5 0	N/A Rock Placement Survey Works Trawl Sweep N/A		
inergy Use		Reel Rockdur Survey Tra Trenchir Fr 176	Vessel mp Vessel y Vessel weler uel 3.3 Te CO ₂	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit)	0 5 9 5 0 Nox	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂		
inergy Use		Reel Rockdur Survey Tra Trenchir 176 0 0 1,83	Vessel mp Vessel y Vessel weler uel 3.3 Te CO ₂ 28 Te	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated	0 5 9 5 0 Nox 10.4 Te	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂		
inergy Use		Reel Rockdur Survey Tra Trenchir 176 00 1,87 Act	Vessel mp Vessel vy Vessel my Vessel my Vessel uel 3.3 Te CO ₂ 28 Te tivity	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²)	0 5 9 5 0 Nox 10.4 Te	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂		
inergy Use Life Cycle Emissions		Reel Rockdur Survey Tra Trenchir 176 0 0 1,82 Act Rocko	Vessel mp Vessel vy Vessel weler mg Vessel uel 3.3 Te CO ₂ 28 Te tivity dumping	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²) 150	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂		
inergy Use life Cycle Emissions		Reel Rockdur Survey Tra Trenchir 176 00 1,87 Act Rocko	Vessel mp Vessel wvler mg Vessel uel 3.3 Te CO ₂ 28 Te tivity dumping IFE	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²) 150 N/A	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂		
inergy Use life Cycle Emissions		Reel Rockdur Survey Tra Trenchir 176 0 0 1,83 Act Rocko	Vessel mp Vessel wvler mg Vessel wel 3.3 Te CO2 28 Te tivity dumping IFE mching	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²) 150 N/A N/A	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te		
inergy Use life Cycle Emissions		Reel Rockdur Survey Tra Trenchir 176 0 0 1,83 Act Rocko	Vessel mp Vessel wvler mg Vessel uel 3.3 Te CO ₂ 28 Te tivity dumping IFE	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²) 150 N/A N/A Parameter	0 5 9 5 0 Nox 10.4 Te 8 8 300Te of rockdump N/A N/A Weight (Te)	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂ 2.1 Te Length (m)		
inergy Use life Cycle Emissions		Reel Rockdur Survey Tra Trenchir 176 C C 1,8 Act Rocko M Trer Compone	Vessel mp Vessel wvler mg Vessel wel 3.3 Te CO2 28 Te tivity dumping IFE mching	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²) 150 N/A N/A N/A Parameter Recovered	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0		
inergy Use ife Cycle Emissions flarine Impact (Seabed)		Reel Rockdur Survey Tra Trenchir 176 C C 1,8 Act Rocko M Trer Compone	Vessel mp Vessel y Vessel weler uel 3.3 Te CO ₂ 28 Te tivity dumping IFE nching mt / Material	0 1 1 1 0 CO ₂ 559 Te CO ₂ (Credit) Not Evaluated Area (m ²) 150 N/A N/A N/A Parameter Recovered Remaining	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106		
inergy Use ife Cycle Emissions Marine Impact (Seabed)		Reel Rockdur Survey Tra Trenchir 176 0 0 1,8 Act Rocko M Trer Compone Carbo	Vessel mp Vessel y Vessel weler uel 3.3 Te CO ₂ 28 Te tivity dumping IFE nching mt / Material	0 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m ²) 150 N/A N/A Parameter Recovered Remaining Recovered	0 5 9 5 0 Nox 10.4 Te 8 8 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0		
inergy Use ife Cycle Emissions Marine Impact (Seabed)		Reel Rockdur Survey Tra Trenchir 176 0 0 1,8 Act Rocko M Trer Compone Carbo	Vessel mp Vessel y Vessel weler outer 02 02 02 02 02 02 02 02 02 02	0 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m ²) 150 N/A N/A Parameter Recovered Remaining Recovered Remaining	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106		
nergy Use ife Cycle Emissions flarine Impact (Seabed)		Reel Rockdur Survey Tra Trenchir 176 0 0 1,8 Rockc Rockc M Trer Compone Carbo	Vessel mp Vessel y Vessel weler outer 02 02 02 02 02 02 02 02 02 02	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106 N/A		
nergy Use ife Cycle Emissions flarine Impact (Seabed)		Reel Rockdur Survey Tra Trenchir 176 0 0 1,8 Act Rocko M Trer Compone Carbo	Vessel mp Vessel y Vessel weler uel S.3 Te CO2 28 Te tivity dumping IFE nching nt / Material on Steel atings ium Alloy	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A Parameter Recovered Remaining	0 5 9 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 4.8	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106		
nergy Use ife Cycle Emissions farine Impact (Seabed)		Reel Rockdur Survey Tra Trenchir 176 CC 1,8 Act Rocko M Carbo Carbo Carbo	Vessel mp Vessel y Vessel weler ng Vessel uel 3.3 Te 20 28 Te tivity dumping IFE nching nt / Material on Steel atings ium Alloy ype	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 662.5 0.0 3.1 0.0 4.8 Returned	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106 N/A		
inergy Use ife Cycle Emissions Aarine Impact (Seabed) Aaterials		Reel Rockdur Survey Tra Trenchir C C C C C C C C C C C C C C C C C C C	Vessel mp Vessel y Vessel wele s.3 Te cog 28 Te tivity dumping IFE nching nt / Material on Steel stings ium Alloy ype Scale	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A	0 5 9 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 3.1 0.0 4.8 Returned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106 N/A		
nergy Use ife Cycle Emissions flarine Impact (Seabed) flaterials		Reel Reel Rockdur Survey Tra Trenchir C C Rockd Rockd Rockd Rockd Rockd Rockd C Compone Carbo Carbo Carbo Carbo Carbo Compone Carbo Ca	Vessel mp Vessel mp Vessel vy Vessel vel vel s.3 Te co2 28 Te tivity dumping IFE nching nt / Material on Steel atings ium Alloy ype Scale bocarbon	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106 N/A		
nergy Use ife Cycle Emissions flarine Impact (Seabed) flaterials		Reel Reel Rockdur Survey Tra Trenchir C C Rockd Rockd Rockd Rockd Rockd Rockd C Compone Carbo Carbo Carbo Carbo Carbo Compone Carbo Carbo Compone Carbo Compone Carbo Ca	Vessel mp Vessel y Vessel wele s.3 Te cog 28 Te tivity dumping IFE nching nt / Material on Steel stings ium Alloy ype Scale	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A	0 5 9 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 3.1 0.0 4.8 Returned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106 N/A		
nergy Use ife Cycle Emissions Marine Impact (Seabed) Materials		Reel Reel Rockdur Survey Tra Trenchir C C Rockd Rockd Rockd Rockd Rockd Rockd C Compone Carbo Carbo Carbo Carbo Carbo Compone Carbo Carbo Compone Carbo Compone Carbo Ca	Vessel mp Vessel mp Vessel vy Vessel vel vel s.3 Te co2 28 Te tivity dumping IFE nching nt / Material on Steel atings ium Alloy ype Scale ocarbon	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 0 2,106 N/A		
inergy Use Life Cycle Emissions Marine Impact (Seabed) Materials		Reel Reel Rockdur Survey Tra Trenchir C C Rockd Rockd Rockd Rockd Rockd Rockd C Compone Carbo Carbo Carbo Carbo Carbo Compone Carbo Carbo Compone Carbo Compone Carbo Ca	Vessel mp Vessel mp Vessel vy Vessel vel vel s.3 Te co2 28 Te tivity dumping IFE nching nt / Material on Steel atings ium Alloy ype Scale ocarbon	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A	0 5 9 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 N/A N/A N/A		
inergy Use Life Cycle Emissions Marine Impact (Seabed) Materials		Reel Reel Rockdur Survey Tra Trenchir C C Rockd Rockd Rockd Rockd Rockd Rockd C Compone Carbo Carbo Carbo Carbo Carbo Compone Carbo Carbo Compone Carbo Compone Carbo Ca	Vessel mp Vessel y Vessel uel sort sort sort sort sort sort sort sort	0 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A N/A N/A Parameter Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established methods and technology. No sp	0 5 9 5 0 Nox 10.4 Te 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned	N/A Rock Placement Survey Works Trawl Sweep N/A SO2 2.1 Te Length (m) 0 2,106 N/A N/A N/A		
inergy Use ife Cycle Emissions Marine Impact (Seabed) Materials Residuals		Reel Rockdur Survey Tra Trenchir 176 0 0 0 1,8 Act Rockd M Trer Compone Carbo Carbo Carbo Carbo Carbo Carbo Carbo Cos Alumini 3.1 Contracting Strateg	Vessel mp Vessel y Vessel uel sort sort sort sort sort sort sort sort	0 1 1 1 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established methods and technology. No sp- flexibility in terms of contracting strategy.	0 5 9 5 0 Nox 10.4 Te 8 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 662.5 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂ 2.1 Te Length (m) 0 2,106 0 2,106 N/A N/A N/A valiable decommissioning contractors.		
inergy Use Life Cycle Emissions Marine Impact (Seabed) Materials Residuals		Reel Rockdur Survey Tra Trenchir Fi C C C C C C C C C C C C C C C C C C	Vessel mp Vessel y Vessel uel sort sort sort sort sort sort sort sort	0 1 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m ²) 150 N/A 150 N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established methods and technology. No spifexibility in terms of contracting strategy. No particular technological factors or major	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 662.5 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned N/A Example A Cleaned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂ 2.1 Te Length (m) 0 2,106 0 2,106 N/A N/A N/A valiable decommissioning contractors.		
nergy Use ife Cycle Emissions larine Impact (Seabed) laterials esiduals		Reel Rockdur Survey Tra Trenchir 176 0 0 0 1,8 Act Rockd M Trer Compone Carbo Carbo Carbo Carbo Carbo Carbo Carbo Cos Alumini 3.1 Contracting Strateg	Vessel mp Vessel y Vessel uel sort sort sort sort sort sort sort sort	0 1 1 1 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m²) 150 N/A N/A Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established methods and technology. No sp- flexibility in terms of contracting strategy.	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 662.5 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned N/A Example A Cleaned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂ 2.1 Te Length (m) 0 2,106 0 2,106 N/A N/A N/A valiable decommissioning contractors.		
nergy Use ife Cycle Emissions larine Impact (Seabed) laterials esiduals <u>TECHNICAL</u> echnical CA Sub-Criteria		Reel Rockdur Survey Tra Trenchir Fi C C C C C C C C C C C C C C C C C C	Vessel mp Vessel y Vessel uel sort sort sort sort sort sort sort sort	0 1 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m ²) 150 N/A 150 N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established methods and technology. No spifexibility in terms of contracting strategy. No particular technological factors or major	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A N/A Weight (Te) 0.0 662.5 0.0 3.1 0.0 662.5 0.0 3.1 0.0 4.8 Returned N/A Flushed & Cleaned N/A Example A Cleaned N/A	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂ 2.1 Te Length (m) 0 2,106 0 2,106 N/A N/A N/A valiable decommissioning contractors.		
Marine Impact (Vessels) Energy Use Life Cycle Emissions Marine Impact (Seabed) Materials Residuals 3. TECHNICAL Fechnical CA Sub-Criteria 4. SOCIETAL		Reel Rockdur Survey Tra Trenchir Fi C C C C C C C C C C C C C C C C C C	Vessel mp Vessel y Vessel uel sort sort sort sort sort sort sort sort	0 1 1 1 1 1 1 0 0 CO2 559 Te CO2 (Credit) Not Evaluated Area (m ²) 150 N/A 150 N/A N/A Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established methods and technology. No spifexibility in terms of contracting strategy. No particular technological factors or major	0 5 9 5 0 Nox 10.4 Te Resources 300Te of rockdump N/A N/A N/A Weight (Te) 0.0 662.5 0.0 662.5 0.0 662.5 0.0 4.8 Returned N/A Flushed & Cleaned N/A Flushed & Cleaned N/A Flushed & Cleaned N/A Flushed schedule. In field Fully mature.	N/A Rock Placement Survey Works Trawl Sweep N/A SO ₂ 2.1 Te Length (m) 0 2,106 0 2,106 N/A N/A N/A valiable decommissioning contractors.		

