Sean Decommissioning

Comparative Assessment

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CONTENTS

EXECUTIVE SUMMARY

ONE-Dyas have conducted a Comparative Assessment (CA) for the decommissioning of the subsea infrastructure associated with the Sean field. The following steps from the Oil and Gas UK CA Guidelines have been completed:

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

The CA for the Sean field subsea infrastructure has focussed on three decommissioning groups - groups 1, 6 and 7, as described in the table below. All other decommissioning groups of the Sean Subsea Infrastructure were confirmed at the CA Scoping and Screening stage to be fully removed from the field.

Post-evaluation Note: The evaluation workshop that was conducted with stakeholders in August 2020 presented the description and as-built / burial status of PL311 (30" Export Pipeline) as understood and believed to be accurate at that time. After the Evaluation was completed, the as-built status of the line from KP 15.5 to KP 54 (surface laid and rock covered) and KP 54 to KP 106 (trenched and rock covered) was found to be incorrect. The as-built status of PL311 is surface laid with no rock cover (KP 15.5 to KP 54) and trenched with no rock cover (KP 54 to KP 106). Given this change in understanding of PL311 post-evaluation, consideration was given to the impact of this change on the options screened out during the screening phase of the CA and the Evaluation conducted. Notes have been added to the Screening Outcomes obtained against the originally understood status of PL311 (see Section 4.2). Those notes show that the Screening conducted and thus the options retained for Evaluation remain valid. Equally, the Evaluation conducted was reviewed in light of the change in understanding of PL311. A clear description of the change in understanding of the as-built status of PL311 is provided in Table 4.1 and detailed discussion of the impact of this change on the evaluation conducted is provided in Section 8.1. In summary, this review has shown that the Evaluation conducted and the outcome obtained remains valid.

The outcome of the CA process has made the following recommendations:

Grp	Title	Decommissioning Approach
1	PL311 30" Export Pipeline Sean PP to Bacton Terminal, Partially Surface Laid & Partially Trenched with natural backfill	Option 5 – Remove Ends and Remediate Snag Risk [1] – Pipeline will be disconnected – Removal and recovery of surface laid section out with existing trench / rock cover – Rock placement to remediate snag risk from cut end – Rock placement over areas of significant spans (approaching FishSafe specification) Note: The definition of surface laid section of the 30" Export Pipeline at the platform end changed due to the as-built status change. The surface laid section of this line at the platform end is now limited to the short section out with the trench and not currently rock covered.
6	PL310 20" Export Pipeline Sean RD to Sean PD, Trenched & Buried	Option 5 – Remove Ends and Remediate Snag Risk – Line will be disconnected

[1] Offshore end of PL311 will be capped and the pipeline will be left flooded with inhibited seawater.

Grp	Title	Decommissioning Approach
		– Removal and recovery of surface laid sections out with existing trench – Rock placement to remediate snag risk from cut ends
7	PLU5156 Power Cable Sean RD to Sean PD, Trenched & Buried	Option 2c – Reverse reel with de-burial – Cable will be disconnected – Line will be de-buried using MFE prior to removal – Recover by reverse reel Note: De-burial was included for the Power Cable due to concerns regarding the integrity of the line for reverse reeling through existing cover. Efforts will be made to remove the line without prior de-burial. Where de-burial is required, alternative methods to MFE may be used. OPRED will be advised if there are any issues with the reverse reeling option and de-burial will be discussed prior to execution.
8	Spools	Full Removal
9	Risers	Full Removal
10	Jumpers / Umbilical PLU5157	Full Removal
11	Structures (Installations)	Full Removal
12	Protection / Stabilisation	Full Removal[2]

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

[2] Any mattresses associated with third part infrastructure shall be decommissioned *in situ*

1 INTRODUCTION

1.1 Background

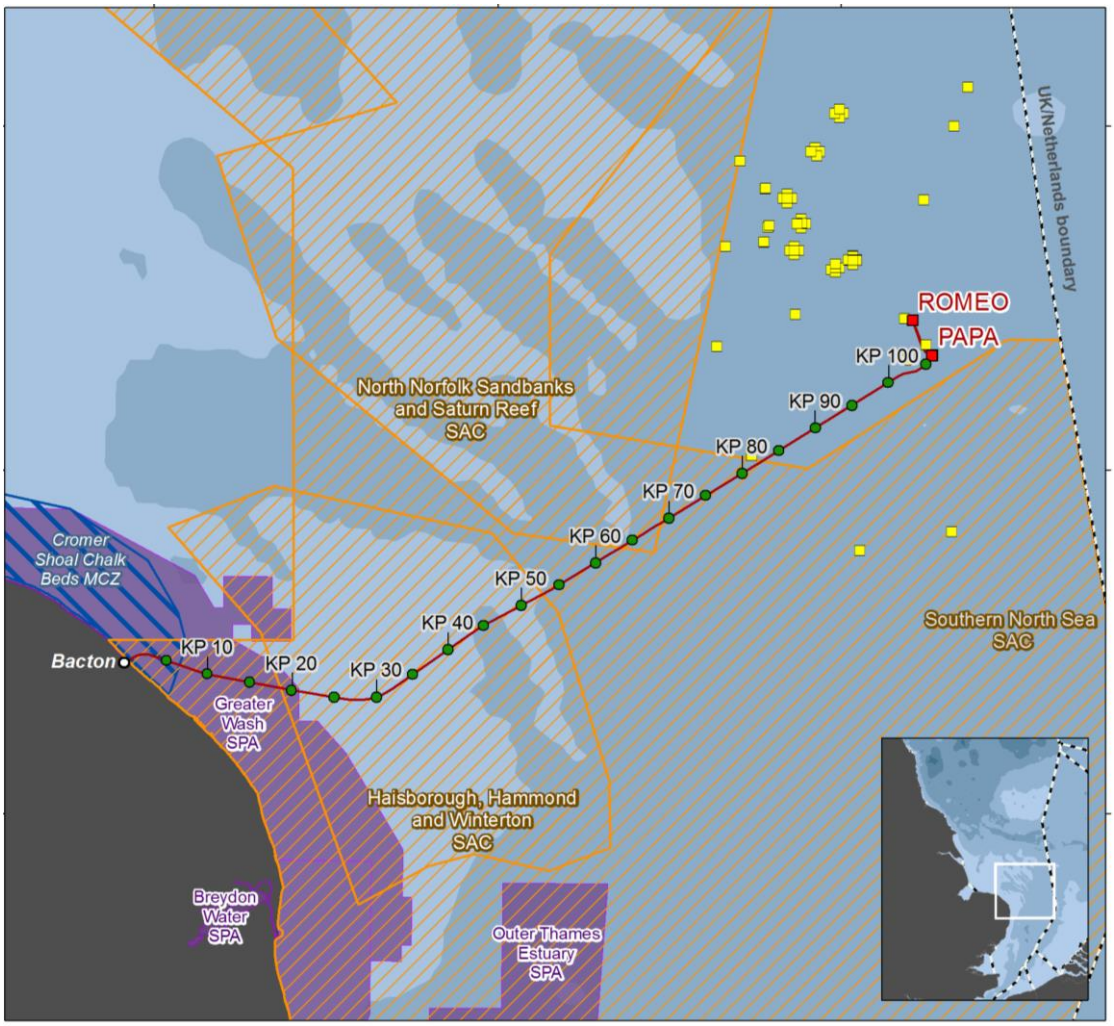


Figure 1.1: Sean Field Locations

The Sean field in the Southern North Sea consists of the Sean Papa, consisting of the bridge linked PP and PD platforms, and Sean Romeo, consisting of the RD platform. Sean Romeo, RD, exports via Sean Papa, PD, and an intra-field 20" Concrete Coated Rigid Export Pipeline (PL310). There is also an intra field Power Cable (PLU5156).

Field production is exported from Sean Papa, PP, to Bacton via a 30" Concrete Coated Rigid Export Pipeline (PL311). There is also a Subsea Safety Isolation Valve (SSIV) structure and a Mechanical Tee structure.

1.2 Purpose

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

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

1.3 Report Structure

This CA Report contains the following:

> Section 1 – An introduction to the document and project, including acronyms and references.

> Section 2 – An overview of the CA methodology and definition of the scoping and boundaries of the CA.

> Section 3 – The decommissioning groups identified and the initial decommissioning approach.

> Section 4 – The CA outcome obtained for Group 1 – 30” Export Pipeline Sean PP to Bacton Terminal.

> Section 5 – The CA outcome obtained for Group 6 – 20” Export Pipeline Sean RD to Sean PD.

> Section 6 – The CA outcome obtained for Group 7 – Power Cable Sean RD to Sean PD.

> Appendix A – Evaluation Methodology.

> Appendix B – Stakeholder CA Workshop Minutes.

> Appendix C – Group 1 – Detailed Evaluation Results.

> Appendix D – Group 6 – Detailed Evaluation Results.

> Appendix E – Group 7 – Detailed Evaluation Results

> Appendix F – Decommissioning Methodologies and Datasheets – all groups

1.4 Terms, Abbreviations and Acronyms

AHP	Analytical Hierarchy Process
BAT	Best Available Technology
BEIS	Department for Business, Energy and Industrial Strategy
BEP	Best Environmental Practice
CA	Comparative Assessment
CO_2	Carbon Dioxide
CP	Cathodic Protection
CSV	Construction Support Vessel
DoB	Depth of Burial
DP	Decommissioning Programme
ESDV	Emergency Shut-Down Valve
FLTC	Fishing Legacy Trust Company
HSE	Health and Safety Executive
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
MCDA	Multi-Criteria Decision Analysis
MCZ	Marine Conservation Zone
MEI	Major Environmental Incident
MFE	Mass Flow Excavator
MMO	Marine Management Organisation
MPA	Marine Protected Area

MS	Much Stronger
MW	Much Weaker
NE	Natural England
NFFO	National Federation of Fishermen's Organisations
NNDC	North Norfolk District Council
NORM	Naturally Occurring Radioactive Material
NOx	Nitrogen Oxide
OD	Outside Diameter
OGA	Oil & Gas Authority
OGUK	Oil & Gas UK
OIW	Oil in Water
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
PLL	Potential for Loss of Life
POB	Personnel on Board
S	Stronger
SAC	Special Area of Conservation
SNS	Southern North Sea
SOx	Sulphur Oxide
SPA	Special Protection Area
SRB	Sulphate Reducing Bacteria
SSIV	Subsea Safety Isolation Valve
SUTU	Subsea Umbilical Termination Unit
TBA	To Be Advised
ToC	Top of Cable
ToP	Top of Pipe
TUTU	Topside Umbilical Termination Unit
VMS	Very Much Stronger
VMW	Very Much Weaker
W	Weaker

1.5 References

1.	OGUK Decommissioning CA Guidelines	OGUK – Guidelines for Comparative Assessment in Decommissioning Programmes, Dated: October 2015, ISBN: 1 903 004 55 1, Issue: 1.
2.	BEIS Guidance Notes	BEIS, Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines, Nov 2018.
3.	Asset & Waste Inventory	Sean Field Decommissioning – Asset & Waste Inventory, A-400309-S00-REPT-005, Rev.: TBA, Dated: TBA
4.	CA Screening Report	Sean Field Decommissioning – Screening Report, Doc. No.: A-400309-S00-REPT-001, Rev.: A01, Dated 06/07/2020.

5.	Risk Analysis of Decommissioning Activities	Safetec, Joint Industry Project Report “Risk Analysis of Decommissioning Activities (http://www.hse.gov.uk/research/misc/safetec.pdf), 2005
6.	Analytical Hierarchy Process	T.L. Saaty, The Analytical Hierarchy Process, 1980
7.	OGUK North Sea Pipeline Decommissioning Guidelines	Decommissioning of Pipelines in the North Sea Region – 2013, Issued by Oil & Gas UK
8.	IP 2000	Guidelines for the Calculations of estimates of energy use and gaseous emissions in the decommissioning of offshore structures.

2 COMPARATIVE ASSESSMENT METHODOLOGY

2.1 Overview

Comparative Assessment is a process by which decisions are made on the most appropriate approach to decommissioning. As such it is a core part of the overall decommissioning planning process being undertaken by ONE-Dyas for the Sean Field Decommissioning Project (Subsea Infrastructure).

The OGUK Decommissioning CA Guidelines ref. [1] were prepared in 2015 by Oil and Gas UK, where seven steps to the CA process were recommended. Table 2.1 introduces each of these steps, along with a status and commentary to demonstrate the current position.

Title	Scope	Status	Commentary
Scoping	Decide on appropriate CA method, confirm criteria, identify boundaries of CA (physical and phase).	✓	CA methodology and criteria established for screening to ensure appropriate evaluation phase. Detailed in Section 2.2 and Appendix A.
Screening	Consider alternative uses and deselect unfeasible options.	✓	Screening workshops were held in Q2 2020 the screening workshops were attended by members of the ONE-Dyas project team. Screening outcomes are documented in CA Screening Report [4]
Preparation	Undertake technical, safety, environmental and other appropriate studies. Undertake stakeholder engagement.	✓	Studies identified during screening phase undertaken to inform the evaluation of the remaining options. Detailed in Section 2.4.
Evaluation	Evaluate the options using the chosen evaluation methodology.	✓	Internal workshops held Q2 2020 and Stakeholder Workshop on 26/08/2020. Evaluation methodology described in Section 2.5 and outcomes detailed in Section 4, 5 and 6. More detail can be found in Appendix A.
Recommendation	Document the recommendation in the form of narrative supported by charts explaining key trade-offs.	✓	The emerging recommendations for the decommissioning options selected are as identified during the Stakeholder Workshop and as detailed in the CA Report (this document). Recommendations can be found in Section 8.
Review	Review the recommendation with internal and/or external stakeholders.	✓	The Stakeholder CA Review Workshop was held on 26th August 2020 and the minutes can be found in Appendix B.
Submit	Submit to OPRED as part of/alongside Decommissioning Programme.	✓	Submitted Q4 2020.

Table 2.1: CA Process Overview and Status

2.2 Scoping

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

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

These are addressed in the following sub-sections.

2.2.1 CA Boundaries

The applicable boundaries for the CA are as follows:

- The following will be complete prior to the Sean subsea infrastructure decommissioning scope commencing:
  - All wells will have been fully plugged and abandoned;
  - All pipelines will have been flushed and cleaned prior to disconnection;
  - The pipelines will be cut / disconnected at the platforms;
  - The cable will be cut / disconnected at the platforms;
- Sean Field subsea infrastructure is as follows:
  - All subsea structures (installations) including their foundations;
  - All rigid subsea flowlines;
  - All rigid risers;
  - All control and chemical jumpers;
  - All spools;
  - All umbilicals / cables;
  - All mattresses and deposits.
- The physical boundaries of the infrastructure are:
  - Export trunk line, PL311, from low water mark at KP 0.6 to the PP Platform ESDV;
    - The onshore section of the trunk line PL311 from the low water mark, KP 0.6 to the Bacton Terminal is out with the scope of this CA.
    - As the PL311 pipeline riser is integrated to the PP Platform jacket it shall be removed with the jacket and for practical purposes the pipeline boundary shall be at the riser seabed tie-in flange.
  - Export pipeline, PL310, from RD Platform ESDV to PD Platform ESDV;
    - As the PL310 pipeline risers are integrated to the RD and PD Platform jackets they shall be removed with the jackets and for practical purposes the pipeline boundary shall be at the riser seabed tie-in flanges.
  - Power cable, PLU5156, from PP Platform junction box to RD Platform junction box
  - SSIV umbilical, PLU5157 from PP Platform TUTU to SSIV SUTU

2.2.2 Physical Attributes of Equipment

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

- Structures:
  - Type;
  - Weight / size / shape;
  - General arrangement;
  - Installation method / foundation type;
  - Integrity issues.
- Pipelines / Flowlines / Spools:
  - Pipeline number;
  - Type (rigid / flexible);
  - Service (gas / oil / water);
  - Material / diameter / wall thickness / coatings / length;
  - Seabed configuration (trenched / buried / surface laid);
  - Details of crossings / mattresses;
  - As-left cleanliness / ability to clean lines;
  - Integrity issues.
- Umbilicals / 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;
  - Integrity issues.

All equipment associated with Sean Field Decommissioning Project (subsea infrastructure) along with their physical attributes are listed in full in the Asset & Waste Inventory ref. [3] with a summary of the equipment included in Table 3.1 herein.

2.2.3 Decommissioning Groups

Once the equipment to be decommissioned and their attributes are captured, it is desirable to group similar equipment together. This has the benefit that many items can be considered as a single group and can reduce the number of items for consideration from potentially hundreds, down to a few, thus streamlining the process. For the Sean Decommissioning Project (Subsea Infrastructure) the decommissioning groups, along with a list of each individual item that makes up the population of those groups, is detailed in full within the Asset & Waste Inventory ref. [3]. A brief summary of the decommissioning groups identified is included in Table 3.1 herein.

2.2.4 Decommissioning Options

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

Alongside full removal options, the following partial removal scenarios should be considered as specified in the BEIS Guidance Notes ref. [2] and OGUK North Sea Pipeline Decommissioning Guidelines ref. [7].

- Re-Use.
- Full Removal:
  - Cut and Lift - Cut pipe into small sections and recover;
  - Reverse Installation without de-burial – Recover pipe using reverse s-lay or reverse reeling;
  - Reverse Installation with de-burial – Recover pipe using reverse s-lay or reverse reeling.
- Leave In-Situ with Major Intervention:
  - Rock cover entire length including surface laid sections out with trench / cover;
  - Re-Trench and bury entire length including surface laid sections out with trench / cover.
- Leave In-Situ with Minor Intervention:
  - Rock cover areas of spans, exposure and shallow burial. Remove surface laid sections out with trench / cover;
  - Trench and bury areas of spans, exposure and shallow burial. Remove surface laid sections out with trench / cover;
  - Cut and Lift areas of spans, exposure and shallow burial. Remove surface laid sections out with trench / cover;
  - Accelerated Decomposition of lines using reverse cathodic protection / chemicals / etc.
- Leave In-Situ and Minimal Intervention:
  - Cut and Lift surface laid sections out with trench / cover only.
- Leave In-Situ with on-going monitoring.

Table 3.1 lists the decommissioning groups and identifies those which were judged to be appropriate for decommissioning by full removal and those where full removal was not considered the clear recommended solution. Of those groups where full removal was not considered the clear recommended solution, the proposed decommissioning options for each of those groups are detailed as follows:

- Section 4.2 for Group 1 – PL311, 30” Export Pipeline Sean PP to Bacton Terminal;
- Section 5.2 for Group 6 – PL310, 20” Export Pipeline Sean RD to Sean PD;
- Section 6.2 for Group 7 – PLU5156, Power Cable Sean RD to Sean PD.

2.3 Screening Phase

The screening phase of the comparative assessment was carried out during a series of workshops held in Q2 2020. The methodology adopted, workshop attendance and outcomes obtained are detailed fully in the CA Screening Report ref. [4]. The methodology is briefly summarised below.

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

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

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

The assessment was performed using a coarse Red / Amber / Green method, as recommended in the OGUK Decommissioning CA Guidelines ref. [1]. An additional category of 'showstopper', coloured dark grey, was used. These categories are described Table 2.2.

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

Table 2.2: Screening Assessment Categories

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

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

The outcomes for each group are summarised in Table 4.3, Table 5.2 and Table 6.2.

2.4 Preparation Phase

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

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

- Integrity Assessment — A high-level assessment of the residual integrity of the lines in order to screen the reverse reel options in or out.
- Concrete Coating Assessment — A high-level assessment of the technical challenges associated with the uncertain integrity of the concrete coating of the 30" and 20" lines.
- Cable Strength Assessment — A high-level assessment of whether the 1" Cable can be reverse reeled with or without deburial.
- Burial Status Review — Review of historical survey data to understand current and historical burial status of lines.
- Method Statements — Detailed method statements were developed for options carried forward to ascertain the activities and resources required to deliver the option.
- Emissions Assessment — Fuel consumption and atmospheric emissions assessment performed for options carried forward based upon activities and resources identified in method statements.
- Environmental Impact Review — Environmental impact reviews were conducted for options carried forward in areas of planned discharges, unplanned discharges and seabed disturbance based on activities and resources identified in method statements. Underwater noise impact was based on a qualitative assessment of the vessels and activities employed as detailed in the method statements.

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

2.5 Evaluation Phase

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

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

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

The CA Stakeholder Workshop was held via VC / Teams Wednesday August 26th, 2020. The attendees were as detailed in Table 2.3.

Name	Company	Role
Jason Golder	Crown Estates	Senior Asset Manager
Abdulgani Oseni		Pipeline Inspector
Bill Chilton	Health and Safety Executive (HSE)	Decommissioning
Hannah Hood	Joint Nature Conservation Council (JNCC)	Offshore Industry Adviser
Lindsey Mullan	Marine Management Organisation (MMO)	Marine Licensing Case Manager
Luella Williamson		Marine Licensing Case Officer
Mark Johnston	Natural England (NE)	Senior Marine Specialist – Estuaries, Ports and Marine Industries
Rob Goodliffe	North Norfolk District Council (NNDC)	Coastal Manager
Jade Jones	Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)	Assistant Decommissioning Manager
Ruth Ledingham		Senior Financial Governance Manager
Dr Sarah Dacre		Senior Environmental Manager
Sam Pattie		Administrative Operations
Ceriel Haesen	ONE-Dyas	Asset Manager
Dirk Drijver		HSEQ Manager
Jan Willem in't Anker		Construction / Engineering Manager
Linda Murray		Environmental Advisor
Martijn Hoefsloot		Senior Production Superintendent
Maurits Waaijenberg		Senior Facility Engineer
Claire Weller[1]	Xodus	Principal Environmental Consultant
Gareth Jones		Decommissioning Manager
Jeff McCleary		Consultant Engineer - Subsea & Decommissioning
John Foreman		CA Facilitator
Phil Roberts[1]		Principal Consultant – Process & Facilities

Table 2.3: Stakeholder Workshop Attendees & Roles

Note 1: Claire Weller and Phil Roberts attended as observers only and on a part-time basis.

2.6 Post-evaluation Clarifications

2.6.1 30" Line Rock Cover

The as-built status of the 30" Export Pipeline from Sean PP to Bacton Terminal (Group 1) used during the Evaluation phase was as follows:

> KP 15.5 to KP 54 (surface laid and rock covered)

> KP 54 to KP 106 (trenched and rock covered)

It was discovered, post-evaluation, that the as-built status of the 30" Export Pipeline was as follows:

> KP 15.5 to KP 54 (surface laid no rock cover)

> KP 54 to KP 106 (trenched no rock cover)

This CA Report provides a record of the evaluation conducted. As such, the definition and findings detailed in Section 4 are provided on the basis of the as-built status of the 30" Export Pipeline as understood at the time of the CA Stakeholder Workshop.

Post-evaluation, each of the judgements have been checked for validity given the altered as-built status where there is no rock cover from KP 15.5 to KP 106. Notes have been added in Section 8.1 discussing any adjustments in the judgements as appropriate.