5. ECONOMIC					
Economic CA Sub-Criteria	5.1 Total Abandonment Expenditure	£1.76M			
	5.2 Net Present Cost	N/A			
	5.3 Cashflow	N/A			
Potential for Future Remediation	Potential for Future Remediation		Bundle is left in situ and exposed.		

Minimal area of natural seabed lost.

Minimal impact on communities and amenities as no material returned to shore.

4.2 Impact on Fisheries 4.3 Impact on Communities



Appendix G.2 Option 2a - Major Intervention - Trench and Bury Exposures

Saltire	
iroup 2: Saltire A to Saltire WID Bundle	
otion 2a: Leave in Situ Major Intervention – Trench and Bury Exposures	
Perform as-found survey	
Prepare for trenching (remove vent valves and ballast chains)	
Trench and backfill pipeline	
Rockdump end transitions	
Perform as-left survey	
Perform trawl sweep of site	

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	1.1 Personnel Offshore	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
Salety CA Sub-Chiena	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	212	Man Hours	30,096	
Diver Requirement	Number	6	Man Hours	2,736	
Onshore Personnel	Number	10	Man Hours	7,608	
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	47	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL				
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report	Refer to ENVID Report	
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report		
Environmental CA Sub-Criteria	2.3 Resource Consumption	Refer to ENVID Report		
	2.4 Disturbance	Refer to ENVID Report		
	2.5 Loss of Habitat	Refer to ENVID Report		
Additional Environmental Data for Information:				
	Vessel Type	Number off	Duration	Activity
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	1	19	Subsea Works
Marine Impact (Vessels)	Reel Vessel	0	0	N/A
	Rockdump Vessel	1	5	Rock Placement
	Survey Vessel	1	9	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	1	9	Trench / Backfill
5	Fuel	CO ₂	Nox	SO ₂
Energy Use	854.8 Te	2709.8 Te	50.4 Te	10.3 Te
Life Cycle Emissions	CO ₂	CO ₂ (Credit)		
	3,978 Te	Not Evaluated		
	Activity	Area (m²)	Resources	
Marine Impact (Seabed)	Rockdumping	2840	4500Te of rockdump	
Marine Impact (Seabed)	MFE	N/A	N/A	
	Trenching	1806	Trenching Spread	
	Component / Material	Parameter	Weight (Te)	Length (m)
	Carbon Steel	Recovered	0.0	0
	Carbon Steel	Remaining	662.5	2,106
Materials	Coatings	Recovered	0.0	0
	Coatings	Remaining	3.1	2,106
	Aluminium Alloy	Recovered	0.0	N/A
	Aluminium Alloy	Remaining	4.8	N/A
	Туре	Left In-Situ	Returned	
Posiduala	LSA Scale	N/A	N/A	
Residuals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	
	Control Fluids	N/A	N/A	

3. TECHNICAL					
	3.1 Contracting Strategy	Suitable trenching/backfill equipment available. Bundle outside diameter is within but approaching the limits of current technology therefore flexibility may be somewhat limited in terms of contracting strategy.			
Technical CA Sub-Criteria	3.7 Schedule	High chance of multi-pass trenching being required to achieve sufficient trench depth. Moderate risk of failure to achieve trench depth resulting in additional time for alternative method, e.g. rock dump. In field time of 47 days.			
	3.3 Technical Maturity	TRL 6. This is a routine subsea operation but has no track record of trenching large diameter bundles. However, bundle is within the limit of current track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in the area of failure.			