It is noted that the change in as-built status of the 30" Export Pipeline has not resulted in a change to the emerging recommendation that the decommissioning option for the 30" Export Pipeline should be Option 5 – Remove Ends and Remediate Snag Risk.

2.6.2 Additional Stakeholder Engagement

The representative of the fishing industry (Ian Rowe, National Federation of Fisherman's Organisations (NFFO)) was unable to attend the CA Stakeholder Workshop due to a last minute, critical operational issue.

ONE-Dyas engaged with NFFO after the workshop, sharing the Emerging Recommendations and the minutes (included in Appendix B) of the workshop. The Emerging Recommendations were also shared with the North Norfolk Fisherman's Association.

Additionally, there was post-evaluation engagement with OPRED regarding the matter of rock cover removal under the full removal option for the 30" Export Pipeline. It was agreed at that engagement session that the current guidance on rock recovery has not changed and that the recovery of rock would only need to be considered if this is intrinsic to the pipeline removal methodology. Given the full removal case considers displacement of rock using remote Mass Flow Tooling the recovery of rock is not proposed under the full removal option.

2.6.3 Preservation for Re-use (PL311)

During the review of the selected decommissioning option for the 30" Export Pipeline from Sean PP to Bacton Terminal (Group 1 – PL311) the potential for re-use options prompted further discussion. While re-use options for this line were considered during the Screening phase, with no viable re-use options being identified, it is recognised that future re-use options may present themselves. As such, during the execution of the selected decommissioning option for Group 1, where the line end at the platform will be removed to the trench transition and the remaining line left in-situ, the remaining line shall be filled with inhibited seawater post flushing and cleaning operations to manage internal corrosion rates going forward. This will require the installation of a cap at the cut end of the pipeline.

ONE-Dyas appreciates that the re-use of Oil and Gas infrastructure is in its infancy and as a result have committed to cap and inhibit the export pipeline contents post flushing in order to allow for the potential for reuse of this pipeline should a technology mature, or a future re-use option present itself. If other methods of pipeline preservation become available after DP approval but before the moment of preservation operations, these will be evaluated for suitability. After preservation, no further maintenance will be undertaken by ONE-

Dyas outside of a post decommissioning stability monitoring programme. This will represent the final decommissioned state of this line.

Note, at present a specific preservation medium has not been selected, however the current assumption is that the selected preservation medium would likely be seawater treated with a known PLONOR chemical and would be subject to a separate application via OPRED.

3 SEAN AREA DECOMMISSIONING GROUPS

Table 3.1 lists all decommissioning groups identified for the Sean Subsea Infrastructure. Early CA scoping and screening activities, detailed in the CA Screening Report ref. [4], identified the decommissioning groups where full removal is the recommended decommissioning approach (highlighted in grey).

The remaining groups are subjected to the remainder of the CA process to identify the recommended decommissioning option. These outcomes are also captured in Table 3.1.

Post-screening update: during screening, five separate groups were identified for the 30" Export Pipeline, aligned with the varying burial statuses of the pipeline. Post-screening, it was agreed that these 5 groups should be consolidated into a single group for the 30" Export pipeline for the remainder of the CA process.

Grp	Title	Description	Decommissioning Approach
1	PL311 – 30" Export Pipeline Sean PP to Bacton Terminal	A single 30" concrete coated rigid export pipeline from Sean PP to Bacton Terminal. 106km in length.	Subject to full Comparative Assessment
6	PL310 – 20" Export Pipeline Sean RD to Sean PD	A single 20" concrete coated rigid pipeline from Sean RD to Sean PD. 4.77km in length.	Subject to full Comparative Assessment
7	PLU5156 - Power Cable Sean RD to Sean PD	A single power cable from Sean RD to Sean PD. 4.77km in length.	Subject to full Comparative Assessment
8	Spools	All spools associated with the tie-in of pipelines to structures / risers.	Full Removal
9	Risers	Risers at platforms associated with pipelines.	Full Removal
10	Jumpers / Umbilical PLU5157	All jumpers / umbilical associated with the power cable and the SSIV structure.	Full Removal
11	Structures (Installations)	All subsea structures (installations).	Full Removal
12	Protection / Stabilisation	All protection, support and stabilisation materials such as mattresses[3] and grout bags.	Full Removal

Table 3.1: Decommissioning Groups and Initial Decommissioning Recommendation

3.1 Decommissioning Groups for Full CA

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

- Group 1 – 30" Export Pipeline Sean PP to Bacton Terminal
- Group 6 – 20" Export Pipeline Sean RD to Sean PD
- Group 7 – Power Cable Sean RD to Sean PD

[3] Any mattresses associated with third part infrastructure shall be decommissioned *in situ*

4 GROUP 1 – 30” EXPORT PIPELINE SEAN PP TO BACTON TERMINAL

4.1 Group 1 Characteristics

There is a single item in Group 1. The key characteristics of this item are listed in Table 4.1. The understanding of the as-built status of PL311 changed, due to additional information becoming available after the evaluation phase was complete. The description of PL311 provided in Table 4.1 provides both the understanding of PL31 during the evaluation conducted and the revised understanding of PL311 post-evaluation.

ID	Description (Evaluation)	Description (Post-evaluation)	OD (inches)	Length (km)
PL311	106km 30” Concrete Coated Rigid Pipeline, various burial statuses: - KP0.6 to KP1.0, Near-shore and in tidal zone - within Cromar Shoal Chalk Beds MCZ, Greater Wash SPA, Southern North Sea SAC - surface laid and un-trenched, no free spans were recorded here during the 2020 survey. - KP1.0 to KP8.0 - within Cromar Shoal Chalk Beds MCZ, Greater Wash SPA, Southern North Sea SAC - trenched and naturally backfilled, 72 separate exposures and no free spans were recorded here during the 2020 survey. - KP8.0 to KP15.5 - within Greater Wash SPA, Southern North Sea SAC - surface laid and un-trenched. 15 free spans were recorded here during the 2020 survey. - KP15.5 to KP54 - within Greater Wash SPA, Southern North Sea SAC, Haisborough, Hammond & Winterton SAC - surface laid and rock covered, 687 exposures and 56 free spans were identified here during the 2020 survey. - KP54 to KP106 - within Southern North Sea SAC for initial section and a short section within the Northern Norfolk Sandbanks and Saturn Reef SAC – trenched and rock covered, 159 exposures and 1 free span were identified here during the 2020 survey.	106km 30” Concrete Coated Rigid Pipeline, various burial statuses: - KP0.6 to KP1.0 – as per evaluation - KP1.0 to KP8.0 – as per evaluation - KP8.0 to KP15.5 – as per evaluation - KP15.5 to KP54 - within Greater Wash SPA, Southern North Sea SAC, Haisborough, Hammond & Winterton SAC - surface laid, 687 exposures and 56 free spans were identified here during the 2020 survey. - KP54 to KP106 - within Southern North Sea SAC for initial section and a short section within the Northern Norfolk Sandbanks and Saturn Reef SAC – trenched and naturally backfilled, 159 exposures and 1 free span were identified here during the 2020 survey.	30”	106

Table 4.1: Group 1 Items

There are known six spans approaching or exceeding the FishSafe criteria (in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which present a potential hazard to fishing activity. These are detailed in Table 4.2 and are all located between KP 14.0 and KP 17.0. These are intended to be addressed as part of the 2021 span remediation campaign.

Span	Span length (m)	Span height (m)
1	37	0.9
2	15	0.8
3	19	1.3
4	40	0.9
5	21	0.9
6	21	0.8

Table 4.2: PL311 FishSafe Spans

4.2 Group 1 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [4] and summarised in Table 4.3.

Post-screening update: during screening, five separate groups were identified for the 30" Export Pipeline, aligned with the varying burial statuses of the pipeline. Post-screening, it was agreed that these 5 groups should be consolidated into a single group for the 30" Export pipeline for the remainder of the CA process.

Post-evaluation update: after the Evaluation was completed, the as-built status of the line from KP 15.5 to KP 54 (surface laid and rock covered) and KP 54 to KP 106 (trenched and rock covered) was found to be incorrect. The as-built status is surface laid with no rock cover (KP 15.5 to KP 54) and trenched with no rock cover (KP 54 to KP 106). Given this change in status of the line post-evaluation, consideration was given to the options screened out. Notes have been added where appropriate to provide a revised narrative.

Group 1 – 30" Export Pipeline Sean PP to Bacton Terminal			
Category	**Option**	**Description**	**Discussion**
Re-use	1 – Re-use	- Leave pipeline in-situ for use in any potential new developments	Ruled out as a showstopper as no potential re-use in-situ options for the Sean Gas Export line.
Full removal	2a – Cut and lift with de-burial	- Pipeline will be disconnected - De-burial of pipeline using MFE - Recover by cutting into sections and removal	Retained as the least onerous and credible Full Removal option.
	2b – Reverse Installation (S-lay) without de-burial	- Line will be disconnected - No de-burial prior to removal - Recover by reverse s-lay	Considered a more onerous full removal option than 2a due to the technical challenges associated with the concrete coating.
Full removal	2c – Reverse Installation (S-lay) with de-burial	- Line will be disconnected - De-burial of line using MFE - Recover by reverse s-lay	Considered a more onerous full removal option than 2a due to the technical challenges associated with the concrete coating.
Leave in-situ (major intervention)	3a – Rock placement over entire line Note 1	- Pipeline will be disconnected - Rock placement over full length of pipeline to address areas of spans, exposure & shallow burial - No recovery of pipeline.	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify rock covering line already mostly buried.
Leave in-situ (major intervention)	3b – Retrench and bury entire line Note 2	- Pipeline will be disconnected - Re-trench and backfill full length of pipeline to remove areas of spans, exposure & shallow burial depth - No recovery of pipeline - No introduction of new material	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify trenching line already mostly buried.
Leave in-situ (minor intervention)	4a – Rock placement over exposures Note 3	- Pipeline will be disconnected - Removal and recovery of surface laid sections out with existing trench / rock cover Note 7 - Rock placement to remediate snag risk from cuts ends - Rock placement at all areas of spans, exposure and shallow burial depth	Retained as a viable leave in-situ option and should be evaluated.

Group 1 – 30" Export Pipeline Sean PP to Bacton Terminal			
Category	**Option**	**Description**	**Discussion**
	4b – Trench & bury exposures Note 4	- Pipeline will be disconnected - Removal and recovery of surface laid sections out with existing trench / rock cover Note 7 - Rock placement to remediate snag risk from cut ends - Trench / bury areas of spans, exposure and shallow burial depth - Minimal introduction of new material	Ruled out as a technical showstopper due to the technical challenges associated with trenching a line already trenched and rock covered. The alternative minor intervention options of 4a or 4c would be adopted.
Leave in-situ (minor intervention)	4c – Remove exposures Note 5	- Pipeline will be disconnected - Removal and recovery of surface laid sections out with existing trench / rock cover Note 7 - Rock placement to remediate snag risk from cut ends - Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques, including de-burial where required	Retained as a viable leave in-situ option and should be evaluated.
	4d – Accelerated decomposition	- Pipeline will be disconnected - Removal and recovery of surface laid sections out with existing trench / rock cover Note 7 - Rock placement to remediate snag risk from cut ends - Introduce material / techniques to accelerate the decomposition process - Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Ruled out as a technical showstopper as accelerated decomposition not a viable solution for concrete coated lines as concrete would remain.
Leave in-situ (minimal intervention)	5 – Remove ends and remediate snag risk Note 6	- Pipeline will be disconnected - Removal and recovery of surface laid section out with existing trench / rock cover Note 7 - Rock placement to remediate snag risk from cut ends - Rock placement over areas of significant spans (approaching FishSafe specification) - Line left filled with inhibited seawater and capped (at cut location) to ensure that consideration of future re-use options are not precluded.	Retained as a viable leave in-situ option as the limited areas of significant spans would be remediated along with removing end of the line out with the trench / rock cover presents a leave in-situ option that should be evaluated.
Leave in-situ (ongoing monitoring)	6 – Leave as-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed and any advisory zones implemented for remaining subsea infrastructure - Monitoring will continue on a regular basis	Ruled out as a safety showstopper due to the sections of line out with the trench / rock cover leaving an unacceptable potential snagging risk.

Table 4.3: Group 1 Decommissioning Options & Screening Summary

Note 1: Rock cover the entire line (Option 3a) would be a significant offshore work scope and would have significant Safety impact (due to risk exposure from significant offshore scope) and significant environmental impact (due to the introduction of significant rock cover). This long rock berm would also be unattractive from a fishing perspective.

Note 2: Trenching of the entire line (Option 3b) would be a significant offshore work scope and would have significant Safety impact (due to risk exposure from significant offshore scope) and significant technical challenges (due to geotechnical conditions dictating that 45% of line was not trenched when installed).

Note 3: Rock cover over areas of exposure (Option 4a) would have much greater scope as the majority of the line would need to be rock covered and thus effectively becomes Option 3a. As per Note 1, this would result in greater Safety, Environmental and Fishing impacts.

Note 4: Trenching areas of exposure (Option 4b) could have been screened in (originally eliminated as presence of rock made trenching technically challenging). The majority of the line would be trenched and thus effectively becomes Option 3b. As per Note 2, this would result in greater Safety and Technical impacts.

Note 5: Removing areas of exposure (Option 4c) would have much greater scope as the majority of the line would need to be removed and thus effectively becomes Option 2a.

Note 6: The change in as-built status means the line will be left surface laid without cover or trenched without cover along its length (typical for a concrete coated trunk line). This will result in potential for a greater legacy snag risk than originally anticipated, however the fact that trawl fishing operations are conducted over this line remains valid.

Note 7: The definition of surface laid section of the 30" Export Pipeline at the platform end changed due to the as-built status change. The surface laid section of this line at the platform end is now limited to the short section out with the trench and not currently rock covered.

4.3 Group 1 Decommissioning Options for Evaluation

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

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

4.4 Group 1 Evaluation Summary

Group 1 – 30" Export Pipeline Sean PP to Bacton Terminal		
Note: for full attributes tables and assessment see Appendix C		
Evaluation	Safety	**Option 5 is assessed as being the preferred option from a safety perspective.** Option 5 is preferred from a risk exposure to Operations Personnel perspective. This is due to the shorter durations associated with the offshore scope to address the line end and areas of spanning compared to the other options. It is also preferred from an onshore risk exposure perspective as there is a minimal quantity of the line returned for processing. With respect to Other Users, Option 5 has a much lower number of vessel days and vessel transits to and from site that the other options. Option 5 is preferred (along with Option 4a) from a High-Consequence Events perspective as there is a much lower potential for dropped objects when compared to the potential associated with the high number (thousands) of lifts associated with partial or full recovery of the pipeline. Option 2a is preferred to the other options in the Legacy Risk criterion due to the line being fully removed. The difference in risk profile between Option 2a and the partial removal options is assessed as minimal as the remaining line is rock covered or trenched and rock covered along the majority of its length. The surface laid sections that would remain are at the near shore end of the pipeline where the water depth limits trawling activity and hence a low potential for snagging. Option 5 is the least preferred against this criterion.
	Environment	**Option 5 is assessed as being the preferred from an environmental perspective.** Option 5 is preferred (along with Option 4a) from an Operational Marine Impact perspective as the other options require extended vessel operations, diamond wire cutting and MFE operations, increasing the noise impact and potential for planned (from the line when cutting) and unplanned discharges. Option 5 is also preferred (along with Option 4a) from an Atmospheric Emissions perspective as the fuel use and atmospheric emissions associated with the other options are much higher. Option 4a is least preferred (other options equal) from an Other Consumptions perspective due to the large quantity of rock associated with this option. Option 5 is preferred with respect to Seabed Disturbance as the other options impact large areas of seabed for de-burial / rock cover operations. Option 2a is preferred from a Legacy Marine Impacts perspective as there is no legacy marine impact as line is removed (although crossings will remain in-situ). There are varying areas of permanent habitat change caused by rock cover in the other options with Option 4a being the most significant.
	Technical	**Option 5 is assessed as being the preferred option from a technical perspective.** Whilst all options use largely proven technology and routine operations, the extensive cut & lift and de-burial operations along 106km of pipeline carry an increased risk of a technical failure from a cumulative effect of de-burial and cutting equipment failure. As such Option 5 (along with Option 4a) is preferred.
	Societal	**Option 5 is assessed as being the preferred from a societal perspective.** With respect to Societal impact on Fishing, Option 5 is preferred. While Option 2a may appear to be preferable as it involves full removal of the line, it also causes significant disruption to fishing operations from the de-burial and removal of the line, which may impact creel pot fishing activities conducted along this pipeline. Option 5 (along with Option 4a) is preferred from a Societal impact on Other Users perspective as, while these options return the least useful material, they also do not return the significant quantities (tens of thousands of tonnes) of difficult to process, salt water contaminated concrete that will use limited landill capacity in the other options..
	Economic	**Option 5 is assessed as the most preferred option.** From a short-term cost perspective, Option 5 is preferred as it is more than 10 times lower cost that the next cheapest option, and 100 times lower cost than the full removal option. For long-term costs, there are none associated with the full removal option, whereas there are legacy costs associated with monitoring, surveying and managing potential snag hazards for all other options.
	Summary	Option 5 was preferred against the Safety, Environment Technical and Societal criteria. Once the Economics criterion was considered, this strengthens the preference for Option 5. **Option 5 – Remove Ends and Remediate Snag Risk will form the emerging recommendation for the decommissioning option for Group 1.**

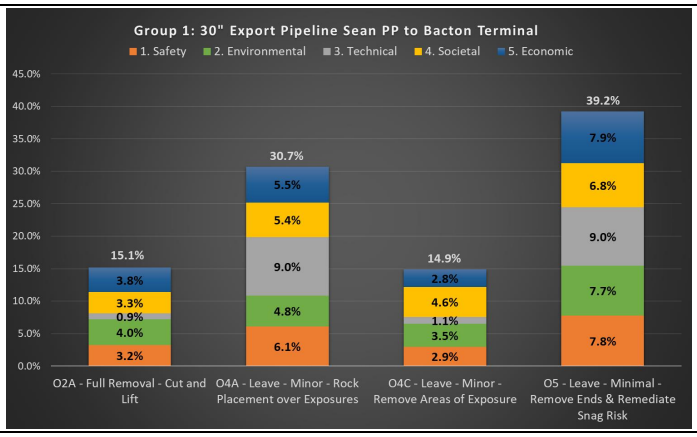


Table 4.4: Group 1 Evaluation Summary

4.5 Group 1 Sensitivities

Sensitivity analysis has been conducted on the outcome obtained during the evaluation phase of the CA for Group 1 (as detailed in Section 4.4). This analysis was conducted based on challenges made during the stakeholder workshop.

Three sensitivities have been investigated:

1. Legacy safety risk increased.
2. Legacy environmental impact increased.
3. Technical risk reduced.

The rationale behind performing the sensitivities and findings obtained are described in the following sections.

4.5.1 Legacy Risk

The base case assessment conducted during the stakeholder workshop was that Option 2a (Full Removal – Cut and lift with de-burial) was Stronger than Option 4a (Partial Removal – Rock placement over exposures) and Option 4c (Partial Removal – Remove exposures) and Much Stronger than Option 5 (Partial Removal – Remove ends & remediate snag risk). Further, Option 4a and Option 4c were assessed as Neutral to each other and both Stronger than Option 5.

This reflects the assertion that, given the as left condition of the partial removal options, i.e. rock cover over exposures, exposures removed or left as-is with areas of spans approaching the FishSafe criteria addressed are less preferred than the full removal option. The relative preference is influenced by the lack of trawl fishing operations in the near shore areas where the line is in shallow water but not rock covered and the commitment to a survey, monitoring and remediation programme, as required, to maintain the as left status and to manage legacy risk from snagging.

There was a challenge to this during the stakeholder workshop on the basis that the legacy risk should be increased to test the outcome under this sensitivity case. It was agreed to run a sensitivity where the relative preference for Option 2a was increased over all other options. The relative preference for Option 4a and Option 4c over Option 5 was also increased as follows:

- O2a v O4a, was Stronger, moves to Much Stronger
- O2a v O4c, was Stronger, moves to Much Stronger
- O2a v O5, was Much Stronger, moves to Very Much Stronger
- O4a v O4c, was Neutral, remains Neutral
- O4a v O5, was Stronger, moves to Much Stronger
- O4c v O5, was Stronger, moves to Much Stronger

The impact of the increased preferences on the overall outcome is shown in Figure 4.1 with the base case assessment represented by the column on the left and the sensitivity case represented by the column on the right .

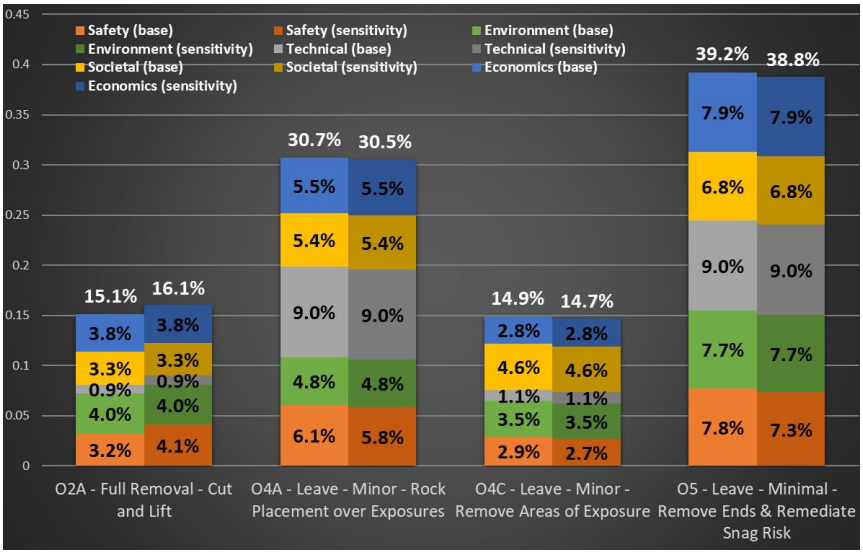


Figure 4.1: Legacy Risk Impact Sensitivity Outcome

Figure 4.1 shows that performing the sensitivity where the preference for the full removal option from a legacy risk impact perspective over the other options is increased, has a small impact on the original assessment. It can be seen that this increased preference for the full removal option increases the safety contribution to the overall score for Option 2a and reduces for the other options. This does not change the overall outcome that Option 5 is preferred.

4.5.2 Legacy Environmental Impact

The base case assessment conducted during the stakeholder workshop was that Option 2a (Full Removal – Cut and lift with de-burial) was Much Stronger than Option 4a (Partial Removal – Rock placement over exposures) and Option 4c (Partial Removal – Remove exposures) and Stronger than Option 5 (Partial Removal – Remove ends & remediate snag risk). Further, Option 4a was assessed as Weaker than Option 4c and Much Weaker than Option 5. Finally, Option 4c was assessed as Much Weaker than Option 5.

This reflects the assertion that, removal of line is preferred to leaving the line in-situ, although the relative preference is small given the line will be flushed and cleaned prior to decommissioning and that any releases or degradation products will occur over a long time period and the environmental impact will be low. Further, this assessment reflects the environmental impact of the rock cover introduced under Option 4a and Option 4c.

There was a challenge to this during the stakeholder workshop on the basis that the impact of the rock cover should be increased, particularly where that rock cover is placed on the line when located in key Marine Protected Areas (MPA). It was agreed that the legacy environmental impact should be increased to test the outcome under this sensitivity case where the relative preference for Option 2a was increased over all other options. The relative preference for Option 4a and Option 4c over Option 5 was also increased as follows:

- O2a v O4a, was Much Stronger, moves to Very Much Stronger
- O2a v O4c, was Much Stronger, moves to Very Much Stronger
- O2a v O5, was Stronger, moves to Much Stronger
- O4a v O4c, was Weaker, moves to Much Weaker
- O4a v O5, was Much Weaker, moves to Very Much Weaker
- O4c v O5, was Much Weaker, moves to Very Much Weaker

The impact of the increased preferences for no rock cover on the overall outcome is shown in Figure 4.2 with the base case assessment represented by the column on the left and the sensitivity case represented by the column on the right .

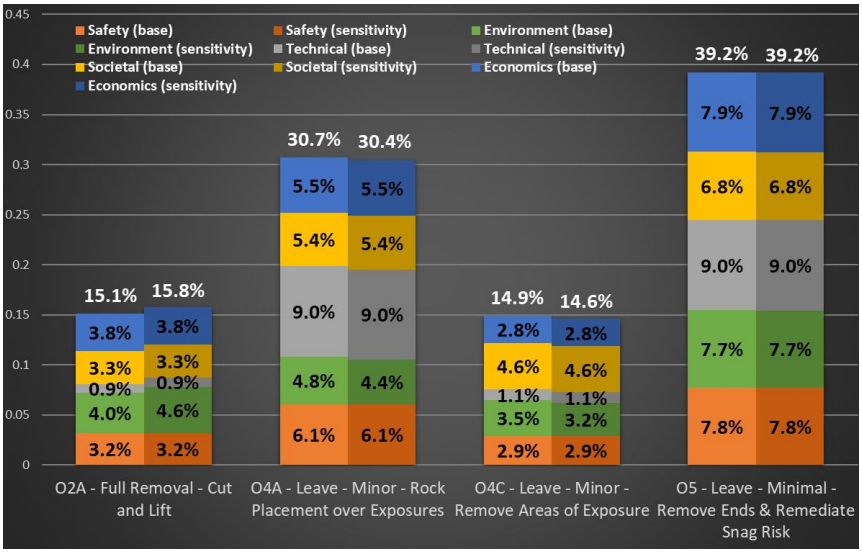


Figure 4.2: Legacy Environmental Impact Sensitivity Outcome

Figure 4.2 shows that performing the sensitivity where the legacy impact of any rock cover introduced was increased, has a small impact on the original assessment. It can be seen that this reduction in preference for options with rock cover (Option 4a and Option 4c) reduces the environmental contribution to the overall score for those options and increases the preference for Option 2a. This does not change the overall outcome that Option 5 is preferred.

4.5.3 Technical Risk

The base case assessment conducted during the stakeholder workshop was that Option 2a (Full Removal – Cut and lift with de-burial) was Very Much Weaker than Option 4a (Partial Removal – Rock placement over exposures) and Option 5 (Partial Removal – Remove ends & remediate snag risk) and Weaker than Option 4c (Partial Removal – Remove exposures). Further, Option 4a was assessed as Very Much Stronger than Option 4c and Neutral to Option 5. Finally, Option 4c was assessed as Very Much Weaker than Option 5.

This reflects the assertion that performing either full removal of the line or removal of exposures carries a much higher level of technical risk due to the length of the line and the scope of the removal operations, including the challenges of performing the de-burial operations and cutting operations at this scale and the associated potential for equipment failure.

There was a challenge to this during the stakeholder workshop on the basis that the difference between the full removal / exposure removal options should be reduced. It was agreed that the technical risk impact should be reduced to test the outcome under this sensitivity case where the relative preference for Option 2a versus Options 4a and 5 and for Option 4c versus Options 4a and 5 was reduced as follows:

- O2a v O4a, was Very Much Weaker, moves to Much Weaker
- O2a v O4c, was Weaker, remains as Weaker
- O2a v O5, was Very Much Weaker, moves to Much Weaker
- O4a v O4c, was Very Much Stronger, moves to Much Stronger
- O4a v O5, was Neutral, remains as Neutral
- O4c v O5, was Very Much Weaker, moves to Much Weaker

The impact of the increased preferences on the overall outcome is shown in Figure 4.3 with the base case assessment represented by the column on the left and the sensitivity case represented by the column on the right .

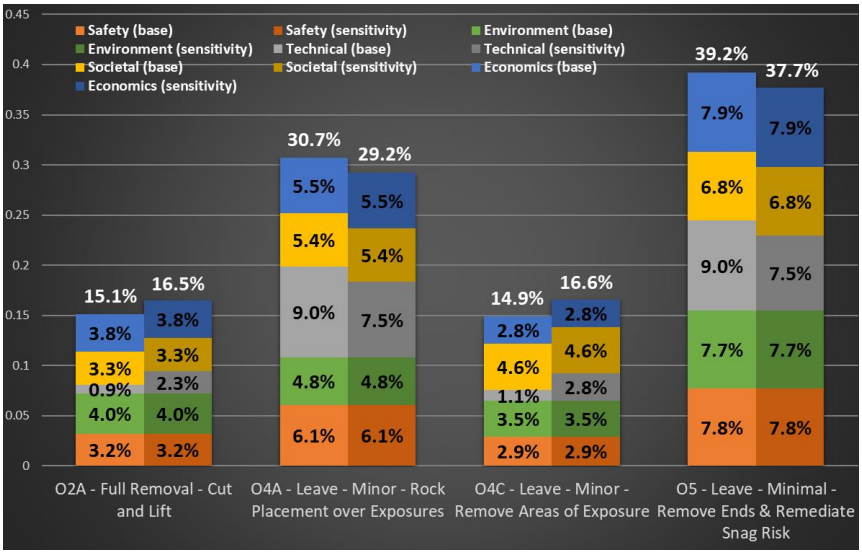


Figure 4.3: Technical Risk Impact Sensitivity Outcome

Figure 4.3 shows that performing the sensitivity where the technical risk associated with the full removal / remove exposures was reduced, has a small impact on the original assessment. It can be seen that this adjustment reduces the technical contribution for Option 4a and Option 5 and increase the technical contribution for Option 2a and Option 4c. This does not change the overall outcome that Option 5 is preferred.

5 GROUP 6 – 20” EXPORT PIPELINE SEAN RD TO SEAN PD

5.1 Group 6 Characteristics

There is a single item in Group 6. The key characteristics of this item are listed in Table 5.1.

ID	Description	OD (inches)	Length (km)
PL310	20” Concrete Coated Rigid Pipeline Trenched & Buried (average 0.72 m ToP), between Sean RD and Sean PD Platforms. The pipeline transitions to surface and is tied in to surface spools at each end which, in turn, tie in to the respective platform risers.	20”	4.77

Table 5.1: Group 6 Items

5.2 Group 6 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [4] and summarised in Table 5.2.

Group 6 – 20” Export Pipeline Sean RD to Sean PD			
Category	**Option**	**Description**	**Discussion**
Re-use	1 – Re-use	- Leave line in-situ for use in any potential new developments	Ruled out as a showstopper as once platforms removed there were no potential re-use in-situ options for this short, in field line.
Full removal	2a – Cut and lift with de-burial	- Line will be disconnected - De-burial of line using MFE - Recover by cutting into sections and removal	Retained as the least onerous and credible Full Removal option.
	2b – Reverse Installation (S-lay) without de-burial	- Line will be disconnected - No de-burial prior to removal - Recover by reverse s-lay	Considered a more onerous full removal option than 2a due to the technical challenges associated with the concrete coating.
	2c – Reverse Installation (S-lay) with de-burial	- Line will be disconnected - De-burial of line using MFE - Recover by reverse s-lay	Considered a more onerous full removal option than 2a due to the technical challenges associated with the concrete coating.
Leave in-situ (major intervention))	3a – Rock placement over entire line	- Line will be disconnected - Rock placement over full length of line to address areas of spans, exposure & shallow burial - No recovery of line	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify fully rock covering line already fully buried.
	3b – Retrench and bury entire line	- Line will be disconnected - Re-trench and backfill full length of line to remove areas of spans, exposure & shallow burial depth - No recovery of line - No introduction of new material	Ruled out as a technical showstopper as there insufficient areas of spans, exposure or shallow burial to justify trenching line already fully buried.

Group 6 – 20" Export Pipeline Sean RD to Sean PD			
Category	**Option**	**Description**	**Discussion**
Leave in-situ (minor intervention)	4a – Rock placement over exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cuts ends - Rock placement at all areas of spans, exposure and shallow burial depth	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4b – Trench & bury exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Trench / bury areas of spans, exposure and shallow burial depth - Minimal introduction of new material	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4c – Remove exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques, including de-burial where required	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4d – Accelerated decomposition	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Introduce material / techniques to accelerate the decomposition process - Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Ruled out as a technical showstopper as accelerated decomposition not a viable solution for concrete coated lines as concrete would remain.
Leave in-situ (minimal intervention)	5 – Remove ends and remediate snag risk	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends	As there are no areas of spans, exposure or shallow burial, removing the ends of the line out with the trench presents a leave in-situ option that should be evaluated.
Leave in-situ (ongoing monitoring)	6 – Leave as-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed and any advisory zones implemented for remaining subsea infrastructure	Ruled out as a safety showstopper due to the sections of line out with the trench leaving an unacceptable potential snagging risk.

Table 5.2: Group 6 Decommissioning Options and Screening Summary

5.3 Group 6 Decommissioning Options for Evaluation

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

- Full Removal
  - 2a – Cut and lift with de-burial
- Leave in-situ (minimal intervention)
  - 5 – Remove ends & remediate snag risk

5.4 Group 6 Evaluation Summary

Group 6 – 20" Export Pipeline Sean RD to Sean PD	
Note: for full attributes tables and assessment see Appendix D	
Safety	**Option 5 is assessed as being the preferred from a safety perspective.** Option 5 is preferred to Option 2a from a risk exposure to Operations Personnel perspective. This is due to the longer durations associated with the offshore scope to de-bury the line and to cut it into short sections and their recovery in Option 2a versus removal of the line ends in Option 5. There is also an increased risk exposure associated with returning the full line under Option 2a. There was also a small preference for Option 5 with respect to Safety risk to Other Users, due to the shorter offshore durations and fewer transits associated with Option 5. Option 5 was also preferred from a High-Consequence Events perspective as there is greater potential for dropped objects in Option 2a from the recovery of the cut sections of the pipeline through the water column due to a much higher number of lifts. Option 2a is preferred to Option 5 in the Legacy Risk criterion due to it being a full removal option. The difference in risk profile between Option 2b and Option 5 is assessed as minor as the remaining line is fully trenched and buried in Option 5.
Environment	**Option 5 is assessed as being the preferred from an environmental perspective.** Option 5 is preferred from an Operational Marine Impact perspective as, while the impacts are expected to be low, the cumulative nature of noise impact from longer durations of onsite working (vessels) and cutting operations (DWC) and discharges from the line when cutting was sufficient to express a preference. Both options are considered equally preferred from an Atmospheric Emissions perspective as the fuel use and atmospheric emissions are similar. They are also equally preferred from an Other Consumptions perspective as, again, the impacts are similar. Option 5 is preferred with respect to Seabed Disturbance as Option 2a disturbs the seabed along the entire length of the line during the de-burial operations required to allow access to cut the line. Option 2a is preferred from a Legacy Marine Impacts perspective as there is no legacy marine impact with this full removal option. There is legacy impact from leaving the line in-situ although the impact is expected to be low due to the lie being flushed and cleaned prior to decommissioning. There is also a small area of permanent habitat change caused by rock cover over the line ends in Option 5. Note: the environmental impact of all decommissioning options is low and the differences between the options are minor.
Technical	**Option 5 is assessed as the being the preferred option from a technical perspective.** While both options use largely proven technology and routine operations, there is a preference for Option 5 due to the technical challenges associated with the de-burial of the line and the cumulative nature of potential technical failures performing DWC operations along almost 5km of line.
Societal	**Option 2a and Option 5 are assessed as being equally preferred from a societal perspective.** With respect to Societal impact on Fishing, there is no preference between the two options. Whilst Option 2a may appear to be preferable as it involves full removal of the lines, it also causes greater disruption to fishing operations during the removal. It is noted that fishing operations are conducted over this line currently. Option 2a and Option 5 are equally preferred from a Societal impact on Other Users perspective as while there is more useful material (duplex steel) returned in Option 2a, there is also more material destined for landfill (concrete) which cancels this out.
Economic	**Option 5 is assessed as being the preferred option from an economic pespective.** From a short-term cost perspective, Option 2a is around 5 times the cost of Option 5 making Option 5 preferred. For long-term costs, there are none associated with Option 2a as it is full removal but for Option 5 there are legacy costs associated with, surveying and managing the left in-situ line making Option 2a preferred.
Summary	Option 5 was preferred against the Safety, Environmental and Technical criteria and equally preferred against the Societal criterion. Without including economics, there is a strong preference for Option 5. Once the Economics criterion is included, this preference is further strengthened. **Option 5 – Remove Ends and Remediate Snag Risk will form the emerging recommendation for the decommissioning option for Group 6.**

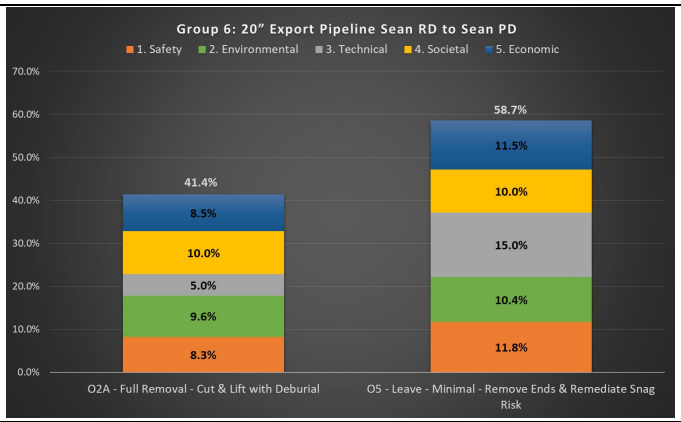


Table 5.3: Group 6 Evaluation Summary

6 GROUP 7 – POWER CABLE SEAN RD TO SEAN PD

6.1 Group 7 Characteristics

There is a single item in Group7. The key characteristics of this item are listed in Table 6.1.

ID	Description	OD (inches)	Length (km)
PLU5156	3.5" Power Cable, Trenched and Buried (average 0.87 m ToC), between Sean RD and Sean PD Platforms.	3.5"	4.9

Table 6.1: Group 7 Items

6.2 Group 7 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [4] and summarised in Table 5.2.

Post-screening update: during screening, there was uncertainty regarding the strength in the power cable to support reverse reeling either through existing cover (no de-burial) or if de-buried first. As such, the CA Screening Report indicated that Option 2a – Full Removal by Cut and Lift was the preferred full removal option, pending a strength assessment. The findings of that strength assessment showed that the power cable has sufficient strength to be reverse reeled if de-buried first. Concerns remain about the strength to reverse reel through existing cover. As such, Option 2c – Reverse reel with de-burial is retained as the most credible and least onerous full removal option, as shown in Table 5.2.

Group 7 – Power Cable Sean RD to Sean PD			
Category	**Option**	**Description**	**Discussion**
Re-use	1 – Re-use	- Leave line in-situ for use in any potential new developments	Ruled out as a showstopper as there were no potential re-use in-situ options for this short, in field power cable.
Full removal	2a – Cut and lift with de-burial	- Line will be disconnected - De-burial of line using MFE - Recover by cutting into sections and removal	Considered a more onerous full removal option than 2c as reeling with de-burial considered viable.
	2b – Reverse reel without de-burial	- Line will be disconnected - No de-burial prior to removal - Recover by reverse reel	Not considered viable due to concerns about the integrity of the cable being reverse reeled through existing cover.
	2c – Reverse reel with de-burial	- Line will be disconnected - De-burial of line using MFE - Recover by reverse reel Note: De-burial was included for the Power Cable due to concerns regarding the integrity of the line for reverse reeling through existing cover. Efforts will be made to remove the line without prior de-burial. Where de-burial is required, alternative methods to MFE may be used. OPRED will be advised if there are any issues with the reverse reeling option and de-burial will be discussed prior to execution.	Retained as the least onerous and credible Full Removal option.

Group 7 – Power Cable Sean RD to Sean PD			
Category	**Option**	**Description**	**Discussion**
Leave in-situ (major intervention))	3a – Rock placement over entire line	- Line will be disconnected - Rock placement over full length of line to address areas of spans, exposure & shallow burial - No recovery of line	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify fully rock covering line already fully buried.
	3b – Retrench and bury entire line	- Line will be disconnected - Re-trench and backfill full length of line to remove areas of spans, exposure & shallow burial depth - No recovery of line - No introduction of new material	Ruled out as a technical showstopper as there insufficient areas of spans, exposure or shallow burial to justify trenching line already fully buried.
Leave in-situ (minor intervention)	4a – Rock placement over exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cuts ends - Rock placement at all areas of spans, exposure and shallow burial depth	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4b – Trench & bury exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Trench / bury areas of spans, exposure and shallow burial depth - Minimal introduction of new material	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4c – Remove exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques, including de-burial where required	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4d – Accelerated decomposition	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Introduce material / techniques to accelerate the decomposition process - Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Ruled out as a technical showstopper as accelerated decomposition not a viable solution for power cables due to their construction.
Leave in-situ (minimal intervention)	5 – Remove ends and remediate snag risk	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends	As there are no areas of spans, exposure or shallow burial, removing the ends of the line out with the trench presents a leave in-situ option that should be evaluated.

Group 7 – Power Cable Sean RD to Sean PD			
Category	**Option**	**Description**	**Discussion**
Leave in-situ (ongoing monitoring)	6 – Leave as-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed and any advisory zones implemented for remaining subsea infrastructure	Ruled out as a safety showstopper due to the sections of line out with the trench leaving an unacceptable potential snagging risk.

Table 6.2: Group 7 Decommissioning Options and Screening Summary

6.3 Group 7 Decommissioning Options for Evaluation

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

- Full Removal
  - 2c – Reverse reel with de-burial

  Note: De-burial was included for the Power Cable due to concerns regarding the integrity of the line for reverse reeling through existing cover. Efforts will be made to remove the line without prior de-burial. Where de-burial is required, alternative methods to MFE may be used. OPRED will be advised if there are any issues with the reverse reeling option and de-burial will be discussed prior to execution.
- Leave in-situ (minimal intervention)
  - 5 – Remove ends & remediate snag risk

6.4 Group 7 Evaluation Summary

Group 7 – Power Cable Sean RD to Sean PD	
Note: for full attributes tables and assessment see Appendix E	
Safety	**Option 2c and Option 5 are assessed as being equally preferred from a safety perspective.** Option 5 is preferred to Option 2c from a risk exposure to Operations Personnel perspective. This is due to the longer durations associated with the offshore scope to reverse reel the line and return to shore for processing in Option 2c versus the smaller offshore scope associated with recovering the line ends out with the trench and smaller onshore handling from less material being returned in Option 5. With respect to Safety risk to Other Users, Option 2c and Option 5 are both equally preferred due to a largely similar numbers of vessel days and transits. They are also equally preferred from a High-Consequence Events perspective as the potential for dropped objects is similar due to the similar number of lifts. Option 2c is preferred to Option 5 in the Legacy Risk criterion due to it being a full removal option. The difference in legacy risk profile between Option 2c and Option 5 is assessed as minimal as the remaining line is fully trenched and buried in Option 5.
Environment	**Option 2c and Option 5 are assessed as being equally preferred from an environmental perspective.** Option 2c and Option 5 are equally preferred from an Operational Marine Impact perspective as the noise impacts and potential for unplanned discharges is similar for both options. There are no operational discharges associated with the removal as it is a power cable. Both options are considered equally preferred from an Atmospheric Emissions perspective as, while there is more fuel use and atmospheric emissions for Option 5, this differential was considered insufficient to express a preference. They are also equally preferred from an Other Consumptions perspective as, while the impact from replacing material left in-situ in Option 5 is greater than processing the returned material in the full removal option, this was insufficient to express a preference. Option 5 is preferred with respect to Seabed Disturbance as Option 2c disturbs a greater area of seabed from the de-burial with MFE prior to reverse reeling the line. Option 2c is preferred from a Legacy Marine Impacts perspective as there is no legacy marine impact as the line is removed. There is also a small area of permanent habitat change caused by rock cover over line ends in Option 5. Note: the environmental impact of all decommissioning options is low and the differences between the options are minor.
Technical	**Option 5 is assessed as the being the preferred option from a technical perspective.** Both options use largely proven technology and routine operations. However, there is potential for the reverse reeling option to fail due to concerns regarding the de-burial operations and the potential for the cable failing requiring the decommissioning solution to be revisited. As such Option 5 is preferred.
Societal	**Option 2c is assessed as being the preferred option from a societal perspective.** With respect to Societal impact on Fishing, there is no preference between the two options. Whilst Option 2c may appear to be preferable as it involves full removal of the lines, it also causes more disruption to fishing operations than Option 5. Option 2c is preferred from a Societal impact on Other Users perspective due to the copper associated with the power cable being returned for recycling.
Economic	**Option 2c and Option 5 are assessed as being equally preferred from an economic perspective.** From a short-term cost perspective, Option 2c is around 20% higher cost than Option 5 which is preferred. For long-term costs, Option 2c is prefered as there are no costs associated with Option 2c as it is full removal, but for Option 5 there are legacy costs associated with, surveying and managing potential snag hazards.
Summary	Option 5 was preferred against the Technical and Societal criteria. The options were equally preferred against the Safety and Environmental criteria. Without including economics, there is a small preference for Option 5. Once the Economics criterion is included, this small preference is maintained. Given the small margin of preference for the leave in-situ option, ONE-Dyas have elected to remove the power cable and, as such, **Option 2c – Reverse reeling with de-burial will form the emerging recommendation for the decommissioning option for Group 7.**

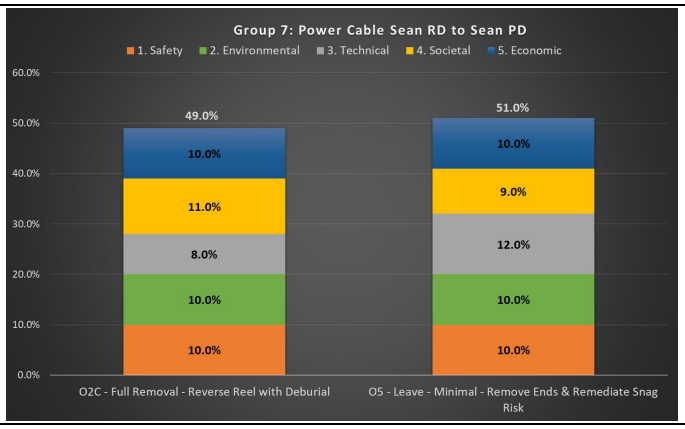


Table 6.3: Group 7 Evaluation Summary

7 WEIGHTING SENSITIVITIES

As part of the Stakeholder Workshop the base case of an equally weighting primary criteria was discussed. It was agreed to conduct two sensitivities as follows:

- Base case of equally weighted primary criteria where Safety, Environment, Technical, Societal and Economic each have a weight of 20% adjusted to Safety – 25%, Environment – 25%, Technical – 15%, Societal – 20% and Economic – 15%. This was done to increase the influence of the Safety and Environmental criteria and test the outcomes obtain for robustness.
- Base case of equally weighted primary criteria adjusted to Safety – 25%, Environment – 30%, Technical – 15%, Societal – 15% and Economic – 15%. This reflected a further increase in the influence of the Environmental criterion, reflecting the status of the 30" line being located in various MPZs.