4. SOCIETAL		
Societal CA Sub-Criteria	4.1 Political	If successful, would leave a clear seabed. Moderate risk of not achieving required depth of cover requiring additional material (e.g. rock dump)
	4.2 Impact on Figherieg	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time. Permanent loss of seabed areas if remedial rock dump is required.
	4.3 Impact on Communities	Minimal impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC					
	5.1 Total Abandonment Expenditure	£8.86M			
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A			
	5.3 Cashflow	N/A			
Potential for Future Remediation		Low	Bundle is left in situ buried below seabed and not exposed.		



Appendix G.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	Saltire
Decision / Group	Group 2 Saltire A to Saltire WID Bundle
Option	Option 2c: Leave in Situ Major Intervention – Rock Cover Exposures
	Perform as-found survey
	Blanket rockdump bundle
Converse of Monke	Perform as-left survey
Sequence of Works	Perform trawl sweep of site

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY							
	1.1 Personnel Offshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report	Refer to HAZID Report				
	1.3 Other Users	Refer to HAZID Report					
	1.4 Residual Risk	Refer to HAZID Report	efer to HAZID Report				
Additional Safety Data for Information:							
Offshore Personnel	Number	116	Man Hours	10,848			
Diver Requirement	Number	0	Man Hours	0			
Onshore Personnel	Number	10 Man Hours 2,536					
Impact to Other Users of the Sea	Number of Vessels Used	3	Duration of Operations	20			
Potential for High Consequence Events	Refer to HAZID Report						

2. ENVIRONMENTAL					
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report			
nvironmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report			
nvironmental CA Sub-Citteria	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	2.5 Loss of Habitat Refer to ENVID Report			
Additional Environmental Data for Information:					
	Vessel Type	Number off	Duration	Activity	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	0	0	N/A	
larine Impact (Vessels)	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	6	Rock Placement	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	Fuel	CO ₂	Nox	SO ₂	
	193.6 Te	613.6 Te	11.4 Te	2.3 Te	
Life Courts Fraincisco	CO ₂	CO ₂ (Credit)			
ife Cycle Emissions	1,882 Te	Not Evaluated			
	Activity	Area (m²)	Resources		
larine Impact (Seabed)	Rockdumping	19610	31000Te of rockdump		
larine impact (seabed)	MFE	N/A	N/A		
	Trenching	N/A	N/A		
	Component / Material	Parameter	Weight (Te)	Length (m)	
	Carbon Steel	Recovered	0.0	0	
	Carbon Steel	Remaining	662.5	2,106	
laterials	Continen	Recovered	0.0	0	
	Coatings	Remaining	3.1	2,106	
	Alternatives Alless	Recovered	0.0	N/A	
	Aluminium Alloy	Remaining	4.8	N/A	
	Туре	Left In-Situ	Returned		
osiduala	LSA Scale	N/A	N/A		
esiduals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		
	· · · · · ·	•	•		
TECHNICAL					
	3.1 Contracting Strategy	Established methods and technology. No spe flexibility in terms of contracting strategy.	ecial requirements that would limit number of ava	ailable decommissioning contractors	
echnical CA Sub-Criteria		notionally interms of contracting strategy.			

Technical CA Sub-Criteria							
reennear ex sub-ernena	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 20 days.					
	3.3 Technical Maturity	TRL 7. Established methods and technology. Fully mature.					
4. SOCIETAL	4. SOCIETAL						
	4.1 Political	Seabed would be left with rock dump over entire bundle length.					
Societal CA Sub-Criteria	4.2 Impact on Fisheries	Significant area of natural seabed permanently lost.					

Societal CA Sub-Criteria	4.2 Impact on Fisheries	Significant area of natural seabed permanently lost.	
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.	

5. ECONOMIC					
	5.1 Total Abandonment Expenditure	£2.82M			
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A			
	5.3 Cashflow	N/A			
Potential for Future Remediation		Low	Bundle is left in situ covered by rock and not exposed.		

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Appendix G.4 Option 3 - Full Removal - Cut and Lift

Area	Saltire
Decision / Group	Group 2: Saltire A to Saltire WID Bundle
Option	Option 3a: Full Removal – Cut and Lift
	Perform as-found survey
	Cut pipe in to 24m lengths using hydraulic shears
	Recover pipeline sections to pipehaul barge
Sequence of Works	Rockdump cut ends at crossing location
	Perform as-left survey
	Perform trawl sweep of site

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY						
	1.1 Personnel Offshore	Refer to HAZID Report				
	1.2 Personnel Onshore	Refer to HAZID Report	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report				
	1.4 Residual Risk	Refer to HAZID Report	Refer to HAZID Report			
Additional Safety Data for Information:						
Offshore Personnel	Number	288	Man Hours	43,824		
Diver Requirement	Number	6	Man Hours	1,872		
Onshore Personnel	Number	16	Man Hours	8,584		
Impact to Other Users of the Sea	Number of Vessels Used	6	Duration of Operations	65		
Potential for High Consequence Events	Refer to HAZID Report					

2. ENVIRONMENTAL		T					
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report	Refer to ENVID Report				
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report					
Environmental CA Sub-Criteria	2.3 Resource Consumption	Refer to ENVID Report					
	2.4 Disturbance	Refer to ENVID Report					
	2.5 Loss of Habitat	Refer to ENVID Report	Refer to ENVID Report				
Additional Environmental Data for Information:							
	Vessel Type	Number off	Duration	Activity			
	Barge / Pipehaul	1	13	Material Transport			
	CSV	1	20	Subsea Works			
	DSV	1	13	Subsea Works			
Marine Impact (Vessels)	Reel Vessel	0	0	N/A			
	Rockdump Vessel	1	5	Rock Placement			
	Survey Vessel	1	9	Survey Works			
	Trawler	1	5	Trawl Sweep			
	Trenching Vessel	0	0	N/A			
-	Fuel	CO ₂	Nox	SO ₂			
Energy Use	1218.1 Te	3861.3 Te	71.9 Te	14.6 Te			
Life Cuele Emissions	CO ₂	CO ₂ (Credit)					
Life Cycle Emissions	4,548 Te	Not Evaluated					
	Activity	Area (m²)	Resources				
Marine Impact (Sechad)	Rockdumping	150	300Te of rockdump				
Marine Impact (Seabed)	MFE	N/A	N/A				
	Trenching	N/A	N/A				
	Component / Material	Parameter	Weight (Te)	Length (m)			
	Carbon Steel	Recovered	646.8	2,056			
	Carbon Steel	Remaining	15.7	50			
Materials	Opetian	Recovered	3.0	2,056			
	Coatings	Remaining	0.1	50			
	Aluminium Alloy	Recovered	4.7	N/A			
	Aluminium Alioy	Remaining	0.1	N/A			
	Туре	Left In-Situ	Returned				
Desiduale	LSA Scale	N/A	N/A				
Residuals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned				
	Control Fluids	N/A	N/A				

3. TECHNICAL				
Technical CA Sub-Criteria	3.1 Contracting Strategy	The vessels required are readily available but there is no established methodology for lifting and removing bundles of this size, so it is likely that, if such a technology is developed, it will be single source.		
	3.7 Schedule	Major technological risk factors to the schedule in that an established lifting technology is not in place and there is major scope for overruns. Current estimate of in-field time is 65 days.		
	3.3 Technical Maturity	TRL 5. No track record for lift and removal of large diameter bundles. Extensive subsea works required, likely complete with diver support. Low technical maturity.		