The outcomes from this sensitivity analysis are shown in Figure 7.1 for Group 1, Figure 7.2 for Group 6 and Figure 7.3 for Group 7 below. In these charts the first column for each option shows the base case outcome, the second column the first weighting sensitivity and the final column the second weighting sensitivity.

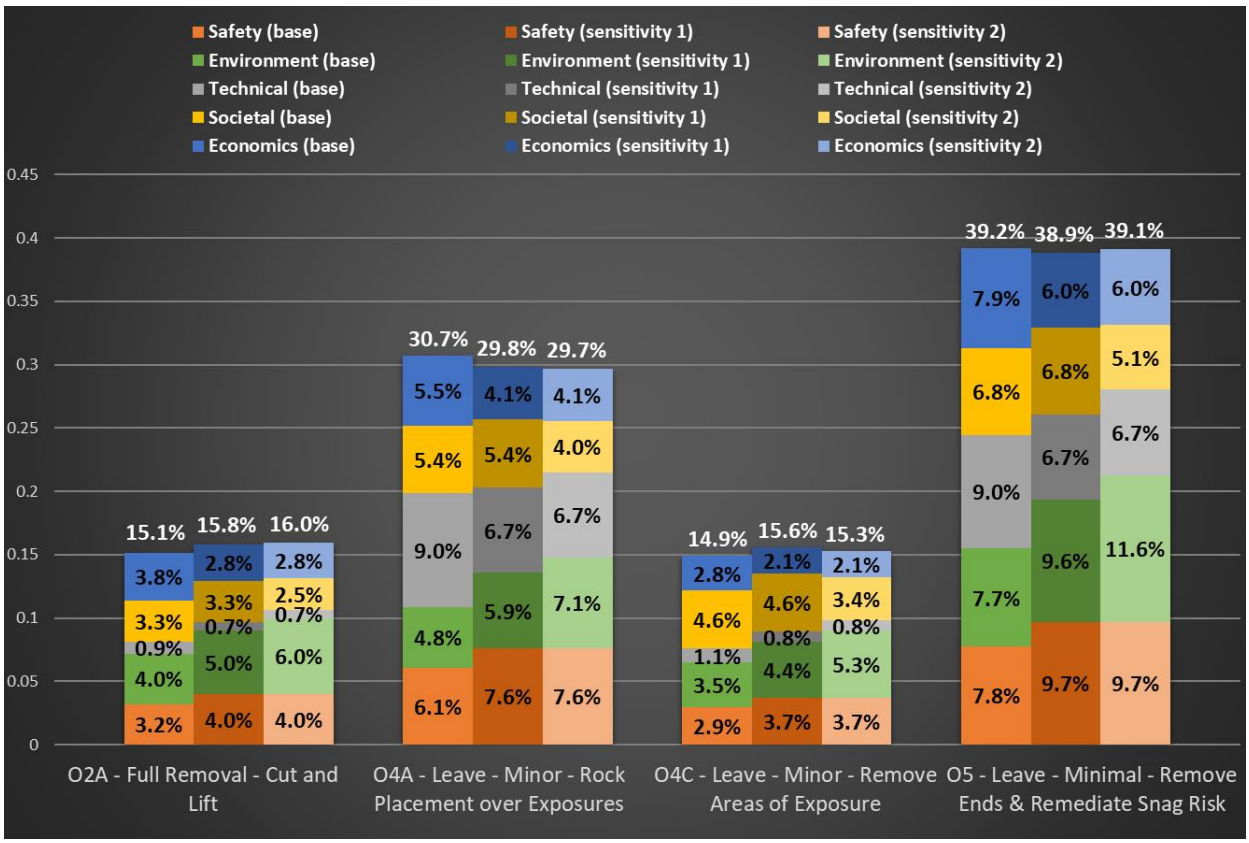


Figure 7.1:Weighting Sensitivity – Group 1

As can be seen from the above chart, the adjusted weighting sensitivity has a small impact on the relative preference for the options with Option 5 remaining as the clear preferred option for Group 1.

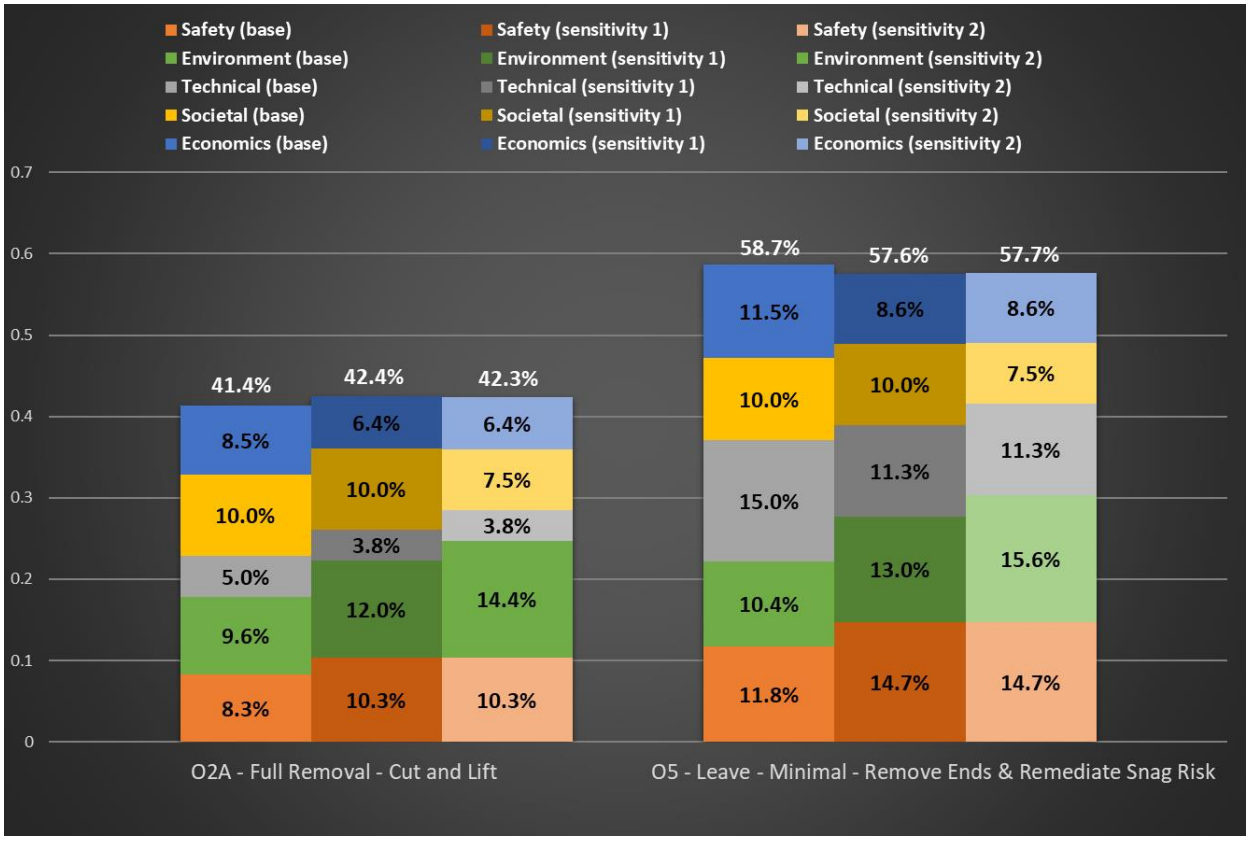


Figure 7.2: Weighting Sensitivity – Group 6

Similarly to Group 1, the adjusted weighting sensitivity has a small impact on the relative preference for the options with Option 5 remaining as the clear preferred option for Group 6.

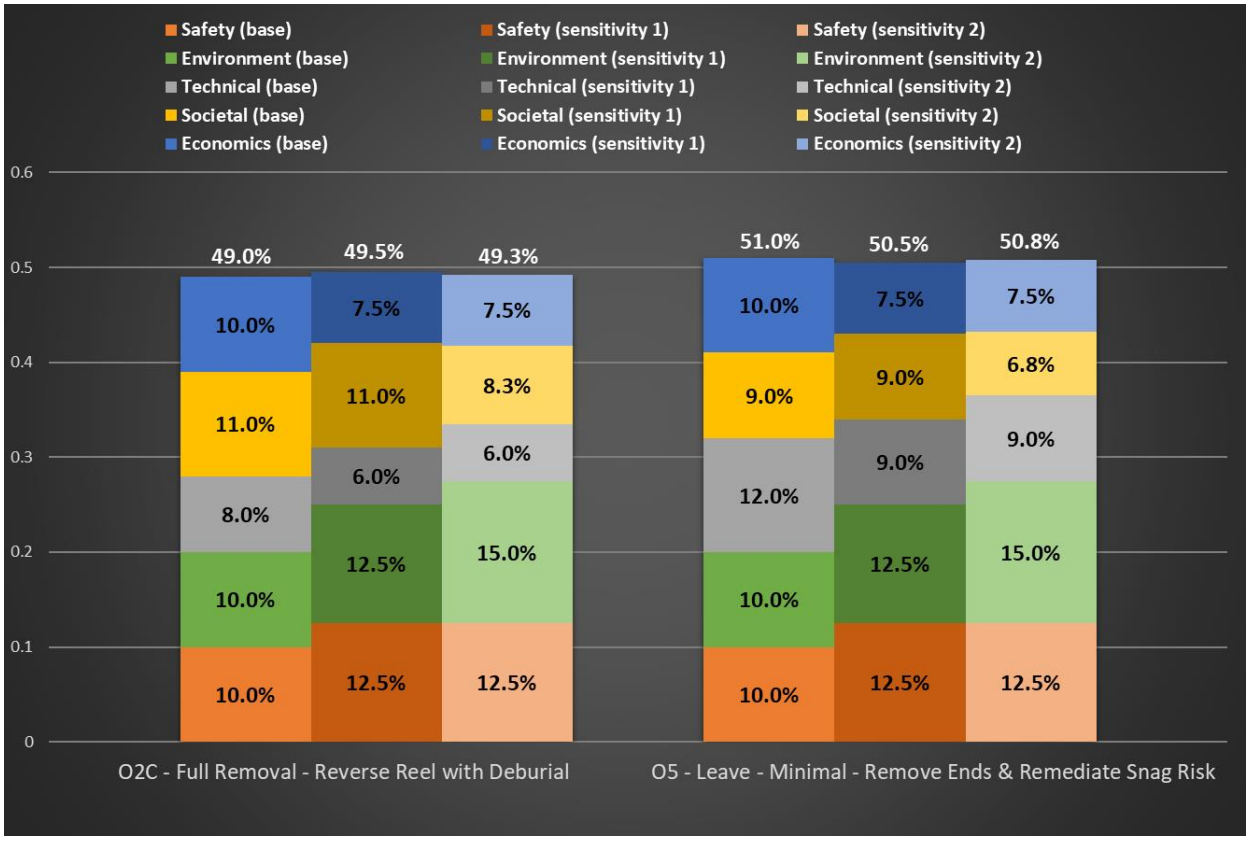


Figure 7.3: Weighting Sensitivity – Group 7

Given how close the assessment for the options for Group 7 were, the small impact from the weighting sensitivities conducted reduces the relative preference for Option 5 over Option 2c. This reinforces ONE-Dyas decision to proceed with the full removal of the power cable in Group 7.

8 RECOMMENDATIONS

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

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

- Group 8 – Spools
- Group 9 - Risers
- Group 10 – Jumpers / Umbilical
- Group 11 – Structures (Installations)
- Group 12 – Protection / Stabilisation

The full comparative assessment process was applied to the remaining decommissioning groups (1, 6 and 7). The recommended decommissioning options for these groups follow below.

8.1 Group 1 Recommendations

The recommended decommissioning option for Group 1 – 30" Export Pipeline Sean PP to Bacton Terminal is:

- Option 5 – Remove Ends and Remediate Snag Risk
  - Pipeline will be disconnected
  - Removal and recovery of surface laid section out with existing trench / rock cover
  - Rock placement to remediate snag risk from cut end
  - Rock placement over areas of significant spans (approaching FishSafe specification)
  - Line left, filled with inhibited seawater and capped (at cut location) to ensure that consideration of future re-use options are not precluded.

Note: The definition of surface laid section of the 30" Export Pipeline at the platform end changed due to the as-built status change. The surface laid section of this line at the platform end is now limited to the short section out with the trench and not currently rock covered.

The following sections provide a summary of the evaluation of the Group 1 decommissioning options against the five criteria and why this recommendation has been made.

8.1.1 Safety

Option 5 has the lowest risk exposure of all options for operations personnel. This is due to the short offshore durations associated with the scope to remove the line end out with the existing trench / rock cover and to remediate snag risk from this cut end and existing spans approaching the FishSafe criteria when compared to any of the other options. It also has the lowest onshore risk exposure due to the minimal quantity of material returned for processing compared to the full removal option.

Option 5 also has the lowest safety impact on other users of the sea due to the minimal offshore durations and vessel transits. It also has the lowest potential for high consequence events due to the minimal lifting involved with this option versus potentially thousands of lifts associated with the full removal option.

The full removal option was preferred from a legacy risk perspective, however while Option 5 leaves the line in-situ, it is trenched and rock covered, or surface laid and rock covered over the vast majority of its length, from KP 15 to KP 106. The 15 km of the line that is surface laid without cover or in an open trench is located at the landfall end of the pipeline and is in shallow water where trawl fishing operations are not carried out. It is noted that the pipeline is currently fished over in the areas where it is rock covered. Additionally, a commitment to survey and monitor the line to ensure any future snag risk is managed, along with remediation as required, is made.

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

Post-evaluation note: the as-built status of the line being surface laid or trenched without rock cover (rather than having rock cover as evaluated) results in an adjustment to the relative preference for the options evaluated.

Option 2a – Full Removal by Cut & Lift would reduce in scope as de-burial of the line to allow cut and lift operations would no longer be required. The associated safety impact would reduce accordingly but would not be sufficient to alter the assessment significantly.

Option 4a – Rock placement over exposures and Option 4c – Remove exposures would reduce in preference as there would be a greater Safety impact from the increase in offshore scope from introducing rock cover over or removing the majority of the line.

Option 5 – Remove ends & remediate snag risk would also reduce in preference as the potential for legacy snag risk would be greater (than if, as evaluated, the line was rock covered along the majority of its length). This is typical for concrete coated trunk lines and the fact the trawl fishing operations are currently conducted over the line remains.

Overall preference for Option 5 from a Safety perspective remains valid.

8.1.2 Environment

Option 5 has the lowest Operational Marine Impact of all options due to the shortest offshore durations and therefore the lowest noise profile and lowest potential for planned discharges from the pipeline. It also has the lowest atmospheric emissions and fuel use for similar reasons.

There is also negligible seabed disturbance associated with Option 5 when compared to the de-burial operations using MFE for the full removal option and rock cover introduced in Option 4a.

It is recognised that the full removal option is preferred from a legacy environmental impact perspective, however, the legacy impact from the line remaining in-situ in Option 5 is expected to be low due to the line being flushed and cleaned prior to decommissioning and any residual contents or degradation products being released over a long time period.

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

Post-evaluation note: the as-built status of the line being surface laid or trenched without rock cover (rather than having rock cover as evaluated) results in an adjustment to the relative preference for the options evaluated.

Option 2a – Full Removal by Cut & Lift would remain as per evaluation.

Option 4a – Rock placement over exposures would reduce in preference as there would be a greater Environmental impact from introducing rock cover over the majority of the line.

Option 4c – Remove exposures would remain as per evaluation.

Option 5 – Remove ends & remediate snag risk would remain as per evaluation.

Overall, the preference for Option 5 from an Environmental perspective remains valid.

8.1.3 Technical

All options considered use largely routine activities and methods, however, there is significant technical risk associated with de-burial and DWC of 106 km of pipeline in the full removal option. This relates to the cumulative nature of potential operational challenges and equipment failures along this length of line. Option 5 was preferred (along with Option 4a) as the shorter durations result in a smaller scope for technical risk. As such, Option 5 is preferred (with Option 4a) from a Technical perspective.

Post-evaluation note: the as-built status of the line being surface laid or trenched without rock cover (rather than having rock cover as evaluated) results in an adjustment to the relative preference for the options evaluated.

Option 2a – Full Removal by Cut & Lift would become marginally more attractive as there would be less technical risk with the removal of the de-burial operations. The significant technical risks associated with extensive cutting and removal operations would remain and, as such, the assessment during evaluation remains valid.

Option 4a – Rock placement over exposures would remain as per the evaluation despite the increased scope.

Option 4c – Remove exposures reduce in preference as the scope of the cutting and removal operations would be increased significantly.

Option 5 – Remove ends & remediate snag risk would remain as per evaluation.

Overall, the preference for Option 5 (with Option 4a) from a Technical perspective remains valid.

8.1.4 Societal

While the line remains in-situ in Option 5, the impact on fishing operations is expected to be negligible due to fishing operations being conducted over this line currently and the commitment to survey, monitor and remediate as required to mitigate any future snag risk to fishing operations. It was recognised that the full removal option would result in long duration disruption to fishing operations, particularly relevant in the near shore area where creel pot fishing is prevalent.

Option 5 was also preferred as the full removal option (and Option 4c) would return tens of thousands of tonnes of difficult to process concrete contaminated with salt water, likely to be destined for landfill.

Overall Option 5 is preferred from a Societal perspective.

Post-evaluation note: the as-built status of the line being surface laid or trenched without rock cover (rather than having rock cover as evaluated) results in an adjustment to the relative preference for the options evaluated.

Option 2a – Full Removal by Cut & Lift would remain as per evaluation.

Option 4a – Rock placement over exposures would reduce in preference due to the lack of rock cover over the line. The fact the trawl fishing operations are currently conducted over the line remains.

Option 4c – Remove exposures would reduce in preference as the scope of the cutting and removal operations would be increased significantly, returning more contaminated concrete to landfill.

Option 5 – Remove ends & remediate snag risk would reduce in preference due to the lack of rock cover over the line. The fact the trawl fishing operations are currently conducted over the line remains.

Overall, the preference for Option 5 from a Societal perspective remains valid.

8.1.5 Economic

The short-term costs associated with executing Option 5 is 10 times lower than the next least expensive option and around 100 times lower than the full removal option. Option 5 does however, have long-term costs associated with monitoring and surveying required to manage potential snag risks in the future.

Overall, Option 5 is preferred from an Economic perspective.

Post-evaluation note: the as-built status of the line being surface laid or trenched without rock cover (rather than having rock cover as evaluated) results in an adjustment to the relative preference for the options evaluated.

Option 2a – Full Removal by Cut & Lift would reduce in cost but would still be significantly more expensive than other options.

Option 4a – Rock placement over exposures would increase in cost and reduce in preference due to the additional scope.

Option 4c – Remove exposures would also increase in cost and reduce in preference due to the additional scope.

Option 5 – Remove ends & remediate snag risk would remain as per evaluation.

Overall, the preference for Option 5 from an Economics perspective remains valid.

8.2 Group 6 Recommendations

The recommended decommissioning option for Group 6 - 20" Export Pipeline Sean RD to Sean PD is:

- Option 5 – Remove Ends and Remediate Snag Risk
  - Line will be disconnected
  - Removal and recovery of surface laid sections out with existing trench
  - Rock placement to remediate snag risk from cut ends

The following sections provide a summary of the evaluation of the two most viable Group 6 decommissioning options (Option 2a and Option 5) against the five criteria and why this recommendation has been made.

8.2.1 Safety

Option 2a has around 7 times higher risk exposure than Option 5 due to the shorter offshore durations associated with the scope to remove the line ends out with the existing trench and to remediate snag risk from these cut ends versus the much longer durations to de-bury the line, cut it into sections and recover. It also has higher onshore risk exposure due to the greater quantity of material returned for processing.

Option 5 is assessed as being preferred to Option 2a in terms of safety impact on other users of the sea due to the greater number of vessel transits associated with Option 2a. Option 5 is also preferred from a potential for high consequence events as there is minimal lifting associated with Option 5 whereas Option 2a requires hundreds of lifts of the pipeline through the water column.

The full removal option was preferred from a legacy risk perspective, however while Option 5 leaves the line in-situ, it is trenched and buried along its full length. It is noted that the pipeline is currently fished over in the areas out with the existing 500m exclusion zones. Additionally, a commitment to survey and monitor the line to ensure any future snag risk is managed, along with remediation as required, is made.

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

8.2.2 Environment

There is a small preference for Option 5 from an Operational Marine Impact perspective. This is due to the greater noise profile from vessels on site and DWC operations and the planned releases from line from cutting it into sections (although releases will have minimal impact as line will be flushed and cleaned prior to decommissioning).

Both options are considered to have similar Environmental impact in terms of Atmospheric Emissions and Fuel Use and Other Consumptions.

Option 5 is preferred from a seabed disturbance perspective as there is less impact on the seabed than in the full removal option where the line has to be de-buried using MFE prior to reverse reeling operations.

Option 2a is preferred from a Legacy Marine Impact perspective as the line is fully removed. However, the legacy impact from the line remaining in-situ in Option 5 is expected to be low due to the line being flushed and cleaned prior to decommissioning and any residual contents or degradation products being released over a long time period.

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

8.2.3 Technical

Both options employ largely routine operations although Option 2a carries a higher risk of technical failure due to the cumulative effect of the de-burial and DWC operations of almost 5 km pipeline and the likely recovery of debris (spalled concrete) from the cutting operations. As such, Option 5 is preferred from a Technical perspective.

8.2.4 Societal

Both Options 2a and Option 5 have a similar impact on fishing as, although the line is fully removed in Option 2a, there will be disturbance caused to fishing activities from the de-burial and cut and lift operations. Option 5 will cause less disruption, but the line will be left in-situ, albeit fully trenched and buried.

Option 2a returns more useful material for recycling (duplex steel) than Option 5, but also returns thousands of tonnes of difficult to process concrete contaminated with salt water, likely to be destined for landfill. On balance, the options were considered similar.

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

8.2.5 Economic

The short-term costs associated with executing Option 2a where the line is fully removed is almost 6 times higher than for the partial removal in Option 5, which is preferred. There are no legacy costs associated with the full removal option versus around £1.25 million associated with surveying and monitoring (six surveys assumed) and FLTC fees required for the partial removal in Option 5.

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

8.3 Group 7 Recommendations

The recommended decommissioning option for Group 7 - Power Cable Sean RD to Sean PD is:

- Option 2c – Reverse reel with de-burial
  - Cable will be disconnected
  - Line will be de-buried using MFE prior to removal
  - Recover by reverse reel

  Note: De-burial was included for the Power Cable due to concerns regarding the integrity of the line for reverse reeling through existing cover. Efforts will be made to remove the line without prior de-burial. Where de-burial is required, alternative methods to MFE may be used. OPRED will be advised if there are any issues with the reverse reeling option and de-burial will be discussed prior to execution.

The following sections provide a summary of the evaluation of the two most viable Group 7 decommissioning options (Option 2c and Option 5) against the five criteria and why this recommendation has been made. It is noted that the outcome from the CA process summarised in Section 6.4 and detailed in Appendix E indicated a small preference for the leave in-situ option (Option 5). As the outcome was marginal, ONE-Dyas have elected to propose full removal of this line using reverse reel (with de-burial).

8.3.1 Safety

Option 5 has around half the exposure to risk of Option 2c due to the shorter offshore durations associated with the scope to remove the line ends out with the existing trench and to remediate snag risk from these cut ends. It also has the lowest onshore risk exposure due to the minimal quantity of material returned for processing compared to the full removal option.

Both options are assessed as similar in terms of safety impact on other users of the sea due to them both having a limited number of vessel transits. They are also considered similar from a potential for high consequence events as there is minimal lifting associated with both options.

The full removal option was preferred from a legacy risk perspective, however while Option 5 leaves the line in-situ, it is trenched and buried along its full length. It is noted that the line is currently fished over in the areas out with the existing 500m exclusion zones. Additionally, a commitment to survey and monitor the line to ensure any future snag risk is managed, along with remediation as required, is made.

Overall, both options are equally preferred from a Safety perspective.

8.3.2 Environment

Both options are considered to have similar Environmental impact in terms of Operational Marine Impact, Atmospheric Emissions and Fuel Use and Other Consumptions.

Option 5 is preferred from a seabed disturbance perspective as there is less impact on the seabed than in the full removal option where the line has to be de-buried using MFE prior to reverse reeling operations.

Option 2c is preferred from a Legacy Marine Impact perspective as the line is fully removed. However, the legacy impact from the line remaining in-situ in Option 5 is expected to be low as this is a power cable which is fully trenched and buried so any degradation products will be isolated from the water column and therefore will be released over a long time period.

Overall, both options are equally preferred from an Environmental perspective.

8.3.3 Technical

Both options employ largely routine operations although Option 2c carries a higher risk of technical failure due to uncertainty around the integrity of the cable for reverse reeling operations. As such, Option 5 is preferred from a Technical perspective.

8.3.4 Societal

Both Options 2c and Option 5 have a similar impact on fishing as, although the line is fully removed in Option 2c, there will be disturbance caused to fishing activities from the reverse reeling operations. Option 5 will cause less disruption, but the line will be left in-situ, albeit fully trenched and buried.

Option 2c returns more useful material (copper) for recycling than Option 5, but also returns material (polymer) that is likely to end up in landfill. On balance, the quantity of useful material returned in Option 2c was considered to provide a small societal benefit.

Overall, there is a small preference for Option 2c from a Societal perspective.

8.3.5 Economic

The short-term costs associated with executing Option 2c where the line is fully removed by reverse reeling is around 25% higher than for the partial removal in Option 5, which is preferred. There are no legacy costs associated with the full removal option versus around £1.25 million associated with surveying and monitoring required for the partial removal in Option 5.

Overall, both options are equally preferred from an Economic perspective.

APPENDIX A EVALUATION METHODOLOGY

Appendix A.1 CA Evaluation Methodology

ONE-Dyas has selected a Multi Criteria Decision Analysis (MCDA) methodology for the evaluation phase of the CA. This methodology uses a pairwise comparison system based on the methodologies of the Analytical Hierarchy Process (AHP) by T.L. Saaty, described in various publications, such as Analytical Hierarchy Process ref. [6]. This allows the relative importance of each differentiating criteria to be judged against each other in a qualitative way, supported by quantification where appropriate. The key steps for the evaluation phase of the CA are as follows:

- Define Differentiating Criteria – this was completed in Q2 2020 and listed in Appendix A.2
- Define Options – completed as part of CA Screening;
- Pre-populate worksheets for internal CA workshops – based on all the studies undertaken the worksheets were pre-populated in advance of the internal CA workshops;
- Perform internal CA workshop;
- Discuss attributes of each option against each differentiating criteria – the discussion was recorded 'live' during the workshop in order that informed opinion and experience was factored into the decision-making process;
- Perform scoring (see Section Appendix A.5);
- Perform sensitivity analyses to test the decision outcomes;
- Export worksheets as a formal record of the workshop attendees' combined opinion on the current preferred options, the 'Emerging Recommendations';
- Evaluate whether the CA needs to 'recycle' to the Preparation phase to obtain any further information to help inform decision making;
- Discuss Emerging Recommendations with stakeholders (October 2020); and
- Recycle process as required prior to decision on the selected options which will be presented in the Decommissioning Programme and assessed in the Environmental Impact Assessment.

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

Appendix A.2 Differentiating Criteria & Approach to Assessment

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

- Safety
- Environmental
- Economic
- Technical
- Societal

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

Criteria	Sub-Criteria	Description	Approach to Assessment
1. Safety	1.1 Operations Personnel	This sub-criterion considers elements that impact risk to operations 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.	Potential for Loss of Life (PLL) metrics were calculated for each option. This allows a quantified direct comparison between options.
	1.2 Other Users	This sub-criterion covers the impact associated with the risk to other users. Considers elements such as collision impact whilst performing activities. Users such as fishing vessels, commercial transport vessels and military vessels are considered.	
	1.3 High Consequence Events	This sub-criterion relates to any inherent potential for high consequence events i.e. major accident hazard. It applies to all onshore and offshore personnel involved in the project. Considerations such as dropped object concerns, support vessel risks, are considered.	Informed by expert judgment upon the understanding of the operations associated with the decommissioning options.
	1.4 Legacy Risk	This sub-criterion addresses residual safety risk to other sea users i.e. fishermen, military vessel crews, commercial vessel crews and passengers, other sea users, that is provided by the option. Issues such as residual snag risk, collision risk, etc. may be considered.	Legacy risk informed by an assessment of the fishing operations conducted in the area of interest and the knowledge of the burial status of the lines being assessed.

Criteria	Sub-Criteria	Description	Approach to Assessment
2. Environmental	2.1 Operational Marine Impact	This sub-criterion addresses the marine environmental impact caused by performing the decommissioning option. Covers both planned impacts (inherent to the option being assessed) and potential unplanned impacts (accidental releases, both large and small in scale and encompassing Major Environmental Incidents (MEIs)). Impacts may be from Project Vessels, Supply Boats, Survey vessels, etc. Examples include; Noise generated by vessels, cutting operations, any explosives, etc., discharges from vessels and from removing infrastructure such as residual pipeline contents.	Planned and unplanned marine impacts are narrative judgement informed by estimates of volumes / composition of any releases. Impacts from vessels are qualitative in nature. Marine noise impact is a qualitative judgement informed by the vessel durations, subsea cutting operations and other operations that generate marine noise.
	2.2 Atmospheric Emissions & Fuel Consumption	This sub-criterion addresses the atmospheric emissions, fuel consumption and energy consumption from performing the decommissioning option. This may be from Project Vessels, Survey vessels, etc. Impacts may be greenhouse gas emissions such as CO_2, NO_x, SO_2, etc. Fuel and energy consumption is included and is tightly correlated to atmospheric emissions. Not considered: Energy / emissions / resource consumption required to replace materials not recovered for re-use or recycling which is covered in 2.3 Other Consumptions.	Fuel use, emissions and energy consumption are calculated from vessel operations using IP 2000 ref. [8] factors for vessel fuel use and emissions. Fuel use, and emissions provided in metric tonnes. Energy provided in joules.
	2.3 Other Consumptions	This sub-criterion addresses the environmental impact caused by the amount of resource consumption associated with the option. It covers elements such as environmental impact from processing returned materials, the use of quarried rock or other new material and any production of replacement materials for equipment left in-situ.	Consumptions such as rock / steel / other fabrications are quoted in metric tonnes. Impact of recycling / processing returned material and replacing leave-in-situ material is quoted in metric tonnes of CO_2. The CO_2 figures allow a direct, quantitative comparison between options.

Criteria	Sub-Criteria	Description	Approach to Assessment
2. Environmental	2.4 Seabed Disturbance	This sub-criterion addresses the direct and indirect seabed disturbance caused by performing the decommissioning option. Impacts that are both permanent and temporary in nature are considered. The level of impact caused and any specific seabed concerns, such as protected areas or habitat changes may be covered.	Assessment based on quantifying the area of disturbance and by type of disturbance (dredging, rock dump, trenching, backfilling, mass flow excavation) in combination with an understanding of the baseline environment in the area as shown by the outputs from the environmental surveys.
	2.5 Legacy Marine Impacts	This sub-criterion addresses the marine environmental impact caused after the decommissioning option has been performed. Covers the long-term impact of any infrastructure left in-situ such as release of materials into the marine environment, environmental impact from legacy monitoring and remediation i.e. planned and unplanned releases from vessels, vessel noise, etc.	Planned and unplanned marine impacts are narrative judgement informed by estimates of volumes / composition of any releases and the duration these may occur over. Impacts from vessels are qualitative in nature. Marine noise impact is a qualitative judgement informed by the vessel durations, subsea cutting operations and other operations that generate marine noise.

Criteria	Sub-Criteria	Description	Approach to Assessment
3. Technical	3.1 Technical Risk	This sub-criterion relates to the various technical risks that could result in a major project failure i.e. failure to deliver the decommissioning option broadly within the timescale / budget / endorsed decommissioning programme. Consideration is given to: Technical Novelty / Track Record, where the novelty of the technical solution is considered. Technical Challenges / Consequence of Failure to deliver the such as amendment to decommissioning approach and Potential for Showstoppers can be captured along with impact on the schedule due to overruns from technical issues such as operations being interrupted by the weather. Technical Feasibility and Technical Maturity is also considered.	Scored 1 – 3 with 1 being least technically feasible and 3 most technically feasible.
4. Societal	4.1 Fishing	This sub-criterion addresses the impact of the option on commercial fishing operations. It includes consideration of impacts from both the decommissioning activities any residual impacts post decommissioning such as reinstatement of access to area.	Scored 1 – 3 with 1 being a proportionally large area lost for fishing and 3 being a minimal area
	4.2 Other Users	This sub-criterion addresses any positive or negative socio-economic impacts on other users, where the impact may be from dismantling, transporting, treating, recycling and land filling activities relating to the decommissioning option. Additionally, Issues such as impact on the health, well-being, standard of living, structure or coherence of communities or amenities are considered here e.g. business or jobs creation, increase in noise, dust or odour pollution during the decommissioning option which has a negative impact on communities, increased traffic disruption due to extra-large transport loads, etc.	Scored 1 -3 with 1 being significant long-term impact to communities and 3 being minimal.
5. Economic	5.1 Short-term Costs	This sub-criterion addresses the cost of delivering the option as described. No long-term cost element is considered here.	Cost data (£ k)
	5.2 Long-term Costs	This sub-criterion addresses the costs associated with any long-term liabilities such as on-going monitoring and any potential future remediation costs.	Cost data (£ k)

Table 8.1: Sub-criteria Definition

Appendix A.3 Differentiator Weighting

The 5 differentiating criteria all carry a 20% weighting. That is, all criteria are neutral to each other. Figure 8.1 shows the pairwise comparison matrix. ONE-Dyas decided that equal weightings offer 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%

Figure 8.1: Example Pairwise Comparison Matrix (N = Neutral)

Appendix A.4 Option Attributes

The next step in the CA process was to describe and discuss the attributes of each option with respect to each of the differentiating criteria. In preparation, all relevant data and information developed during the preparation phase were pre-populated into the attributes table for each option. Appendix C, Appendix D and Appendix E contain the completed Attributes Tables for Groups 1, 6 and 7 respectively.

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

Appendix A.5 Option Pair-Wise Comparison

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

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

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

importance scale explanations (see Table 8.2). It was agreed that three positions from equal (and their reciprocals) would be sufficient for this CA. These positions were:

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

Table 8.2: Explanation of Phrasing Adopted for Pairwise Comparison

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

A summary example of the completed pair-wise comparisons for differentiating criteria versus options are shown in Figure 8.2.

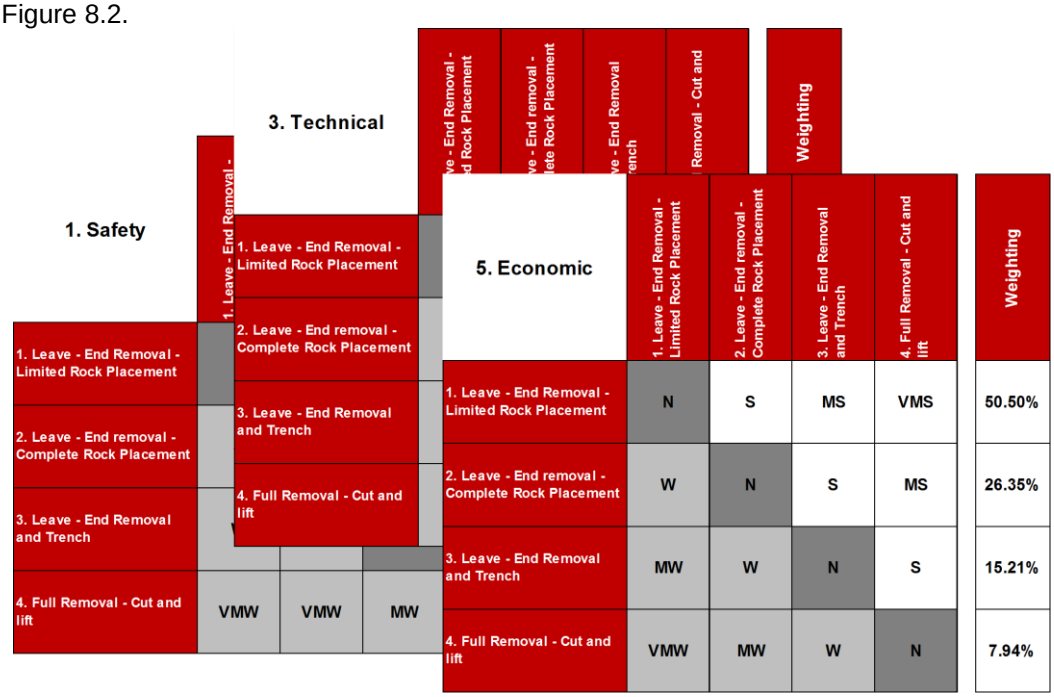


Figure 8.2: Example Option Pair-Wise Comparison

Appendix A.6 Visual Output and Sensitivities

The decision-making tool used the above pairwise comparisons to automatically generate a visual output indicating the highest scoring option i.e. the option which represents the most 'successful' solution in terms of its overall contribution to the set of differentiating criteria. At this stage, opportunity was provided to fine tune the judgements provided, to ensure that all attendees were happy to endorse the outcome. The visual outputs from each decision point are included in Appendix C, Appendix D and Appendix E. An example of the visual output obtained is shown in Figure 8.3.

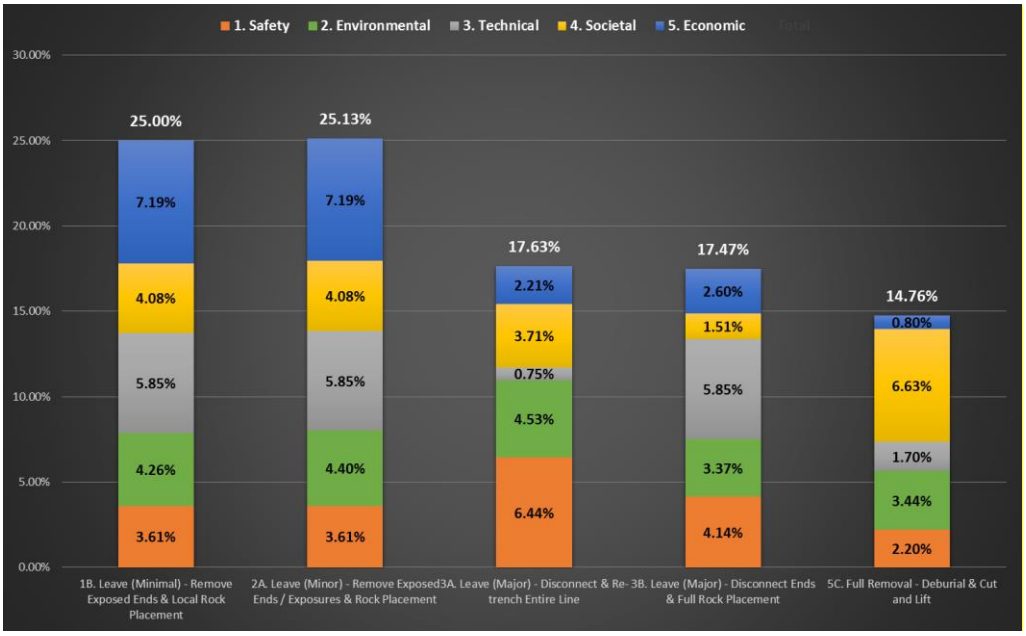


Figure 8.3: CA Visual Output Example

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

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

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

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

APPENDIX B STAKEHOLDER CA WORKSHOP MINUTES

Subject: Sean Field Decommissioning – Stakeholders CA Workshop

Location: Video Conference (UK, Netherlands)

Date: 26/08/2020

Minuted by: Jeff McCleary

Issued on: 21/09/2020

Attending:

Organisation	Attendee
Marine Management Organisation (MMO)	Lindsey Mullan - Marine Licensing Case Manager Luella Williamson - Marine Licensing Case Officer
Joint Nature Conservation Council (JNCC)	Hannah Hood - Offshore Industry Adviser Becky Hitchin - Offshore Industry Advice Manager (sandbank specialist)
Natural England (NE)	Mark Johnston - Senior Marine Specialist – Estuaries, Ports and Marine Industries
Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)	Ruth Ledingham - Senior Financial Governance Manager Dr Sarah Dacre - Senior Environmental Manager Jade Jones - Assistant Decommissioning Manager Sam Pattie – Administrative Operations
North Norfolk District Council (NNDC)	Rob Goodliffe- Coastal Manager
Crown Estates	Jason Golder - Senior Asset Manager
Health and Safety Executive (HSE)	Bill Chilton – Decommissioning Abdulgani Oseni – Pipeline Inspector
ONE-Dyas	Jan Willem in't Anker – Construction / Engineering Manager Ceriel Haesen - Asset Manager Maurits Waaijenberg - Senior Facility Engineer Martijn Hoefsloot - Senior Production Superintendent Dirk Drijver - HSEQ Manager Linda Murray - Environmental Advisor
Xodus	John Foreman - Consultant Engineer - TSR Gareth Jones – Decommissioning Manager Jeff McCleary - Consultant Engineer - Subsea & Decommissioning Phil Roberts – Principal Consultant – Process & Facilities Claire Weller – Principal Environmental Consultant

Distribution: Attendees plus;

Organisation	
National Federation of Fishermen's Organisations (NFFO)	Ian Rowe - General Manager
Environment Agency (EA)	TBA

Item	Comment	Action
1.0	**Pre-Workshop Crown Estates Discussion**	
1.1	Prior to the main stakeholder workshop separate discussions were held with Crown Estate representative Jason Golder.	Info

Item	Comment	Action
1.2	Discussions around how the fundamental approach to decommissioning has changed over the lifetime of the asset. Original Lease agreement (1988) was quite binary with respect to remove/leave, in 2008 the regulatory regime was introduced, whilst now the fundamental principal of leave *in situ* can be accepted provided the regulations are followed and provided there is an evidence based argument to environmental and societal benefit for doing so.	Info
1.3	Jason remarked that ONE-Dyas should remain in contact with regards the outcome of the CA process and timeline for decommissioning and follow up discussions are required to investigate the mechanism for termination of the lease agreement subject to findings of CA and the decommissioning approach selected.	ONE-Dyas
2.0	**Introductions & Background**	
2.1	The workshop was introduced by ONE-Dyas followed by a brief overview of the fields and relevant infrastructure under consideration.	Info
2.1.1	ONE-Dyas were asked to clarify the anticipated date for decommissioning to take place and indicated that at present decommissioning is forecast for 2024 but was dependant on many factors including oil price hence may be subject to change.	Info
2.2	A summary of the methodology and outcomes from the Screening phase of the CA Process was provided.	Info.
2.2	Further detail of the subsea infrastructure which had been identified for review as part of the comparative assessment was presented by Xodus Group. This included: • 30” Export Pipeline, Sean PP to Bacton Terminal • 20” Export Pipeline, Sean RD to Sean PD • 1” Electrical Cable, Sean RD Sean PD *Key points of interest with regards these assets are described later within these minutes.*	Info
3.0	**Environmental Baseline**	
3.1	An environmental summary including; details of the benthic environment, threatened and/or declining habitats and species as well as relevant conservation sites was described by Xodus Group.	Info
3.2	Although the onshore section of the 30” Export Pipeline is out with CA scope and with reference to pre-workshop discussions (See 1.0) Xodus Group presented the current base case to decommission *in situ* this section of the pipeline. It was highlighted that if onshore sections become exposed in the future these sections will be remediated/removed to reduce any potential risk following discussion with the appropriate regulatory authority	Info

Item	Comment	Action
4.0	**Comparative Assessment**	
4.1	The background to the comparative assessment (CA) process conducted to date was provided by Xodus Group, as well as details of the evaluation methodology that would be re-visited during this review workshop.	Info