4. SOCIETAL					
Societal CA Sub-Criteria	4.1 Political	Full removal would leave a clear seabed (only short section, 50m, left rock covered at crossings) and BEIS encourages all decommissioning programmes to review existing and emerging technology for bundle removal.			
	4.2 Impact on Figherieg	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.			
	4.3 Impact on Communities	Medium benefit to communities as majority of bundle would be returned to shore for dismantling/recycling. Local infrastructure upgrades may be required.			

5. ECONOMIC				
Economic CA Sub-Criteria	5.1 Total Abandonment Expenditure	£7.47M		
	5.2 Net Present Cost	N/A		
	5.3 Cashflow	N/A		
Potential for Future Remediation		Very Low	Bundle is fully removed with the exception of the short section (approx. 50m) which is covered by rock at the MacCulloch pipeline crossings.	



APPENDIX H GROUP 3 – CHANTER OIL / CONDENSATE FLEXIBLE FLOWLINE – OPTION DATASHEETS

		Chanter						
Decision / Group		Group 3: Chanter Oil/C						
Option		-		French and Bury Exposures				
		Perform as-found survey						
		Cut & recover pipeline en	ds					
		Trench and backfill pipelin	e exposures and cut end	8				
equence of Works		Perform as-left survey						
		Perform trawl sweep of s	site					
ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status		
L847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10.675	988	Partially Buried		
2047	o olicondensate riexible riowille	Steen Plastica		10,010		Turnany Barroa		
SAFETY								
SAFEIT								
		1.1 Personnel Offshore		Refer to HAZID Report				
afety CA Sub-Criteria		1.2 Personnel Onshore	•	Refer to HAZID Report				
		1.3 Other Users		Refer to HAZID Report				
		1.4 Residual Risk		Refer to HAZID Report				
dditional Safety Data for Inforn	nation:							
ffshore Personnel		Nun	nber	192	Man Hours	17,952		
ver Requirement		Nun	nber	6	Man Hours	864		
nshore Personnel		Nun	nber	16	Man Hours	4,256		
npact to Other Users of the Se	a	Number of V	essels Used	4	Duration of Operations	30		
otential for High Consequence	Events	Refer to HA	ZID Report					
ENVIRONMENTAL								
ENVIRONMENTAL		2.4 Impact of Decomposit	incidning Operations					
		2.1 Impact of Decommi Offshore	issioning Operations	Refer to ENVID Report				
nvironmental CA Sub-Criteria				Refer to ENVID Report				
				Refer to ENVID Report				
				Refer to ENVID Report				
		2.5 Loss of Habitat		Refer to ENVID Report				
dditional Environmental Data f	or Information:							
		Vesse	el Type	Number off	Duration	Activity		
		Barge /	Pipehaul	0	0	N/A		
		C	SV	0	0	N/A		
		D	SV	1	6			
		Reel Vessel				Subsea Works		
arine Impact (Vessels)		Reel	/essel	0	0	Subsea Works N/A		
arine Impact (Vessels)						N/A		
arine Impact (Vessels)		Rockdum	np Vessel	0	0	N/A N/A		
arine Impact (Vessels)		Rockdum Survey	np Vessel Vessel	0	0 10	N/A N/A Survey Works		
arine Impact (Vessels)		Rockdum Survey Tra	np Vessel Vessel wler	0 1 1	0 10 5	N/A N/A Survey Works Trawl Sweep		
arine Impact (Vessels)		Rockdum Survey Tra Trenchin	np Vessel Vessel wler g Vessel	0 1 1 1 1	0 10 5 9	N/A N/A Survey Works Trawl Sweep Trench / Backfill		
		Rockdum Survey Tra Trenchin Fu	np Vessel Vessel wier g Vessel iel	0 1 1 1 1 CO 2	0 10 5 9 Nox	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
		Rockdum Survey Tra Trenchin Fu 357	p Vessel Vessel wler g Vessel tel 6 Te	0 1 1 1 CO₂ 1133.5 Te	0 10 5 9	N/A N/A Survey Works Trawl Sweep Trench / Backfill		
nergy Use		Rockdum Survey Tra Trenchin Fu 357. C	p Vessel Vessel wier g Vessel nel 6 Te O ₂	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit)	0 10 5 9 Nox	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
iergy Use		Rockdum Survey Tra Trenchin Fu 357 C 2,67	p Vessel Vessel wier g Vessel el 6 Te O ₂ 11 Te	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated	0 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
nergy Use		Rockdum Survey Tra Trenchin Fu 357 C 2,67	p Vessel Vessel wier g Vessel nel 6 Te O ₂	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit)	0 10 5 9 Nox	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
nergy Use fe Cycle Emissions		Rockdum Survey Tra Trenchin Fu 357 C 2,67 Act	p Vessel Vessel wier g Vessel el 6 Te O ₂ 11 Te	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated	0 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
arine Impact (Vessels) hergy Use fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd	p Vessel Vessel wier g Vessel eel 6 Te O ₂ 11 Te ivity	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated Area (m ²)	0 10 5 9 Nox 21.1 Te Resources	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
iergy Use fe Cycle Emissions		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd	p Vessel Vessel wier g Vessel eel 6 Te O ₂ '1 Te ivity umping	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated Area (m ²) N/A	0 10 5 9 Nox 21.1 Te Resources N/A N/A	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
ergy Use fe Cycle Emissions		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren	p Vessel Vessel wier g Vessel tel 6 Te 0 ₂ 1 Te tivity umping FE ching	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated Area (m ²) N/A N/A	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A Trenching Spread	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂ 4.3 Te		
ergy Use fe Cycle Emissions		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer	p Vessel Vessel wler g Vessel el 6 Te 0 2 1 Te ivity umping FE ching nt / Material	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated Area (m ²) N/A N/A 98 Parameter	0 10 5 9 Nox 21.1 Te Resources N/A N/A	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO ₂		
iergy Use fe Cycle Emissions		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer	p Vessel Vessel wier g Vessel tel 6 Te 0 ₂ 1 Te tivity umping FE ching	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated Area (m ²) N/A N/A 98 Parameter Recovered	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te 4.3 Te		
nergy Use fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo	p Vessel Vessel wier g Vessel el 6 Te 0 ₂ 1 Te ivity umping FE ching nt / Material n Steel	0 1 1 1 CO ₂ 1133.5 Te CO ₂ (Credit) Not Evaluated Area (m ²) N/A N/A 98 Parameter Recovered Remaining	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635		
nergy Use fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo	p Vessel Vessel wler g Vessel el 6 Te 0 2 1 Te ivity umping FE ching nt / Material	0 1 1 1 1 1 CO2 1133.5 Te CO2 (Credit) Not Evaluated Area (m ²) N/A N/A 98 Parameter Recovered Remaining Recovered	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40		
ergy Use fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo	p Vessel Vessel wier g Vessel el 6 Te 0 ₂ 1 Te ivity umping FE ching nt / Material n Steel	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 Credit) Not Evaluated Area (m ²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635		
ergy Use fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo	p Vessel Vessel wier g Vessel el 6 Te 0 ₂ 1 Te ivity umping FE ching nt / Material n Steel	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 Credit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo Stainles	p Vessel Vessel wier g Vessel el 6 Te 0 ₂ 1 Te ivity umping FE ching nt / Material n Steel ss Steel stics	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 CCedit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining Recovered Remaining	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635		
nergy Use fe Cycle Emissions arine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo Stainles	p Vessel Vessel wier g Vessel el 6 Te 0 ₂ 1 Te ivity umping FE ching nt / Material n Steel ss Steel stics pe	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 Credit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
nergy Use fe Cycle Emissions		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo Stainlet Plas Ty	p Vessel	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 Credit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
nergy Use fe Cycle Emissions arine Impact (Seabed) aterials		Rockdum Survey Tra Trenchin Fu 357, C 2,67 Act Rockd M Tren Componer Carbo Stainles Plas Ty LSA	p Vessel Vessel Vessel wer g Vessel el 6 Te 0 2 1 Te ivity umping FE ching n Steel stics pe Scale carbon	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 1133.5 Te CO2 CCedit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A Trenching Spread Weight (Te) 2.6 688.1 0.5 124.0 0.6 172.5 Returned N/A Flushed & Cleaned	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
ergy Use Te Cycle Emissions Arine Impact (Seabed) Aterials		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo Stainlet Plas Ty	p Vessel Vessel Vessel wer g Vessel el 6 Te 0 2 1 Te ivity umping FE ching n Steel stics pe Scale carbon	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 Credit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A	0 10 10 5 9 Nox 21.1 Te	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
ergy Use e Cycle Emissions rine Impact (Seabed)		Rockdum Survey Tra Trenchin Fu 357, C 2,67 Act Rockd M Tren Componer Carbo Stainles Plas Ty LSA	p Vessel Vessel Vessel wer g Vessel el 6 Te 0 2 1 Te ivity umping FE ching n Steel stics pe Scale carbon	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 1133.5 Te CO2 CCedit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A Trenching Spread Weight (Te) 2.6 688.1 0.5 124.0 0.6 172.5 Returned N/A Flushed & Cleaned	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
ergy Use fe Cycle Emissions arine Impact (Seabed) aterials		Rockdum Survey Tra Trenchin Fu 357, C 2,67 Act Rockd M Tren Componer Carbo Stainles Plas Ty LSA	p Vessel Vessel Vessel wer g Vessel el 6 Te 0 2 1 Te ivity umping FE ching n Steel stics pe Scale carbon	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 1133.5 Te CO2 CCedit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A Trenching Spread Weight (Te) 2.6 688.1 0.5 124.0 0.6 172.5 Returned N/A Flushed & Cleaned	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
nergy Use fe Cycle Emissions arine Impact (Seabed) aterials		Rockdum Survey Tra Trenchin Fu 357, C 2,67 Act Rockd M Tren Componer Carbo Stainles Plas Ty LSA	p Vessel Vessel wier g Vessel nel 6 Te O2 11 Te ivity umping FE ching nt / Material n Steel stics pe Scale carbon I Fluids	0 1 1 1 1 1 CO2 1133.5 Te CO2 CO2 1133.5 Te CO2 CCedit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A N/A Trenching Spread Weight (Te) 2.6 688.1 0.5 124.0 0.6 172.5 Returned N/A Flushed & Cleaned N/A	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
tergy Use fe Cycle Emissions arine Impact (Seabed) aterials		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo Stainles Plas Ty LSA Hydro	p Vessel Vessel wier g Vessel nel 6 Te O2 11 Te ivity umping FE ching nt / Material n Steel stics pe Scale carbon I Fluids	0 1 1 1 1 1 CO2 1133.5 Te CO2 (Credit) Not Evaluated Area (m²) N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A N/A Trenching Spread Weight (Te) 2.6 688.1 0.5 124.0 0.6 172.5 Returned N/A Flushed & Cleaned N/A fvendors. Flexible contracting strategy.	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40		
ergy Use fe Cycle Emissions arine Impact (Seabed) aterials		Rockdum Survey Tra Trenchin Fu 357. C 2,67 Act Rockd M Tren Componer Carbo Stainles Plas Ty LSA Hydro Contro	p Vessel Vessel wier g Vessel nel 6 Te O2 11 Te ivity umping FE ching nt / Material n Steel stics pe Scale carbon I Fluids	0 1 1 1 1 1 CO2 1133.5 Te CO2 (Credit) Not Evaluated Area (m²) N/A N/A N/A 98 Parameter Recovered Remaining Recovered Remaining Recovered Remaining Left In-Situ N/A Flushed & Cleaned N/A Established technology with a wide range o In field time of 30 days. No particular techno	0 10 10 5 9 Nox 21.1 Te Resources N/A N/A N/A Trenching Spread Weight (Te) 2.6 688.1 0.5 124.0 0.6 172.5 Returned N/A Flushed & Cleaned N/A fvendors. Flexible contracting strategy.	N/A N/A Survey Works Trawl Sweep Trench / Backfill SO2 4.3 Te Length (m) 40 10,635 40 10,635 40 10,635		