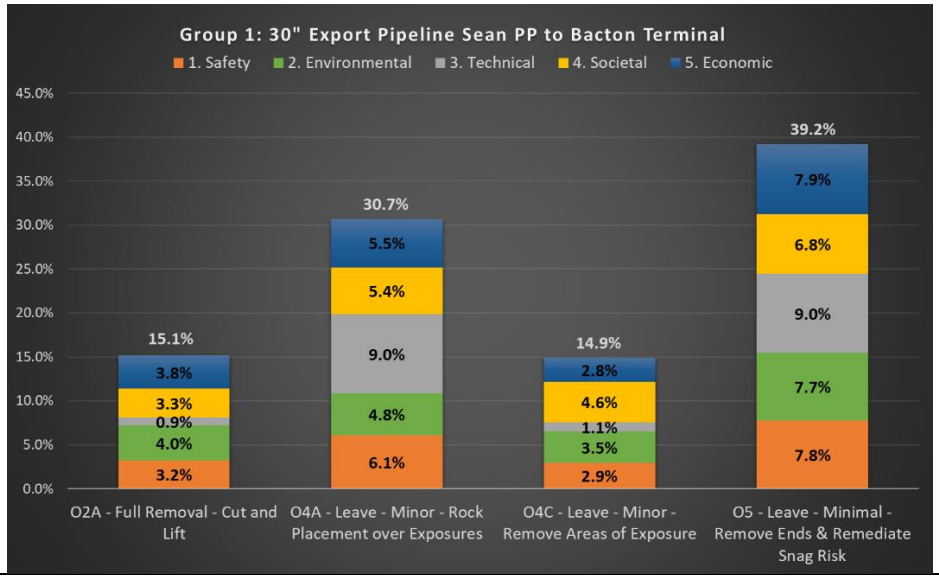
4.2	Handouts provided for the workshop included:
	• A set of presentation slides (appended to these minutes) including;
	  ○ A set of the criteria and sub-criteria definitions used;
	  ○ Preliminary Emerging Recommendation developed for each option to be re-appraised for this review workshop.
		Info

5.0	**Group 1: 30" Export Pipeline, Sean PP to Bacton Terminal**	

5.1	As part of the introduction a summary of the infrastructure and key features within this group was provided:
	• 30" Gas Export Pipeline (PL311)
	  ○ Sean PP to Bacton Terminal
	  ○ Min Water Depth 9.3m (Smiths Knoll at KP51.45 approx)
	  ○ 105.4km
	  ○ Carbon Steel
	  ○ Concrete Weight Coating
	  ○ Asphalt Enamel Corrosion Coating
	  ○ Partially Trenched, Partially Buried
	  ○ Sections with Rock Placement
	• Crosses 5 designated sites
		Info

5.2	Four options were evaluated for this group: • Option 2a – Full removal cut and lift with de-burial. • Option 4a – Leave *in situ*, minor, rock placement over exposures • Option 4c – Leave *in situ*, minor, remove exposures • Option 5 – Leave *in situ*, minimal intervention, remove ends and remediate snag risk.	Info
5.3	**Safety**	
5.3.1	Operational Personnel – The assessment presented with no challenges raised.	Info
5.3.2	Other Users – The assessment presented with no challenges raised.	Info
5.3.3	High Consequence Events – The assessment presented with no challenges raised.	Info
5.3.4	Legacy Risk – The assessment was presented and debated. The existing assessment was to remain as the base case with a sensitivity conducted to increase the preference for the full removal option over the other options. Sensitivity case to be presented within CA Report.	Xodus

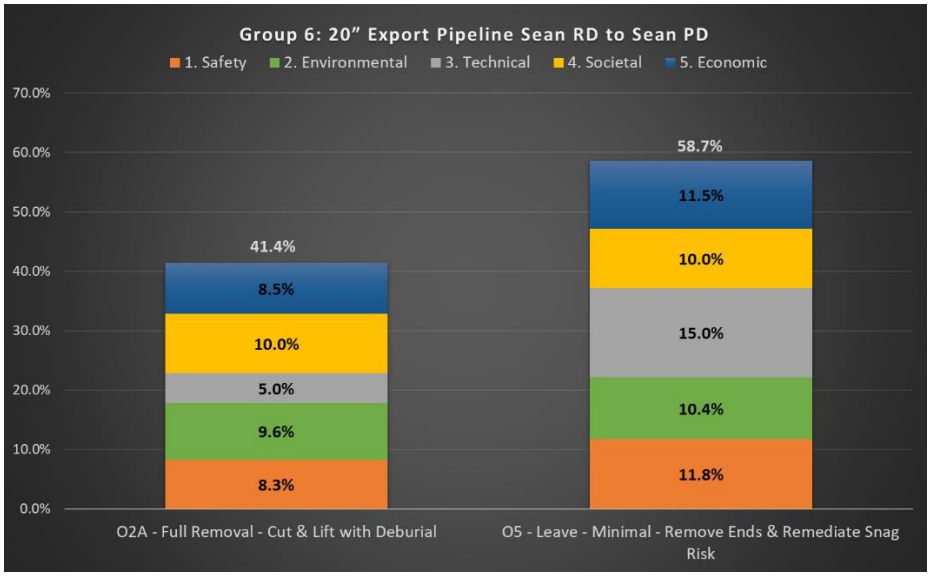
Item	Comment	Action
5.4	**Environmental**	
5.4.1	Operational Marine Impacts – The assessment presented with no challenges raised.	Info
5.4.2	Atmospheric Emissions & Fuel Consumption – The assessment presented with no challenges raised.	Info
5.4.3	Other Consumptions – The assessment presented with no challenges raised.	Info
5.4.4	Seabed Disturbance – The assessment presented with no challenges raised.	Info
5.4.5	Legacy Marine Impacts – The assessment was presented and debated. The existing assessment was to remain as the base case with a sensitivity conducted to increase the preference for the full removal option over the other options. Sensitivity case to be presented within CA Report.	Xodus
5.4.6	Ruth Ledingham also stated that Option 5 – Leave *in situ*, minimal intervention, remove ends and remediate snag risk would be need to be monitored more frequently if spanning remained on the line. Current provision for legacy monitoring covers 6 surveys at 5 yearly frequency considered adequate no action.	Info
5.5	**Technical**	
5.5.1	Technical Risk – The assessment presented and debated. The existing assessment was to remain as the base case with a sensitivity conducted to reduce the preference for the full removal option over the other options. Sensitivity case to be presented within CA Report.	Xodus
5.6	**Societal**	
5.6.1	Fishing – The assessment presented with no challenges raised.	Info
5.6.2	Other Users – The assessment presented with no challenges raised. Rob Goodcliffe (NNDC) highlighted that in the near shore areas consideration of aspects such as noise, other sea users and beach access must be accounted for and the narrative was adjusted to make note of this under the full removal option.	Info
5.6.3	There was discussion relating the waste path for the steel and concreted associated with the line. It was asserted that whilst the aim would be for steel to be recycled that the concrete which was considered to be salt contaminated, for the most part, would likely go to landfill. Given the unavailability of the Environment Agency, this was followed up by ONE-Dyas post-meeting. Post meeting Note: *ONE-Dyas contacted the Environment Agency to clarify the waste path for the steel and concrete associated with the line. It was clarified that concrete would need to be assessed (in accordance with the WM3 Waste classification technical guidance) and potentially treated accordingly. Salt contamination wouldn't necessarily mean all concrete would have to be landfilled. It was also stated that landfilling of concrete should be avoided and should only be considered as the last option (Email from Dominic Murphy, EA National Customer Contact Centre to Linda Murray 09/09/20).*	Info

Item	Comment	Action
5.7	**Economic**	
5.7.1	Short-Term Costs – The assessment presented with no challenges raised.	Info
5.7.2	Long-Term Costs – The assessment presented and debated. Ruth Ledingham (OPRED) commented in regard to legacy survey allowance that the requirement to survey in perpetuity should not assume that survey frequency can be reduced on an evidence-based approach. She also highlighted that in the Southern North Sea it is not uncommon for operators to have to perform regular remediation works and sufficient provision for this level of remediation should be allowed for.	ONE-Dyas
5.8	**Results**	
5.8.1	The base case outcome of the assessment is shown in the chart below. The emerging recommendation for Group 1: 30" Export Pipeline, Sean PP to Bacton Terminal is Option 5 – Remove Ends & Remediate Snag Risk.  	

Item	Comment	Action
6.0	**Group 6: 20" Export Pipeline, Sean RD to Sean PD**	

6.1	As part of the introduction a summary of the infrastructure and key features within this group was provided:
	• 20" Interfield Gas Pipeline (PL310)
	  ○ Sean RD to Sean PD
	  ○ Circa 30m Water Depth
	  ○ 4.8km
	  ○ Duplex Stainless Steel
	  ○ Concrete Weight Coated
	  ○ Neoprene Corrosion Coating
	  ○ Trenched and 3" Gravel Backfill
	  ○ Trench Depth 0.45 -1.4m (Target 0.6m)
	  ○ 7" Rock cover over Trench Transitions
	  ○ No spans, & only pipeline ends exposed (40m & 72m)
	• Does not lie in any designated sites
		Info

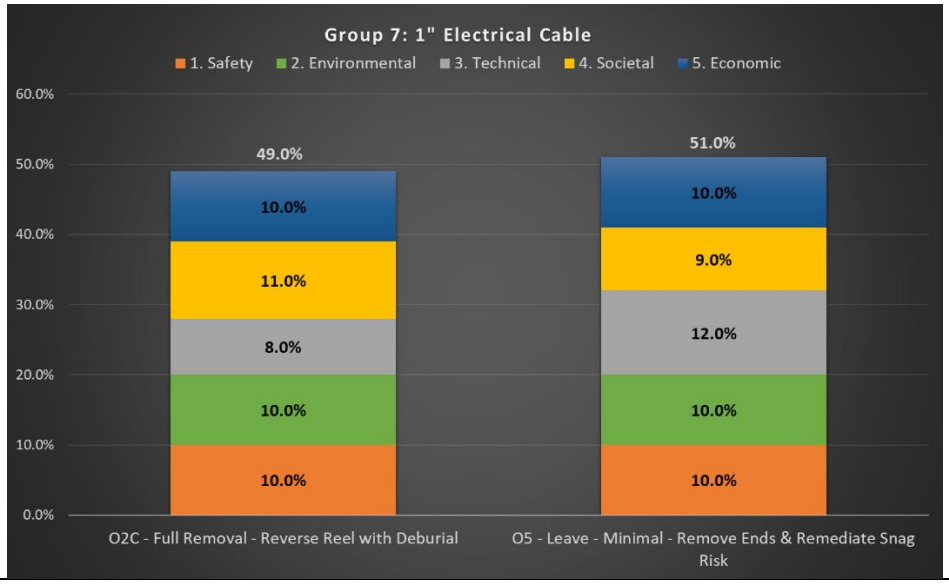
6.2	Two options were evaluated for this group: • Option 2a – Full removal cut and lift with de-burial. • Option 5 – Leave *in situ*, minimal intervention, remove ends and remediate snag risk.	Info
6.3	**Safety**	
6.3.1	Operational Personnel – The assessment presented with no challenges raised.	Info
6.3.2	Other Users – The assessment presented with no challenges raised.	Info
6.3.3	High Consequence Events – The assessment presented with no challenges raised.	Info
6.3.4	Legacy Risk – The assessment presented with no challenges raised.	Info
6.4	**Environmental**	
6.4.1	Operational Marine Impacts – The assessment presented with no challenges raised.	Info
6.4.2	Atmospheric Emissions & Fuel Consumption – The assessment presented with no challenges raised.	Info
6.4.3	Other Consumptions – The assessment presented with no challenges raised.	Info
6.4.4	Seabed Disturbance – The assessment presented with no challenges raised.	Info
6.4.5	Legacy Marine Impacts – The assessment presented with no challenges raised.	Info
6.5	**Technical**	
6.5.1	Technical Risk – The assessment presented with no challenges raised.	Info
6.6	**Societal**	
6.6.1	Fishing – The assessment presented with no challenges raised.	Info

Item	Comment	Action
6.6.2	Other Users – The assessment presented with no challenges raised.	Info
6.7	**Economic**	
6.7.1	Short-Term Costs – The assessment presented with no challenges raised.	Info
6.7.2	Long-Term Costs – The assessment presented with no challenges raised.	Info
6.8	**Results**	
6.8.1	The base case outcome of the assessment is shown in the chart below. The emerging recommendation for Group 6: 20" Export Pipeline, Sean RD to Sean PD is Option 5 – Remove Ends & Remediate Snag Risk. 	

Item	Comment	Action
7.0	**Group 7: 1" Electrical Cable, Sean RD Sean PD**	

7.1	As part of the introduction a summary of the infrastructure and key features within this group was provided:
	• 1" Power Cable (PLU5156)
	  ○ Sean RD to Sean PD
	  ○ Circa 30m Water Depth
	  ○ 4.9km
	  ○ Trenched and Buried
	  ○ Burial average 0.54m, max 1.22m
	  ○ No Spans or Exposures
	• Does not lie in any designated sites
		Info

7.2	Two options were evaluated for this group: • Option 2c – full removal using reverse reel with de-burial. • Option 5 – leave *in situ*, minimal intervention, remove ends and remediate snag risk.	Info
7.3	**Safety**	
7.3.1	Operational Personnel – The assessment presented with no challenges raised.	Info
7.3.2	Other Users – The assessment presented with no challenges raised.	Info
7.3.3	High Consequence Events – The assessment presented with no challenges raised.	Info
7.3.4	Legacy Risk – The assessment presented with no challenges raised.	Info
7.4	**Environmental**	
7.4.1	Operational Marine Impacts – The assessment presented with no challenges raised.	Info
7.4.2	Atmospheric Emissions & Fuel Consumption – The assessment presented with no challenges raised.	Info
7.4.3	Other Consumptions – The assessment presented with no challenges raised.	Info
7.4.4	Seabed Disturbance – The assessment presented with no challenges raised.	Info
7.4.5	Legacy Marine Impacts – The assessment presented with no challenges raised.	Info
7.5	**Technical**	
7.5.1	Technical Risk – The assessment presented with no challenges raised.	Info
7.6	**Societal**	
7.6.1	Fishing – The assessment presented with no challenges raised.	Info
7.6.2	Other Users – The assessment presented with no challenges raised.	Info
7.7	**Economic**	
7.7.1	Short-Term Costs – The assessment presented with no challenges raised.	Info
7.7.2	Long-Term Costs – The assessment presented with no challenges raised.	Info

Item	Comment	Action
7.8	**Results**	
7.8.1	The base case outcome of the assessment is shown as Option 5, leave in-situ in the chart below. Given the narrow difference in assessment between the full removal and leave in-situ options, the emerging recommendation for Group 7: 1" Electrical Cable, Sean RD Sean PD is Option 2C – Full Removal by Reverse Reeling with Deburial.  	
8.0	**Additional Points**	
8.1	Mark Johnston (NE) Queried whether the full removal methodology accounted for recovery of rock protection. He informed the room that the Hornsea 3 windfarm development have elected to recover all rock from their cables and shared their subcontractor methodology post meeting. Post Meeting Note: *In discussions with OPRED 09.09.20 it was clarified that current guidance on rock recovery has not changed and that the recovery of rock would only need to be considered if this is intrinsic to the pipeline removal methodology. Given the full removal case considers displacement of rock using remote Mass Flow Tooling the recovery of rock is not proposed and shall not be considered further.* Post Meeting Note: *Following the workshop rock quantities were reviewed alongside recently acquired 2020 pipeline survey results. It has been confirmed that rock is placed at the platform end of the pipeline end, and in short sections intermittently along its length only. The extensive lengths of rock berms established from legacy pipeline schematics as presented during the workshop have since been discounted*.	Info
8.2	Hannah Hood (JNCC) suggested that a sensitivity case where full rock removal is considered should be included. See minute 8.1, full rock removal is not proposed.	Info

Item	Comment	Action
8.3	Hannah Hood (JNCC) queried the use of equal weighting across the 5 criteria (Safety, Environment, Technical, Societal and Economic) and their associated attributes. Discussions led to a number of sensitivities being tabled for consideration. Hannah also raised the point that Technical only uses one sub-criterion and is therefore quite dominant in the assessment. Post Meeting Note: *Alternative weighting for primary criteria discussed and agreed with ONE-Dyas and will be presented in the CA Report.*	Info
8.4	Ruth Ledingham (OPRED) stated that the use of rock placement in certain areas is likely to be opposed therefore it may prudent to take a closer look at the proposed remediation in specific areas. Indicative locations of proposed remediation shall be established from recently acquired 2020 pipeline survey data. These locations shall be considered and presented in the EA Report.	Info
8.5	Becky Hitchin (JNCC) enquired as to whether the review could consider the specific impact of each option on site specific locations i.e. per Marine Protected Area (MPA). It is confirmed that impacts on all Marine Conservation zones shall be considered and captured as part of the EA Report.	Info
8.6	Luella Williamson (MMO) requested that the features of each MPA are considered for each line and options under consideration. See minute 8.5.	
8.7	Ruth Ledingham (OPRED) enquired as to what re-use options have been considered for the 30" Export Pipeline and informed the room that the trunkline had been identified by BEIS as a potential candidate for the development of carbon capture, usage and storage (CCUS). ONE-Dyas outlined the re-use options explored and discounted. It was agreed that this discussion would be continued between OPRED and ONE-Dyas. Post Meeting Note: *Further discussions regarding re-use options and potential CCUS usage were held between ONE-Dyas and OPRED on 08/09/20. A summary of this shall be included within the DP and discussed further with the OGA as part of COP document development.*	

APPENDIX C GROUP 1 – DETAILED EVALUATION RESULTS

Appendix C.1 Group 1 Attributes Table

		O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
		- Pipeline will be cut at platform and near shore ends. - Line will be deburied where required using MFE to access for cutting. - Line cut into 20m sections using trident dual DWC tooling. - Pipeline is 30" diameter, concrete coated, rigid. - Note: No recovery of existing rock cover.	- Pipeline will be cut at platform and near shore ends. - Rock placement to remediate snag risk from cut ends - Rock placement at all areas of spans and exposure - Pipeline is 30" diameter, concrete coated, rigid.	- Pipeline will be cut at platform and near shore ends. - Removal of areas of spans and exposure using cut and lift techniques (including deburial with MFE where required) with trident dual DWC tooling. - Rock placement to remediate snag risk from cut ends - Pipeline is 30" diameter, concrete coated, rigid.	- Pipeline will be cut at platform and near shore ends. - Rock placement to remediate snag risk from cut ends - Rock placement to remediate spans approaching fishsafe criteria - Pipeline is 30" diameter, concrete coated, rigid.
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 803.5 / 732,746 / 5.50E-02 Total offshore hours: 732,746 hrs Total offshore PLL: 5.50E-02 Resource Type: Days / Hours / PLL Engineering & Management: 11,700.0 / 374,400 / 1.50E-03 Project Management: 10,672.0 / 170,752 / 6.83E-04 Onshore Operations (includes Cleaning & Disposal): 1,108.0 / 70,912 / 8.72E-03 Total onshore hours: 616,064 hrs Total onshore PLL: 1.09E-02 Total operational hours: 1,348,810 hrs Total operational PLL: 6.59E-02	Vessel Type: PoB / Days / Hours / PLL Rockdump Vessel: 20 / 57.3 / 13,754 / 1.03E-03 Total offshore hours: 13,754 hrs Total offshore PLL: 1.03E-03 Resource Type: Days / Hours / PLL Engineering & Management: 1,204.4 / 38,541 / 1.54E-04 Project Management: 1,093.0 / 17,488 / 7.00E-05 Total onshore hours: 56,029 hrs Total onshore PLL: 2.24E-04 Total operational hours: 69,784 hrs Total operational PLL: 1.26E-03	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 548.4 / 500,168 / 3.75E-02 Total offshore hours: 500,168 hrs Total offshore PLL: 3.75E-02 Resource Type: Days / Hours / PLL Engineering & Management: 9,425.0 / 301,600 / 1.21E-03 Project Management: 9,558.0 / 152,928 / 6.12E-04 Onshore Operations (includes Cleaning & Disposal): 290.0 / 18,560 / 2.28E-03 Total onshore hours: 473,088 hrs Total onshore PLL: 4.10E-03 Total operational hours: 973,256 hrs Total operational PLL: 4.16E-02	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 6.0 / 5,445 / 4.08E-04 Total offshore hours: 5,445 hrs Total offshore PLL: 4.08E-04 Resource Type: Days / Hours / PLL Engineering & Management: 75.0 / 2,400 / 9.60E-06 Project Management: 94.0 / 1,504 / 6.02E-06 Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 3,968 hrs Total onshore PLL: 2.35E-05 Total operational hours: 9,413 hrs Total operational PLL: 4.32E-04
		MW / W / VMW	MS / W	VMW	
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 2A is assessed as being Much Weaker than Option 4A as the risk exposure is around 50 times higher due to the much longer durations associated with the cut and lift of the entire line and the processing of the material returned, versus the shorter offshore durations to rock cover areas of the line with no material returned for processing. Option 2A is assessed as being Weaker than Option 4C as the risk exposure is higher for full removal than removing areas of the line only. Option 2A is assessed as being Very Much Weaker than Option 5 as the risk exposure is more than 200 times higher for the long durations for full removal versus limited offshore scope to address the line end only. Option 4A is assessed as being Much Stronger than Option 4C as the risk exposure to remove areas of the line versus rock cover areas of the line is around 30 times higher. Option 4A is assessed as being Weaker than Option 5 as the risk exposure for rock covering areas of the line is around 4 times higher than the minimal operations associated with Option 5. Option 4C is assessed as being Very Much Weaker than Option 5 as the risk exposure from removing areas of the pipeline versus the minimal operations in Option 5 is around 130 times higher. **Overall, Option 5 is the preferred option from a risk to Operations Personnel perspective.**			
1. Safety	1.2 Other Users	Vessel Days: CSV: 803.5 Total vessel days: 803.5 days Transits: 154	Vessel Days: Rockdump Vessel: 57.3 Total vessel days: 57.3 days Transits: 26	Vessel Days: CSV: 548.4 Total vessel days: 548.4 days Transits: 94	Vessel Days: CSV: 6.0 Total vessel days: 6.0 days Transits: 2
		W / W / MW	S / W	W	
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 4A as the much greater number of vessel days offshore, along with the higher number of transits for offloading pipeline sections, is considered to have a higher potential safety impact on other users than the shorter duration of operations and fewer transits in Option 4A. Option 2A is also assessed as being Weaker than Option 4C, again due to the greater number of vessel days of operations along the pipeline and the higher number of transits in Option 2A. Option 2A is assessed as being Much Weaker than Option 5 as there is limited safety impact on other users with the short duration of offshore operations and a single transit to / from the area. Option 4A is assessed as being Stronger than Option 4C as there are fewer vessel days and transits associated with Option 4A. Option 4A is assessed as being Weaker than Option 5 as there are fewer vessel days and transits associated with Option 5. Option 4C is assessed as being Weaker than Option 5 as there are fewer vessel days and transits associated with Option 5. **Overall, Option 5 is the preferred option from a risk to Other Users perspective.**			