Appendix H.1 Option 2a - Major Intervention - Trench and Bury Exposures

 4.1 Political
 Similar to options 2b and 2c but slightly more impact than 3a as pipeline will be left in-situ.

 Societal CA Sub-Criteria
 A.2 Impact on Fisheries
 Modest area of natural seabed temporarily disturbed, area would recover to natural condition. Low impact.

 4.3 Impact on Communities
 Low impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC				
Economic CA Sub-Criteria	5.1 Total Abandonment Expenditure	£4.78M		
	5.2 Net Present Cost	N/A		
	5.3 Cashflow	N/A		
Potential for Future Remediation		Moderate	Flowline is left in situ buried below the seabed with no exposures.	



Appendix H.2 Option 2b - Major Intervention - Cut and Remove Exposures

Area	Chanter
Decision / Group	Group 3: Chanter Oil/Condensate Flexible Flowline
Option	Option 2b: Leave in Situ Minor Intervention – Cut and Remove Exposures
	Perform as-found survey
	Cut & recover pipeline ends and exposures
	Rockdump cut ends
Sequence of Works	Perform as-left survey
	Perform trawl sweep of site

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried

1. SAFETY							
Safety CA Sub-Criteria	1.1 Personnel Offshore	Refer to HAZID Report					
	1.2 Personnel Onshore	Refer to HAZID Report	Refer to HAZID Report				
Salety CA Sub-Chteria	1.3 Other Users	Refer to HAZID Report					
	1.4 Residual Risk	Refer to HAZID Report	Refer to HAZID Report				
Additional Safety Data for Information:							
Offshore Personnel	Number	192	Man Hours	19,968			
Diver Requirement	Number	6	Man Hours	1,296			
Onshore Personnel	Number	16	Man Hours	3,824			
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	30			
Potential for High Consequence Events	Refer to HAZID Report						

2. ENVIRONMENTAL							
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report					
	2.2 Processing of Returned Materials	Refer to ENVID Report					
nvironmental CA Sub-Criteria	2.3 Resource Consumption	Refer to ENVID Report					
	2.4 Disturbance	Refer to ENVID Report					
	2.5 Loss of Habitat	Refer to ENVID Report					
dditional Environmental Data for Information:							
	Vessel Type	Number off	Duration	Activity			
	Barge / Pipehaul	0	0	N/A			
	CSV	0	0	N/A			
	DSV	1	9	Subsea Works			
Marine Impact (Vessels)	Reel Vessel	0	0	N/A			
	Rockdump Vessel	1	6	Rock Placement			
	Survey Vessel	1	10	Survey Works			
	Trawler	1	5	Trawl Sweep			
	Trenching Vessel	0	0	N/A			
Energy Use	Fuel	CO ₂	Nox	SO ₂			
	364.3 Te	1154.9 Te	21.5 Te	4.4 Te			
fo Ovela Fasianiana	CO ₂	CO ₂ (Credit)					
ife Cycle Emissions	2,689 Te	Not Evaluated					
	Activity	Area (m ²)	Resources				
	Rockdumping	950	950 1900Te of rockdump				
arine Impact (Seabed)	MFE	N/A N/A					
	Trenching	N/A	N/A				
	Component / Material	Parameter	Weight (Te)	Length (m)			
	Carbon Steel	Recovered	6.3	98			
	Carbon Steel	Remaining	684.4	10,577			
aterials	Stainless Steel	Recovered	1.1	98			
	Stainess Steel	Remaining	123.4	10,577			
	Displace	Recovered	1.6	98			
	Plastics	Remaining	171.5	10,577			
	Туре	Left In-Situ	Returned				
aciduale	LSA Scale	N/A	N/A				
esiduals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned				
	Control Fluids	N/A N/A					
TECHNICAL							
	3.1 Contracting Strategy	Established technology with a wide range of	f vendors. Flexible contracting strategy.				
echnical CA Sub-Criteria	3.2 Schedule	In field time of 30 days. No particular technol	ogy or major operation risk factors.				
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.					

		in hold time of co days. No particular technology of major operation not factore.
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.
4. SOCIETAL		
	4.1 Political	Similar to options 2a and 2c but slightly more impact than 3a as pipeline will be left in-situ.
Societal CA Sub-Criteria	4.2 Impact on Fisheries	Limited area of natural seabed disturbed.
	4.3 Impact on Communities	Low impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC			
	5.1 Total Abandonment Expenditure	£4.11M	
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		Moderate	Flowline is left in situ buried below the seabed with no exposures.



Appendix H.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	Chanter
Decision / Group	Group 3: Chanter Oil/Condensate Flexible Flowline
Option	Option 2c: Leave in Situ Minor Intervention – Rock Cover Exposures
	Perform as-found survey
	Cut & Recover Pipeline Ends
	Rockdump cut ends and exposures to remove snagging hazard
Sequence of Works	Perform as-left survey
	Perform trawl sweep of site

	ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
P	L847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried

1. SAFETY					
	1.1 Personnel Offshore	Refer to HAZID Report			
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report			
Salety CA Sub-Chiena	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	192	Man Hours	17,232	
Diver Requirement	Number	6	Man Hours	864	
Onshore Personnel	Number	16	Man Hours	3,240	
Legacy Risk	Number	0	Man Hours	0	
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	27	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report			
Facility and the California	2.2 Processing of Returned Materials	Refer to ENVID Report	fer to ENVID Report		
Environmental CA Sub-Criteria	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
	Vessel Type	Number off	Duration	Activity	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	6	Subsea Works	
Marine Impact (Vessels)	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	6	Rock Placement	
	Survey Vessel	1	10	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
	Fuel	CO ₂	Nox	SO ₂	
Energy Use	305.8 Te	969.5 Te	18 Te	3.7 Te	
	C02	CO ₂ (Credit)			
Life Cycle Emissions	2,507 Te	Not Evaluated			
	Activity	Area (m²)	Resources		
	Rockdumping	950	1900Te of rockdump		
Marine Impact (Seabed)	MFE	N/A	N/A		
	Trenching	N/A	N/A		
	Component / Material	Parameter	Weight (Te)	Length (m)	
		Recovered	2.6	40	
	Carbon Steel	Remaining	688.1	10,635	
Materials		Recovered	0.5	40	
	Stainless Steel	Remaining	124.0	10,635	
		Recovered	0.6	40	
	Plastics	Remaining	172.5	10.635	
	Туре	Left In-Situ	Returned		
	LSA Scale	N/A	N/A		
Residuals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		
	Contorrada	100	0/0		
3. TECHNICAL					
5. TECHNICAL	3.1 Contracting Strategy	Established technology with a wide range of	vendore. Elevible contracting strategy		
Technical CA Sub-Criteria	3.2 Schedule	In field time of 27 days. No particular technology			
roomingal CA Sub-Oriteria	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea			
	5.5 rechnical Maturity	TRE 7. reclinically mature. Standard Subsea	operations.		
4. SOCIETAL					
4. JULIETAL	4.1 Political	Similar to options 2a and 2b but slightly more i	mnact than 3a as ninalina will be left in situ		
Societal CA Sub Criteria	4.1 Political 4.2 Impact on Fisheries		mpact than 5a as pipeline will be left III-Situ.		
Societal CA Sub-Criteria		Limited area of natural seabed disturbed. Low impact on communities and amenities as minimal material returned to shore.			
	4.3 Impact on Communities		minimal material action adds above		

5. ECONOMIC			
	5.1 Total Abandonment Expenditure	£3.38M	
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		Moderate	Flowline is left in situ buried below the seabed with exposures covered by rock.

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Appendix H.4 **Option 3 - Full Removal - Reverse Reeling**

Area	Chanter
Decision / Group	Group 3: Chanter Oil/Condensate Flexible Flowline
Option	Option 3: Full Removal – Reverse Reeling
	Perform as-found survey
	Debury flowline
	Disconnect and rig pipeline ends
Sequence of Works	Reverse reel pipeline
	Perform as-left survey
	Perform trawl sweep of site

	ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL847		6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried
_							

1. SAFETY						
	1.1 Personnel Offshore	Refer to HAZID Report	Refer to HAZID Report			
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report				
Salety CA Sub-Chiefia	1.3 Other Users	Refer to HAZID Report	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report				
Additional Safety Data for Information:						
Offshore Personnel	Number	324	Man Hours	33,120		
Diver Requirement	Number	6	Man Hours	1,008		
Onshore Personnel	Number	16	Man Hours	9,368		
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	40		
Potential for High Consequence Events	Refer to HAZID Report					

2. ENVIRONMENTAL							
	2.1 Impact of Decommissioning Operations						
	Offshore	Refer to ENVID Report					
	2.2 Processing of Returned Materials	Refer to ENVID Report					
Environmental CA Sub-Criteria	2.3 Resource Consumption	Refer to ENVID Report					
	2.4 Disturbance	Refer to ENVID Report					
	2.5 Loss of Habitat	Refer to ENVID Report					
Additional Environmental Data for Information:							
	Vessel Type	Number off	Duration	Activity			
	Barge / Pipehaul	0	0	N/A			
	CSV	1	10	Subsea Works			
	DSV	1	7	Subsea Works			
Marine Impact (Vessels)	Reel Vessel	1	8	Reverse Reeling			
	Rockdump Vessel	0	0	N/A			
	Survey Vessel	1	10	Survey Works			
	Trawler	1	5	Trawl Sweep			
	Trenching Vessel	0	0	N/A			
	Fuel	CO ₂	Nox	SO ₂			
nergy Use	733.8 Te	2326.2 Te	43.3 Te	8.8 Te			
	CO ₂	CO ₂ (Credit)					
ife Cycle Emissions	3,157 Te	Not Evaluated					
	Activity	Area (m²)	Resources				
	Rockdumping	N/A	N/A				
Marine Impact (Seabed)	MFE	21350	MFE Spread				
	Trenching	N/A	N/A	1			
	Component / Material	Parameter	Weight (Te)	Length (m)			
		Recovered	689.4	10,655			
	Carbon Steel	Remaining	1.3	20			
Materials		Recovered	124.3	10,655			
	Stainless Steel	Remaining	0.2	20			
		Recovered	172.8	10655			
	Plastics	Remaining	0.3	20			
	Туре	Left In-Situ	Returned				
	LSA Scale	N/A	N/A				
Residuals	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	1			
	Control Fluids	N/A	N/A	1			
		•		•			
. TECHNICAL							
	3.1 Contracting Strategy	Reel vessel of suitable capacity required. Ves strategy.	ssels are generally available from a number o	of vendors. Reasonably flexible contracting			
Fechnical CA Sub-Criteria	3.2 Schedule	In field time of 40 days. Potential for extension	to schedule due to possible failure of pipelir	ne during reverse reeling			
	3.3 Technical Maturity	TRL 7. Reel installation of pipelines is a standard subsea operation but, while reverse reeling has been carried out elsewhere, there is a relatively limited track record of reverse reeling for removal of pipeline in the UKCS.					

4. SOCIETAL					
Societal CA Sub-Criteria	4.1 Political	Advantage over other options in that pipeline is permanently removed, leaving a clear seabed, with the exception of the bundle crossing where a short (20m) section of pipe will be left buried.			
	4.2 Impact on Fisheries	Significant area of seabed temporarily disturbed but this will revert to natural condition over time and there would be no impact on fisheries after this time.			
	4.3 Impact on Communities	Medium impact on communities and amenities as majority of pipeline would be returned to shore for dismantling/recycling.			