		O2A - Full Removal - Cut and Lift			O4A - Leave - Minor - Rock Placement over Exposures		O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
1. Safety	1.3 High Consequence Events	Largely routine operations. Potential for dropped object from multiple lifts through water column (8617 lifts). In addition there is the offloading associated with transferring the pipeline to quayside.			Routine operations - no lifting of pipeline.		Largely routine operations. Potential for dropped object from multiple lifts through water column (2290 lifts).	Routine operations - Minimal lifting of line and rock bags.
		VMW	W	VMW	VMS	N	VMW	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 2A is assessed as being Very Much Weaker than both Option 4A and Option 5 due to the very high number of lifting operations associated with full removal by cut and lift versus no lifting operations with Option 4A and minimal lifting operations with Option 5. Option 2A is assessed as being Weaker than Option 4C as while both options have significant lifting operations for pipeline recovery, there is around 4 time more lifting in Option 2A. Option 4A is assessed as being Very Much Stronger than Option 4C as there is no lifting associated with this option versus a high number of lifts with Option 4C. Option 4A is assessed as being Neutral to Option 5 as the potential for High Consequence Events is similar as there is no / minimal lifting associated with these options. Option 4C is assessed as being Very Much Weaker than Option 5, again due to the high number of lifts associated with Option 4C. **Overall, Option 5 is the preferred option from a High Consequence Events perspective.**						
1. Safety	1.4 Legacy Risk	No legacy risk from this full removal option.			The line would remain in-situ with this option although the majority of its length would be fully buried. Areas of spans or exposure will be rock covered to mitigate potential snag hazard. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 41.6 / 21,949 / 1.65E-03		The line would remain in-situ with this option although the majority of its length would be fully buried. Areas of spans or exposure will be removed with small areas of rock cover to mitigate potential snag hazard from cut ends. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 41.6 / 21,949 / 1.65E-03	The line would remain in-situ with this option although the majority of its length would be fully buried. The line ends will be removed with rock cover to mitigate potential snag hazard from cut ends and spans approaching fishsafe crietria. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 41.6 / 21,949 / 1.65E-03
		S	S	MS	N	S	S	
	Summary	The assessment of the Residual Risk sub-criterion is as follows: Option 2A is assessed as being Stronger than both Option 4A and Option 4C as the line is fully removed versus the majority of the line being left in situ, although any potential snag risk is mitigated by areas of spans and exposure being rock covered / removed and the remaining pipeline being subject to a survey and monitoring programme. Option 2A is assessed as being Much Stronger than Option 5 as the line is fully removed versus the line remaining in situ as is but subject to a survey and monitoring programme. Option 4A is assessed as being Neutral to Option 4C as the potential for snag risk is considered similar for the line with areas of spans and exposure either rock covered or removed. Both Option 4A and Option 4C are assessed as being Stronger than Option 5, again as the potential for snag risk is considered similar for the line with areas of spans and exposure either rock covered or removed versus the line remaining in situ as is. **Overall, 2A is the preferred option from a Residual Risk perspective.**						
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): CSV = 570 days MFE: 86 days DWC: 180 days Operation Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 570 days it is the highest of the options being evaluated.			Vessel Noise (days on-site): Rock Dump Vessel 18 days Rock Dump: 11 days Operation Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 18 days it is 2nd lowest of the options being evaluated and considered negligible.		Vessel Noise (days on-site): CSV 406 days DWC: 191 days Operation Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 406 days it is the 2nd highest of the options being evaluated.	Vessel Noise (days on-site): CSV 2 days DWC 0.02 days Operation Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at less than a day is the lowest of the options being evaluated and considered negligible.
		MW	N	MW	MS	N	MW	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 2A is assessed as being Much Weaker than both Option 4A and Option 5 as the noise, operational discharges and vessel discharges are greater for Option 2A due to the extended durations of vessels on-site, extensive diamond wire cutting operations and discharges from the numerous mid-line cuts. Option 2A is assessed as being Neutral to Option 4C as the impacts are expected to relatively similar. Option 4A is assessed as being Much Stronger than Option 4C due to the higher noise impact, operational discharges and vessel discharges for Option 4C due to the extended durations of vessels on-site, extensive diamond wire cutting operations and discharges from the numerous mid-line cuts. Option 4A is assessed being Neutral to Option 5 as the environmental impact from conducting these options is similar. Option 4C is assessed as being Much Weaker than Option 5, again due to the higher noise impact, operational discharges and vessel discharges for Option 4C due to the extended durations of vessels on-site, extensive diamond wire cutting operations and discharges from the numerous mid-line cuts. **Overall, Option 4A and Option 5 are equally preferred from an Operational Marine Impact perspective.**						

		O2A - Full Removal - Cut and Lift			O4A - Leave - Minor - Rock Placement over Exposures		O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 22,455 CO2: 71,181 NOx: 1,333.80 SO2: 89.82 Vessel Energy Use: 965,548 GJ			Vessel Emissions (in tonnes): Fuel: 2,205 CO2: 6,991 NOx: 130.99 SO2: 8.82 Vessel Energy Use: 94,825 GJ		Vessel Emissions (in tonnes): Fuel: 16,567 CO2: 52,516 NOx: 984.06 SO2: 66.27 Vessel Energy Use: 712,367 GJ	Vessel Emissions (in tonnes): Fuel: 1,378 CO2: 4,368 NOx: 81.84 SO2: 5.51 Vessel Energy Use: 59,245 GJ
		MW	**W**	**MW**	**MS**	**N**	**MW**	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: Option 2A is assessed as being Much Weaker than both Option 4A and Option 5 as the atmospheric emissions and fuel use is significantly higher for the full removal option due to extended offshore durations. Option 2A is assessed as being Weaker than Option 4C as there are more atmospheric emissions and fuel use associated with the full removal option. Option 4A is assessed as being Much Stronger than Option 4C due to the atmospheric emissions and fuel use being significantly lower for the rock cover option. Option 4A is assessed being Neutral to Option 5 as while there are differences in the atmospheric emissions and fuel use for these options, this was considered insufficient to express a preference. Option 4C is assessed as being Much Weaker than Option 5 due to the atmospheric emissions and fuel use being significantly higher for the remove spans / exposures option. **Overall, Option 4A and Option 5 are equally preferred from an Atmospheric Emissions & Consumptions perspective.**						
2. Environmental	2.3 Other Consumptions	Material Emissions (CO2 in tonnes): Recovered Material: 137,807 Remaining Material: 2,911 Total: 140,718 Rock: 500 tonnes			Material Emissions (CO2 in tonnes): Recovered Material: Remaining Material: 153,413 Total: 153,413 Rock: 270,720 tonnes		Material Emissions (CO2 in tonnes): Recovered Material: 36,081 Remaining Material: 114,009 Total: 150,089 Rock: 18,320 tonnes	Material Emissions (CO2 in tonnes): Recovered Material: 27 Remaining Material: 153,384 Total: 153,411 Rock: 452 tonnes
		S	**N**	**N**	**W**	**W**	**N**	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: All options are assessed as being Neutral to each other except Option 4A, which is Weaker than all other options. This is due to the significant quantity of rock consumed in delivering Option 4A. The other environmental impacts in terms of other consumptions are similar for all options. **Overall, Option 2A, Option 4A and Option 5 are equally preferred from an Other Consumptions perspective.**						
2. Environmental	2.4 Seabed Disturbance	Seabed disturbance (MFE): 391640 m2			Short Term Disturbance (Rock Cover): 270,720 m2		Short Term Disturbance (Rock Cover): 114,500 m2	Short Term Disturbance (Rock Cover): 2,825 m2
		W	**MW**	**VMW**	**W**	**MW**	**MW**	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 4A as there is a greater area of seabed disturbance which applies both in the areas of existing rock cover (KP 15.5 to KP 106) but also in the Cromar Shoal Chalk Beds MCZ (KP 1 to KP 7). Option 2A is assessed as being Much Weaker than Option 4C as there is a much greater area of seabed disturbance in Option 2A. Option 2A is assessed as being Very Much Weaker than Option 5 as MFE deburial along the line has much greater seabed disturbance than addressing the line end and spans approaching fishsafe criteria only. Option 4A is assessed as being Weaker than Option 4C as there is a greater area of seabed disturbance in Option 4A, although the majority of this disturbance is in areas of the line already rock covered. Option 4A is assessed as being Much Weaker than Option 5 as there is much greater seabed disturbance associated with the rock cover versus addressing the line end and spans approaching fishsafe criteria only. Option 4C is assessed as being Much Weaker than Option 5 as there is much greater seabed disturbance associated with the removing the areas of spans and exposure versus addressing the line end and spans approaching fishsafe criteria only.. **Overall, Option 5 is the preferred option from a Seabed Disturbance perspective.**						
2. Environmental	2.5 Legacy Marine Impacts	No legacy marine impact from this full removal option. Habitat Loss (Rock Bags): 500 m2 Rock cover existing over line will remain in-situ.			Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Habitat Loss (Rock Cover): 270,720 m2		Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Habitat Loss (Rock Bags): 114,500 m2	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Habitat Loss (Rock Bags): 2,825 m2
		MS	**MS**	**S**	**W**	**MW**	**MW**	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2A is assessed as being Much Stronger than both Option 4A and Option 4C as the line is fully removed and there is significant areas of habitat change from the rock cover introduced in the partial removal options. It is noted that the majority of the rock introduced is in areas where the line is already rock covered although there is also habitat change from cover introduced in the KP 8 to KP 15.5 area of the line which is in various SACs and was not rock covered originally. Option 2A is assessed as being Stronger than Option 5 as the line is fully removed whereas the line remains in Option 5 with small area of rock cover and has degradation products and slow release of residual line contents although the impact of these is expected to be low. Option 4A is assessed as being Weaker than Option 4C as there is more rock introduced and therefor more habitat loss in Option 4A. Option 4A is assessed as being Much Weaker than Option 5, again due to the significant areas of rock cover introduced. Option 4C is assessed as being Much Weaker than Option 5, again due to the significant areas of rock cover introduced. **Overall, Option 2A is the preferred option from a Legacy Marine Impacts perspective.**						

		O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
3. Technical	3.1 Technical Risk	Concept Maturity: Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: The scale of this scope would result in significant technical risks, >100km of partly buried line is feasible to remove by cut and lift with 100s of trips to offload recovered materials. (Score 1)	Concept Maturity: Rock placement is a well proven technique for the southern sector. (Score 3) Technical Risks: Limited technical risks associated with option (Score 3)	Concept Maturity: Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: The scale of this scope would result in significant technical risks, ~27km of exposed line is feasible to remove by cut and lift with 10s of trips to offload recovered materials. (Score 2)	Concept Maturity: Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: Limited technical risks, Pipeline end only is feasible to remove by cut and lift with a single trip to offload recovered materials. (Score 3)
		VMW / W / VMW	VMS / N	VMW	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 2A is assessed as being Very Much Weaker than Option 4A and Option 5 as, while the operations for these options are largely routine, the extended durations associated with the deburial and cut and lift of the 106km line results in a much greater technical risk of deburial challenges, cutting challenges and equipment failure. Option 2A is assessed as being Weaker than Option 4C is while deburial and cut and lift operations are required in both options, the extended scope associated with the full removal option gives greater scope for technical failures. Option 4A is assessed as being Very Much Stronger than Option 4C as the short duration, routine rock cover operations have much less scope for technical failure than the deburial and cut and lift operations over extended durations in Option 4C. Option 4A is assessed as being Neutral to Option 5 as the routine operations have similar limited scope for technical failure. Option 4C is assessed as being Very Much Weaker than Option 5 due to the scope for technical failure during the extended deburial and cut and lift operations over extended durations in Option 4C. **Overall, Option 5 is the preferred option from a Technical Risk perspective.**			
4. Societal	4.1 Fishing	Very long duration operation, large area of disturbance, Fishing operations are conducted in vicinity of the pipeline. (Score 1)	Large area of disturbance, Fishing operations are conducted in vicinity of the pipeline. (Score 1)	Long duration operation, large area of disturbance, Fishing operations are conducted in vicinity of the pipeline. (Score 1)	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the pipeline. (Score 3)
		W / W / MW	N / W	W	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 4A and Option 4C as, while the line is removed, fishing operations (especially creel pot fishing) are currently conducted in the vicinity of the line and the extended durations of disruption to these fishing operations to fully remove the line in Option 2A is considered less preferable. Option 2A is assessed as being Much Weaker than Option 5 as there is minimal disruption associated with Option 5. Option 4A is assessed as being Neutral to Option 4C as the line is left in a similar status from a fishing perspective and the disruption caused by the options is largely similar. Option 4A is assessed as being Weaker than Option 5 as there is more disruption associated with Option 4A. Option 4C is also assessed as being Weaker than Option 5 as there is more disruption associated with Option 4C. **Overall, Option 5 is the preferred option from a Societal impact on Fishing perspective.**			
4. Societal	4.2 Other Users	Returned steel can be recycled. Concrete coating likely will go to landfill. (Score 2) Materials Returned: Steel: 33,224 tonnes (recyclable) Concrete: 99,708 tonnes (landfill) There would also be a negative societal impact in terms of beach access for recreational uses during the decommissioning operations and associated impacts on local caravan park.	Minimal societal benefits / impacts with this option. (Score 1) Materials Returned: None.	Returned steel can be recycled. Concrete coating likely will go to landfill. (Score 2) Materials Returned: Steel: 8,699 tonnes (recyclable) Concrete: 26,106 tonnes (landfill)	Minimal returned steel can be recycled. Concrete coating likely will go to landfill. (Score 3) Materials Returned: Steel: 7 tonnes (recyclable) Concrete: 20 tonnes (landfill)
		W / W / W	S / N	W	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Weaker than all other options as, while it does return significant quantities of recyclable steel, this is more than offset by the large quantity of concrete that would be returned and take up landfill capacity. Option 4A is assessed as being Stronger than Option 4C as there is significant quantity of concrete returned in Option 4C which would take up landfill capacity. Option 4A is assessed as being Neutral to Option 5 as there are limited societal benefits and detriments with both options. Option 4C is assessed as being Weaker than Option 5, again due to the significant quantity of concrete returned in Option 4C which would take up landfill capacity. **Overall, Option 4A and Option 5 are equally preferred from a Societal impact on Other Users perspective.**			

		O2A - Full Removal - Cut and Lift			O4A - Leave - Minor - Rock Placement over Exposures		O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
5. Economic	5.1 Short-term Costs	£104.179 Million			£10.851 Million		£92.932 Million	£1.18 Million
		VMW	W	VMW	VMS	MW	VMW	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Very Much Weaker than both Option 4A and Option 5 as the costs are around 100 million higher for Option 2A. Option 2A is assessed as being Weaker than Option 4C as the costs are around 10 million higher for Option 2A. Option 4A is assessed as being Very Much Stronger than Option 4C as the costs are around 80 million lower for Option 4A. Option 4A is assessed as being Much Weaker than Option 5 as the costs are around 10 million higher for Option 4A. Option 4C is assessed as being Very Much Weaker than Option 5 as the costs are around 90 million higher for Option 4C. **Overall, Option 5 is the preferred option from a Short-term Cost perspective.**						
5. Economic	5.2 Long-term Costs	Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million			Surveys: £2.078 Million FLTC: N/A Total Legacy Cost: £2.078 Million		Surveys: £2.078 Million FLTC: N/A Total Legacy Cost: £2.078 Million	Surveys: £2.078 Million FLTC: £0.081 Million Total Legacy Cost: £2.159 Million
		S	S	S	N	N	N	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Stronger than all other options as there are no long-term costs associated with the full removal option. All other options are assess as being Neutral to each other as the long-term costs for survey and monitoring for all the partial removal options is the same. **Overall, Option 2A is the preferred option from a Long-term Cost perspective.**						

Appendix C.2 Group 1 Pairwise Comparison Matrices - Safety

1.1 Operations Personnel	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MW	W	VMW	6.9%
O4A - Leave - Minor - Rock Placement over Exposures	MS	N	MS	W	27.1%
O4C - Leave - Minor - Remove Areas of Exposure	S	MW	N	VMW	8.4%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	VMS	S	VMS	N	57.6%

1.2 Other Users	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	W	W	MW	14.6%
O4A - Leave - Minor - Rock Placement over Exposures	S	N	S	W	26.1%
O4C - Leave - Minor - Remove Areas of Exposure	S	W	N	W	21.3%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	S	S	N	38.0%

1.3 High Consequence Events	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	VMW	W	VMW	4.5%
O4A - Leave - Minor - Rock Placement over Exposures	VMS	N	VMS	N	45.0%
O4C - Leave - Minor - Remove Areas of Exposure	S	VMW	N	VMW	5.5%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	VMS	N	VMS	N	45.0%

1.4 Legacy Risk	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	S	S	MS	38.1%
O4A - Leave - Minor - Rock Placement over Exposures	W	N	N	S	23.6%
O4C - Leave - Minor - Remove Areas of Exposure	W	N	N	S	23.6%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MW	W	W	N	14.7%

Appendix C.3 Group 1 Pairwise Comparison Matrices - Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MW	N	MW	12.5%
O4A - Leave - Minor - Rock Placement over Exposures	MS	N	MS	N	37.5%
O4C - Leave - Minor - Remove Areas of Exposure	N	MW	N	MW	12.5%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	N	MS	N	37.5%

2.2 Atmospheric Emissions & Fuel Consumption	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MW	W	MW	11.3%
O4A - Leave - Minor - Rock Placement over Exposures	MS	N	MS	N	37.5%
O4C - Leave - Minor - Remove Areas of Exposure	S	MW	N	MW	13.8%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	N	MS	N	37.5%

2.3 Other Consumptions	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	S	N	N	27.3%
O4A - Leave - Minor - Rock Placement over Exposures	W	N	W	W	18.2%
O4C - Leave - Minor - Remove Areas of Exposure	N	S	N	N	27.3%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	S	N	N	27.3%

2.4 Seabed Disturbance	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	W	MW	VMW	7.5%
O4A - Leave - Minor - Rock Placement over Exposures	S	N	W	MW	14.4%
O4C - Leave - Minor - Remove Areas of Exposure	MS	S	N	MW	21.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	VMS	MS	MS	N	57.0%

2.5 Legacy Marine Impacts	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	MS	MS	S	41.3%
O4A - Leave - Minor - Rock Placement over Exposures	MW	N	W	MW	11.2%
O4C - Leave - Minor - Remove Areas of Exposure	MW	S	N	MW	13.8%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	MS	MS	N	33.7%

Appendix C.4 Group 1 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	VMW	W	VMW	4.5%
O4A - Leave - Minor - Rock Placement over Exposures	VMS	N	VMS	N	45.0%
O4C - Leave - Minor - Remove Areas of Exposure	S	VMW	N	VMW	5.5%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	VMS	N	VMS	N	45.0%

Appendix C.5 Group 1 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	W	W	MW	14.7%
O4A - Leave - Minor - Rock Placement over Exposures	S	N	N	W	23.6%
O4C - Leave - Minor - Remove Areas of Exposure	S	N	N	W	23.6%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	S	S	N	38.1%

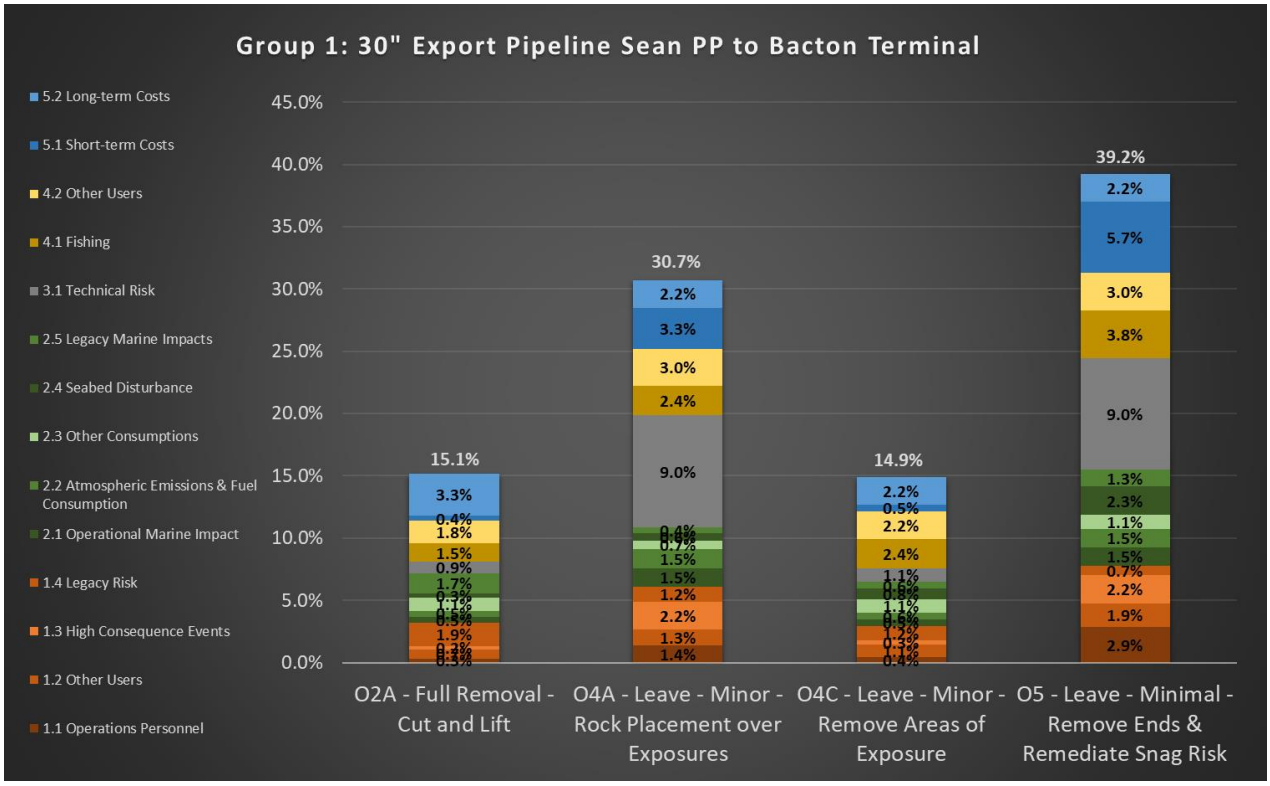
4.2 Other Users	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	W	W	W	18.0%
O4A - Leave - Minor - Rock Placement over Exposures	S	N	S	N	29.9%
O4C - Leave - Minor - Remove Areas of Exposure	S	W	N	W	22.1%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	S	N	29.9%