5. ECONOMIC					
	5.1 Total Abandonment Expenditure	£9.65M			
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A			
	5.3 Cashflow	N/A			
Potential for Future Remediation		Verylow	Flowline is fully removed with the exception of short section (approx. 20m) where line is crossed by Saltire A to Saltire WID bundle.		



APPENDIX I GROUP 4 – TRENCHED & BURIED UMBILICALS / POWER CABLES – OPTION DATASHEETS

Area	Saltire & Chanter
Decision / Group	Group 4: Trenched & Buried Umbilicals / Power Cables
Option	Option 2a: Leave in Situ Minor Intervention – Trench and Bury Exposures
	Perform as-found survey
	Cut & recover umbilical/cable ends
	Trench and backfill exposures and cut ends
Sequence of Works	Perform as-left survey
	Perform trawl sweep of site

Appendix I.1 Option 2a - Major Intervention - Trench and Bury Exposures

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

A PACETY						
1. SAFETY						
	1.1 Personnel Offshore	Refer to HAZID Report				
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report				
salety CA sub-criteria	1.3 Other Users	Refer to HAZID Report				
	1.4 Residual Risk	Refer to HAZID Report	afer to HAZID Report			
Additional Safety Data for Information:						
Offshore Personnel	Number	192	Man Hours	25,440		
Diver Requirement	Number	6	Man Hours	2,016		
Onshore Personnel	Number	16	Man Hours	5,568		
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	36		
Potential for High Consequence Events	Refer to HAZID Report					

P. ENVIRONMENTAL					
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report			
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report			
Wironmental CA Sub-Chteria	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
dditional Environmental Data for Information:					
	Vessel Type	Number off	Duration	Activity	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	14	Subsea Works	
arine Impact (Vessels)	Reel Vessel	0	0	N/A	
	Rockdump Vessel	0	0	N/A	
	Survey Vessel	1	11	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	1	6	Trench / Backfill	
nergy Use	Fuel	CO ₂	Nox	SO ₂	
	494.1 Te	1566.2 Te	29.2 Te	5.9 Te	
ife Cycle Emissions	CO ₂	CO ₂ (Credit)			
	2,990 Te	Not Evaluated			
	Activity	Area (m²)	Resources		
aring Impact (Sechod)	Rockdumping	N/A	N/A		
arine Impact (Seabed)	MFE	N/A	N/A		
	Trenching	80	Trenching Spread		
	Component / Material	Parameter	Weight (Te)	Length (m)	
	Carbon Steel	Recovered	19.0	1440	
	Carbon Steel	Remaining	296.9	23,854	
aterials	Plastics	Recovered	21.9	1,440	
	Flastics	Remaining	416.6	23,854	
	Copper	Recovered	10.3	1,440	
	Copper	Remaining	116.9	23,854	
	Туре	Left In-Situ	Returned		
eiduale	LSA Scale	N/A	N/A		
Residuals	Hydrocarbon	N/A	N/A		
	Control Fluids	Flushed	Flushed		
TECHNICAL					
	3.1 Contracting Strategy	Established technology with a wide range of	vendors. Flexible contracting strategy.		
chnical CA Sub-Criteria	3.2 Schedule	In field time of 36 days. No particular technology or major operation risk factors.			
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.			

4. SOCIETAL		
	4.1 Political	Similar to options 2b and 2c but more political impact than option 3a as items would be left in-situ.
Societal CA Sub-Criteria	4.2 Impact on Fisheries	Low impact on commerical fisheries as items are already trenched and buried and small number of exposures would also be buried.
	4.3 Impact on Communities	Low as minimal material returned to shore for dismantling/recycling.

5. ECONOMIC				
	5.1 Total Abandonment Expenditure	£6.26M		
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A		
	5.3 Cashflow	N/A		
Potential for Future Remediation		Low	Umbilical/cables are left in situ buried below the seabed with no exposures.	



Appendix I.2 Option 2b - Major Intervention - Cut and Remove Exposures

Area	Saltire & Chanter
Decision / Group	Group 4: Trenched & Buried Umbilicals / Power Cables
Option	Option 2b: Leave in Situ Minor Intervention – Cut and Remove Exposures
	Perform as-found survey
	Cut & Recover Ends and Exposures
	Rockdump cut ends to remove snagging hazard
Sequence of Works	Perform as-left survey
	Perform trawl sweep of site

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY							
	1.1 Personnel Offshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.3 Other Users	Refer to HAZID Report					
	1.4 Residual Risk	Refer to HAZID Report	Refer to HAZID Report				
Additional Safety Data for Information:							
Offshore Personnel	Number	192	Man Hours	25,200			
Diver Requirement	Number	6	Man Hours	2,016			
Onshore Personnel	Number	16	Man Hours	5,080			
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	35			
Potential for High Consequence Events	Refer to HAZID Report						

P. ENVIRONMENTAL					
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report			
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat				
dditional Environmental Data for Information:					
	Vessel Type	Number off	Duration	Activity	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	14	Subsea Works	
arine Impact (Vessels)	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	5	Rock Placement	
	Survey Vessel	1	11	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
ergy liee	Fuel	CO ₂	Nox	SO ₂	
Energy Use	476.8 Te	1511.5 Te	28.1 Te	5.7 Te	
fe Cycle Emissions	CO ₂	CO ₂ (Credit)			
	2,935 Te	Not Evaluated			
	Activity	Area (m²)	Resources		
arine Impact (Seabed)	Rockdumping	400	800Te of rockdump		
anne impact (seabed)	MFE	N/A	N/A		
	Trenching	N/A	N/A		
	Component / Material	Parameter	Weight (Te)	Length (m)	
	Carbon Steel	Recovered	19.3	1,466	
	Carbon Steel	Remaining	296.6	23,828	
aterials	Plastics	Recovered	22.5	1,466	
	Plastics	Remaining	416.0	23,828	
	C	Recovered	10.3	1,466	
	Copper	Remaining	116.9	23,828	
	Туре	Left In-Situ	Returned		
siduala	LSA Scale	N/A	N/A		
esiduals	Hydrocarbon	N/A	N/A		
	Control Fluids	Flushed			

3. TECHNICAL		
	3.1 Contracting Strategy	Established technology with a wide range of vendors. Flexible contracting strategy.
Technical CA Sub-Criteria	3.2 Schedule	In field time of 35 days. No particular technology or major operation risk factors.
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.
4. SOCIETAL		
	4.1 Political	Similar to options 2a and 2c but more political impact than option 3a as items would be left in-situ.
Societal CA Sub-Criteria	4.2 Impact on Fisheries	Low impact on commerical fisheries as items are already trenched and buried and small number of exposures would also be buried.
	4.3 Impact on Communities	Low as minimal material returned to shore for dismantling/recycling.

5. ECONOMIC				
	5.1 Total Abandonment Expenditure	£5.55M		
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A		
	5.3 Cashflow	N/A		
Potential for Future Remediation		Low	Umbilical/cables are left in situ buried below the seabed with no exposures.	



Appendix I.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	Saltire & Chanter			
Decision / Group	Group 4: Trenched & Buried Umbilicals / Power Cables			
Option	tion 2c: Leave in Situ Minor Intervention – Rock Cover Exposures			
	Perform as-found survey			
	Cut & Recover Umbilical / Cable Ends			
	Rockdump cut ends and exposures to remove snagging hazard			
Sequence of Works	Perform as-left survey			
	Perform trawl sweep of site			

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY						
	1.1 Personnel Offshore					
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report				
Salety CA Sub-Chiena	1.3 Other Users	Refer to HAZID Report				
	1.4 Residual Risk	Refer to HAZID Report				
Additional Safety Data for Information:						
Offshore Personnel	Number	192	Man Hours	25,200		
Diver Requirement	Number	6	Man Hours	2,016		
Onshore Personnel	Number	16	Man Hours	5,008		
Legacy Risk	Number	0	Man Hours	0		
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	35		
Potential for High Consequence Events	Refer to HAZID Report					

2.1 Impact of Decommissioning Operations Offshore Refer to ENVID Report 2.2 Processing of Returned Materials Refer to ENVID Report 2.3 Resource Consumption Refer to ENVID Report 2.4 Disturbance Refer to ENVID Report 2.5 Loss of Habitat Refer to ENVID Report Additional Environmental Data for Information: Vessel Type Number off Duration						
Environmental CA Sub-Criteria 2.3 Resource Consumption 2.4 Disturbance 2.4 Disturbance 2.5 Loss of Habitat Coss of Habitat Cos						
2.3 Resource Consumption Refer to ENVID Report 2.4 Disturbance Refer to ENVID Report 2.5 Loss of Habitat Refer to ENVID Report Additional Environmental Data for Information: Vessel Type Number off Duration						
2.5 Loss of Habitat Refer to ENVID Report Additional Environmental Data for Information: Vessel Type Number off Duration						
Additional Environmental Data for Information: Vessel Type Number off Duration Activity						
Vessel Type Number off Duration Activit	Refer to ENVID Report					
	y					
Barge / Pipehaul 0 0 N/A						
CSV 0 0 N/A	,					
DSV 1 14 Subsea W	orks					
Marine Impact (Vessels) Reel Vessel 0 N/A	,					
Rockdump Vessel 1 5 Rock Place	ment					
Survey Vessel 1 11 Survey We	orks					
Trawler 1 5 Trawl Sw	еер					
Trenching Vessel 0 N/A						
Fuel CO ₂ Nox SO ₂						
Annu Street Annu Street Stree Street Street <t< td=""><td></td></t<>						
Life Cycle Emissions CO ₂ CO ₂ (Credit)						
2,935 Te Not Evaluated						
Activity Area (m ²) Resources						
Rockdumping 400 800Te of rockdump						
Marine Impact (Seabed) MFE N/A N/A						
Trenching N/A N/A						
Component / Material Parameter Weight (Te) Length (m)					
Carbon Steel 19.0 1440						
Remaining 296.9 23,854	e					
Plastics Recovered 21.9 1,440						
Remaining 416.6 23,854						
Copper Recovered 10.3 1,440						
Remaining 116.9 23,854	<i>i</i>					
Type Left In-Situ Returned						
LSA Scale N/A N/A						
Hydrocarbon N/A N/A						
Control Fluids Flushed Flushed						
3. TECHNICAL						

	3.1 Contracting Strategy	Established technology with a wide range of vendors. Flexible contracting strategy.			
Technical CA Sub-Criteria	3.2 Schedule	In field time of 35 days. No particular technology or major operation risk factors.			
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.			
4. SOCIETAL					
	4.1 Political	Similar to options 2a and 2b but more political impact than option 3a as items would be left in-situ.			

Societal CA Sub-Criteria	4.2 Impact on Fisheries	Minimal area of seabed impacted by introduced rock however insufficient to have impact on commercial fishing operations.	
	4.3 Impact on Communities	Low as minimal material returned to shore for dismantling/recycling.	

	5.1 Total Abandonment Expenditure	£5.45M	
Economic CA Sub-Criteria	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation			Umbilical/cables are left in situ buried below the seabed with exposures covered by rock.



Appendix I.4 Option 3 - Full Removal - Reverse Reeling

Area	altire & Chanter			
Decision / Group	Group 4: Trenched & Buried Umbilicals / Power Cables			
Option	ption 3: Full Removal – Reverse Reeling			
	Perform as-found survey			
	Debury umbilical and cables			
	Disconnect and rig umbilical/cable ends			
Sequence of Works	Reverse reel umbilical and cables			
	Perform as-left survey			
	Perform trawl sweep of site			

ID No.	Туре	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY							
	1.1 Personnel Offshore	Refer to HAZID Report					
Safety CA Sub-Criteria	1.2 Personnel Onshore	Refer to HAZID Report	Refer to HAZID Report				
Safety CA Sub-Chiefia	1.3 Other Users	Refer to HAZID Report					
	1.4 Residual Risk	Refer to HAZID Report					
Additional Safety Data for Information:							
Offshore Personnel	Number	324	Man Hours	44,976			
Diver Requirement	Number	6	Man Hours	1,296			
Onshore Personnel	Number	16	Man Hours	8,720			
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	53			
Potential for High Consequence Events	Refer to HAZID Report						

2. ENVIRONMENTAL						
	2.1 Impact of Decommissioning Operations Offshore	Refer to ENVID Report				
Environmental CA Sub-Criteria	2.2 Processing of Returned Materials	Refer to ENVID Report				
	2.3 Resource Consumption	Refer to ENVID Report				
	2.4 Disturbance	Refer to ENVID Report				
	2.5 Loss of Habitat	Refer to ENVID Report				
Additional Environmental Data for Information:						
	Vessel Type	Number off	Duration	Activity		
	Barge / Pipehaul	0	0	N/A		
	CSV	1	16	Subsea Works		
	DSV	1	9	Subsea Works		
larine Impact (Vessels)	Reel Vessel	1	12	Reverse Reeling		
	Rockdump Vessel	0	0	N/A		
	Survey Vessel	1	11	Survey Works		
	Trawler	1	5	Trawl Sweep		
	Trenching Vessel	0	0	N/A		
Energy Use	Fuel	CO ₂	Nox	SO ₂		
	1134.1 Te	3595 Te	66.9 Te	13.6 Te		
ife Cycle Emissions	CO ₂	CO ₂ (Credit)				
ne cycle Emissions	3,979 Te	Not Evaluated				
	Activity	Area (m²)	Resources			
larine Impact (Seabed)	Rockdumping	N/A	N/A	1		
arme impact (seabed)	MFE	50588	MFE Spread			
	Trenching	N/A	N/A	-		
	Component / Material	Parameter	Weight (Te)	Length (m)		
	Carbon Steel	Recovered	315.7	25,274		
	Carbon Steel	Remaining	0.2	20		
aterials	Plastics	Recovered	438.1	25,274		
	Flastics	Remaining	0.4	20		
	Copper	Recovered	127.2	25,274		
	Copper	Remaining	0.02	20		
	Туре	Left In-Situ	Returned			
esiduals	LSA Scale	N/A	N/A]		
esiuuais	Hydrocarbon	N/A	N/A	1		
	Control Fluids	Flushed	Flushed	1		

3. TECHNICAL						
	3.1 Contracting Strategy	Reel vessel of suitable capacity required. Vessels are generally available from a number of vendors. Reasonably flexible contracting				
		strategy.				
Technical CA Sub-Criteria	3.2 Schedule	In field time of 53 days. Potential for extension to schedule due to possible failure of cables/umbilicals during reverse reeling.				
	3.3 Technical Maturity	TRL 7. Reel installation of cables/umbilicals is a standard subsea operation and has been completed succesfully but there is a limited track record of reverse reeling for removal of cables/umbilicals in the UKCS.				

4. SOCIETAL						
	4.1 Political	Advantage over other options in that cables/umbilical is permanently removed, leaving a clear seabed.				
Societal CA Sub-Criteria	4.2 Impact on Fisheries	Area of seabed temporarily disturbed but this will revert to natural condition over time and there would be no impact on fisheries after this time.				
		Medium impact on communities and amenities as full items would be returned to shore for dismantling/recycling.				

5. ECONOMIC			
Economic CA Sub-Criteria	5.1 Total Abandonment Expenditure	£7.84M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		Verviow	Umbilical/cables are fully removed with the exception of short section (approx. 20m) of umbilical where it is crossed by Saltire A to Saltire WID bundle.



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