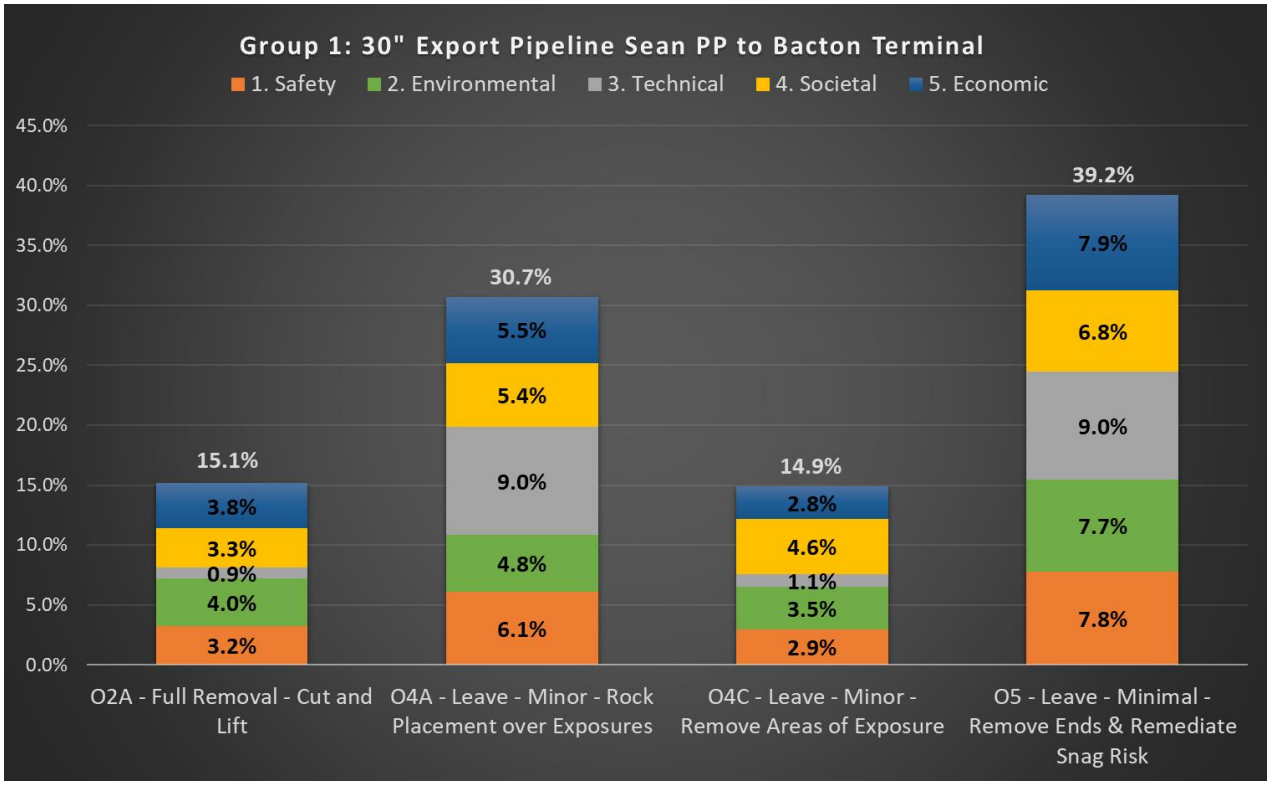
Appendix C.6 Group 1 Pairwise Comparison Matrices - Economic

5.1 Short-term Costs	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	VMW	W	VMW	4.4%
O4A - Leave - Minor - Rock Placement over Exposures	VMS	N	VMS	MW	33.0%
O4C - Leave - Minor - Remove Areas of Exposure	S	VMW	N	VMW	5.3%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	VMS	MS	VMS	N	57.2%

5.2 Long-term Costs	O2A - Full Removal - Cut and Lift	O4A - Leave - Minor - Rock Placement over Exposures	O4C - Leave - Minor - Remove Areas of Exposure	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut and Lift	N	S	S	S	33.3%
O4A - Leave - Minor - Rock Placement over Exposures	W	N	N	N	22.2%
O4C - Leave - Minor - Remove Areas of Exposure	W	N	N	N	22.2%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	N	N	22.2%

Appendix C.7 Group 1 Results Charts





APPENDIX D GROUP 6 – DETAILED EVALUATION RESULTS

Appendix D.1 Group 6 Attributes Table

		O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
		- Pipeline will be disconnected at platform ends. - Line will be deburied where required using MFE to access for cutting. - Line cut into 20m sections using trident dual DWC tooling. - Pipeline is 20" diameter, concrete coated, rigid.	- Pipeline will be disconnected at platform ends. - Pipeline will be cut at rock transition with cut ends recovered. - Rock placement to remediate snag risk from cut ends - Pipeline is 20" diameter, concrete coated, rigid.
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 32.8 / 29,904 / 2.24E-03 Total offshore hours: 29,904 hrs Total offshore PLL: 2.24E-03 Resource Type: Days / Hours / PLL Engineering & Management: 504.4 / 16,141 / 6.46E-05 Project Management: 473.0 / 7,568 / 3.03E-05 Onshore Operations (includes Cleaning & Disposal): 28.0 / 1,792 / 2.20E-04 Total onshore hours: 25,501 hrs Total onshore PLL: 3.15E-04 Total operational hours: 55,406 hrs Total operational PLL: 2.56E-03	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 4.9 / 4,460 / 3.34E-04 Total offshore hours: 4,460 hrs Total offshore PLL: 3.34E-04 Resource Type: Days / Hours / PLL Engineering & Management: 58.8 / 1,882 / 7.53E-06 Project Management: 65.0 / 1,040 / 4.16E-06 Total onshore hours: 2,922 hrs Total onshore PLL: 1.17E-05 Total operational hours: 7,382 hrs Total operational PLL: 3.46E-04
		MW	
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 2A is assessed as being Much Weaker than Option 5 as personnel exposure is more than 7 times higher than Option 5 due to the much greater offshore scope for cut & lift and the much greater onshore scope for processing the returned material with the full removal option. **Overall, Option 5 is the preferred option from a risk to Operations Personnel perspective.**	
1. Safety	1.2 Other Users	Vessel Days: CSV: 32.8 Total vessel days: 32.8 days Transits: 12	Vessel Days: CSV: 4.9 Total vessel days: 4.9 days Transits: 2
		W	
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 5 as there is slightly greater safety impact on other users from the longer duration of offshore operations and, more significantly, the increased transits associated with the full removal option. **Overall, Option 5 is the preferred option from a risk to Other Users perspective.**	
1. Safety	1.3 High Consequence Events	Routine operations however this involves a high volume of lifting operations (241 lifts).	Routine operations with minimal lifting (6 lifts).
		W	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 5 as there are a high number of lifting operations to recover the cut sections of the pipeline under the full removal option versus minimal lifting in Option 5. **Overall, Option 5 is the preferred option from a High Consequence Events perspective.**	

		O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
1. Safety	1.4 Legacy Risk	No legacy risk from this full removal option.	The line would remain in-situ with this option with its full length fully buried. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 24.8 / 13,084 / 9.81E-04
		S	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 2A is assessed as being Stronger than Option 5 as there is no legacy risk from the full removal option. The legacy risk associated with the leave in-situ option is considered small and managed by the remaining line being fully buried along its length and future snag risk being managed by the survey and monitoring programme. **Overall, Option 2A is the preferred option from a Legacy Risk perspective.**	
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): CSV 28.8 days MFE: 2.0 days Diamond Wire Cutting: 5 days Operation Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the lines. However, given the prior cleaning of the lines, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 29 days it is the highest of the options being evaluated but still negligible.	Vessel Noise (days on-site): CSV 0.9 days Tooling negligible. Operation Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends would lead to an elevated discharge of fluids from within the lines. However, given the prior cleaning of the lines, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 1 day it is the lowest of the options being evaluated and negligible.
		W	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 5 as a combination of the higher noise profile (due to extended vessel operations), the release of a greater quantity of residual pipeline contents from the cut and lift operations and the greater vessel discharges from the extended vessel operations, all lead to a small preference for Option 5. **Overall, Option 5 is the preferred option from an Operational Marine Impact perspective.**	
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 876 CO2: 2,777 NOx: 52.04 SO2: 3.50 Vessel Energy Use: 37,673 GJ	Vessel Emissions (in tonnes): Fuel: 806 CO2: 2,555 NOx: 47.88 SO2: 3.22 Vessel Energy Use: 34,661 GJ Note: the emissions and fuel consumption data for this option includes those associated with the survey and monitoring programme. This is considered lower impact as it is spread over a long time period of around 30 years.
		N	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the emissions and fuel use is largely similar for both options. It is noted that a significant portion of the emissions and fuel use associated with Option 5 are associated with the survey and monitoring programme which is spread over around 30 years. **Overall, both options are equally preferred from an Atmospheric Emissions & Consumptions perspective.**	
2. Environmental	2.3 Other Consumptions	Material Emissions (CO2 in tonnes): Recovered Material: 3,030 Remaining Material: Total: 3,030 Rock: N/A tonnes	Material Emissions (CO2 in tonnes): Recovered Material: 72 Remaining Material: 3,330 Total: 3,402 Rock: 32 tonnes
		N	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the impact from processing returned material in Option 2A and the impact from replacing the material left in situ in Option 5 are largely similar. **Overall, both options are equally preferred from an Other Consumptions perspective.**	

		O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
2. Environmental	2.4 Seabed Disturbance	Short Term Disturbance (MFE): 23850 m2	Short Term Disturbance: N/A
		W	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Option 2A is assessed as being Weaker than Option 5 due to the greater area of seabed disturbance associated with the deburial of the line using MFE prior to cut and lift. It is noted that this line between the platforms does not lie in any areas of special interest from an environmental perspective. **Overall, Option 5 is the preferred option from a Seabed Disturbance perspective.**	
2. Environmental	2.5 Legacy Marine Impacts	No legacy marine impact from this full removal option. Habitat Loss (Rock Cover): N/A	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual Oil in Water (OIW) and other chemical levels in lines post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges and any line degradation products is therefore expected to be low overall. Habitat Loss (Rock Bags): 50 m2
		S	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2A is assessed as being Stronger than Option 5 as there are no legacy environmental impacts as the line is fully removed. The impact associated with Option 5 will be limited as the line is buried and the small area of habitat change from the rock placement is considered negligible, particularly in the area between the two platforms where there is already significant rock cover. **Overall, Option 2A is the preferred option from a Legacy Marine Impacts perspective.**	
3. Technical	3.1 Technical Risk	Concept Maturity: Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: Potential for technical risks from deburial and cut & lift of line although <5km of buried line is feasible to remove by cut and lift with several trips to offload recovered materials. (Score 2)	Concept Maturity: Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: Limited technical risks, Pipeline ends only are feasible to remove by cut and lift with a single trip to offload recovered materials. (Score 3)
		MW	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 2A is assessed as being Much Weaker than Option 5 as, while both options employ routine operations, there is additional technical risk from equipment failure and additional debris recovery associated with Option 2A. **Overall, Option 5 is the preferred option from a Technical Risk perspective.**	
4. Societal	4.1 Fishing	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the pipeline. (Score 3)	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the pipeline. (Score 3)
		N	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as the impact on the fishing industry is limited and similar for both options. **Overall, both options are equally preferred from a Societal impact on Fishing perspective.**	
4. Societal	4.2 Other Users	Returned steel can be recycled. Concrete coating likely will go to landfill. (Score 3) Materials Returned: Steel: 829 tonnes (recyclable) Concrete: 2,097 tonnes (landfill)	Minimal returned steel can be recycled. Concrete coating likely will go to landfill. (Score 3) Materials Returned: Steel: 20 tonnes (recyclable) Concrete: 50 tonnes (landfill)
		N	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2A is assessed as being Neutral to Option 5 as, while there are societal benefits associated with returning the recyclable duplex steel in Option 2A, this is offset by the significant quantity of concrete that would take up landfill capacity. **Overall, both options are equally preferred from a Societal impact on Other Users perspective.**	

		O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
5. Economic	5.1 Short-term Costs	£4.794 Million	£0.838 Million
		MW	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Much Weaker than Option 5 as the costs are 6 times higher for Option 2A. **Overall, Option 5 is the preferred option from a Short-term Cost perspective.**	
5. Economic	5.2 Long-term Costs	Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million	Surveys: £1.239 Million FLTC: £0.012 Million Total Legacy Cost: £1.251 Million
		S	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 2A is assessed as being Stronger than Option 5 as there are no legacy costs associated with the full removal option. **Overall, Option 5 is the preferred option from a Long-term Cost perspective.**	

Appendix D.2 Group 6 Pairwise Comparison Matrices - Safety

1.1 Operations Personnel	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	MW	25.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	N	75.0%

1.2 Other Users	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

1.3 High Consequence Events	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

1.4 Legacy Risk	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

Appendix D.3 Group 6 Pairwise Comparison Matrices - Environment

2.1 Operational Marine Impact	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

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

2.3 Other Consumptions	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

2.4 Seabed Disturbance	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

2.5 Legacy Marine Impacts	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

Appendix D.4 Group 6 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	MW	25.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	N	75.0%

Appendix D.5 Group 6 Pairwise Comparison Matrices - Societal

4.1 Fishing	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

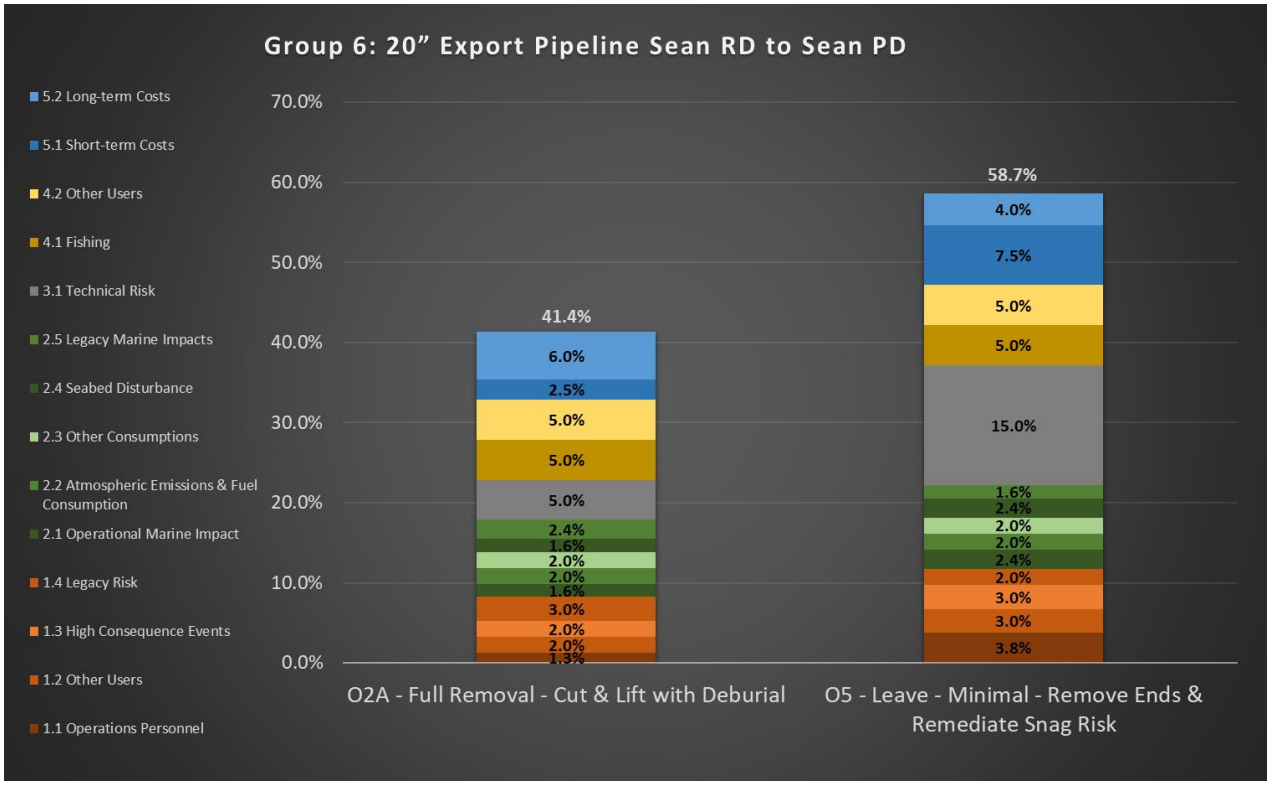
4.2 Other Users	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

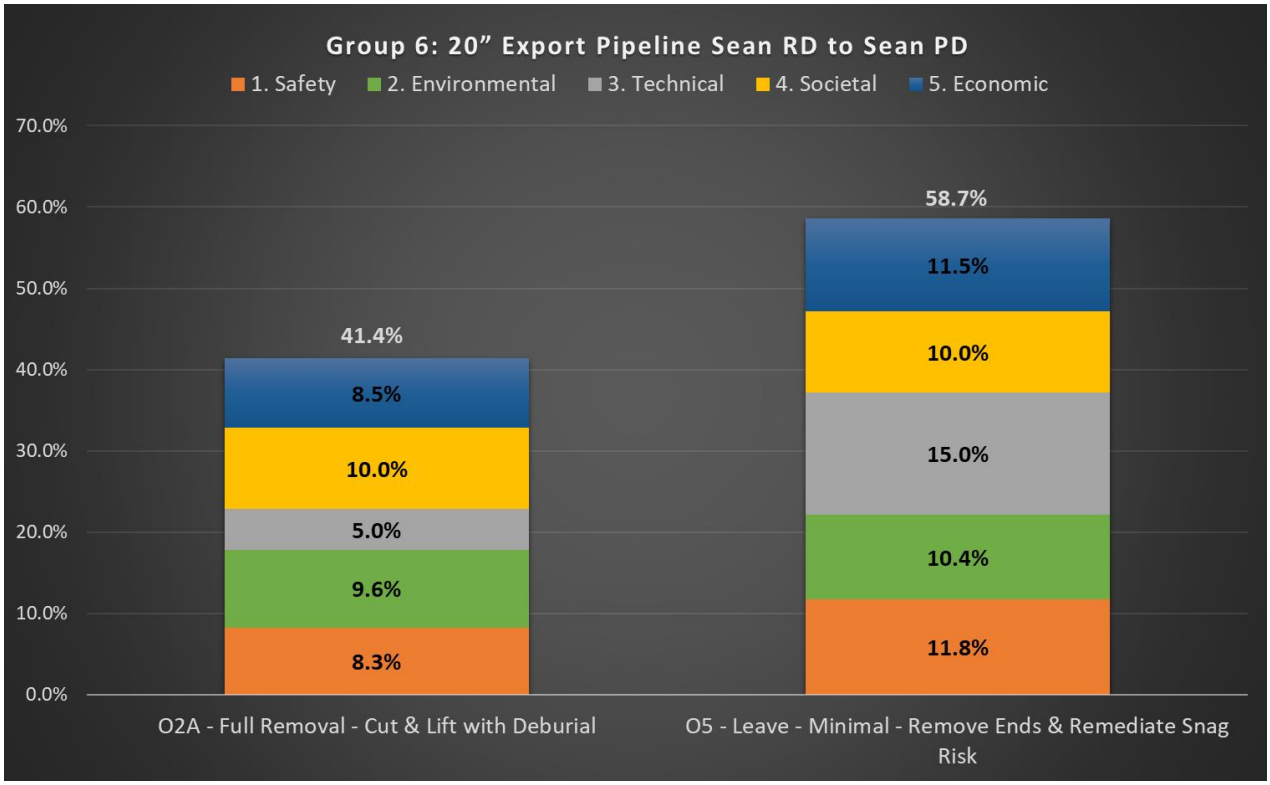
Appendix D.6 Group 6 Pairwise Comparison Matrices - Economic

5.1 Short-term Costs	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	MW	25.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	MS	N	75.0%

5.2 Long-term Costs	O2A - Full Removal - Cut & Lift with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2A - Full Removal - Cut & Lift with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

Appendix D.7 Group 6 Results Charts





APPENDIX E GROUP 7 – DETAILED EVALUATION RESULTS

Appendix E.1 Group 7 Attributes Table

		O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
		- Cable will be disconnected at platform ends. - Cable will be deburied to allow reverse reeling. - Cable reverse reeled to vessel. - Cable is 3.5" diameter.	- Cable will be disconnected at platform ends. - Cable will be cut at trench transition with cut ends recovered. - Rock placement to remediate snag risk from cut ends - Cable is 3.5" diameter.
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 11.9 / 10,862 / 8.15E-04 Total offshore hours: 10,862 hrs Total offshore PLL: 8.15E-04 Resource Type: Days / Hours / PLL Engineering & Management: 69.1 / 2,212 / 8.85E-06 Project Management: 93.0 / 1,488 / 5.95E-06 Onshore Operations (includes Cleaning & Disposal): 3.0 / 192 / 2.36E-05 Total onshore hours: 3,892 hrs Total onshore PLL: 3.84E-05 Total operational hours: 14,754 hrs Total operational PLL: 8.53E-04	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 5.2 / 4,715 / 3.54E-04 Total offshore hours: 4,715 hrs Total offshore PLL: 3.54E-04 Resource Type: Days / Hours / PLL Engineering & Management: 61.8 / 1,976 / 7.91E-06 Project Management: 68.0 / 1,088 / 4.35E-06 Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 3,128 hrs Total onshore PLL: 2.01E-05 Total operational hours: 7,844 hrs Total operational PLL: 3.74E-04
		W	
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 2C is assessed as being Weaker than Option 5 as personnel exposure is around double that of Option 5 due to the greater offshore and onshore scopes for the full removal option. **Overall, Option 5 is the preferred option from a risk to Operations Personnel perspective.**	
1. Safety	1.2 Other Users	Vessel Days: CSV: 11.9 Total vessel days: 11.9 days Transits: 2	Vessel Days: CSV: 5.2 Total vessel days: 5.2 days Transits: 2
		N	
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 2C is assessed as being Neutral to Option 5 as the safety impact to other users of the is similar for both options. **Overall, both options are equally preferred from a risk to Other Users perspective.**	
1. Safety	1.3 High Consequence Events	Routine operations. Lifting of reel to / from vessel.	Routine operations with minimal lifting (2 lifts).
		N	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 2C is assessed as being Neutral to Option 5 as the potential for High Consequence Events is limited and similar for both options. **Overall, both options are equally preferred from a High Consequence Events perspective.**	
1. Safety	1.4 Legacy Risk	No legacy risk from this full removal option.	The line would remain in-situ with this option with it's full length fully buried. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 24.8 / 13,100 / 9.82E-04
		S	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 2C is assessed as being Stronger than Option 5 as there is no legacy risk from the full removal option. The legacy risk associated with the leave in-situ option is considered small and managed by the remaining line being fully buried along its length and future snag risk being managed by the survey and monitoring programme. **Overall, Option 2C is the preferred option from a Legacy Risk perspective.**	

		O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): CSV 7.9 days MFE: 6.1 days Operation Discharges: No operation impacts. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 7.9 days is the highest of the options being evaluated but still negligible.	Vessel Noise (days on-site): CSV 1.2 days Tooling negligible. Operation Discharges: No operation impacts. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 1.2 days is the lowest of the options being evaluated and negligible.
		N	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 2C is assessed as being Neutral to Option 5 as the environmental impacts from performing the options are limited, with the additional noise generated from the deburial of the line using MFE being considered insufficient to express a preference. **Overall, both options are equally preferred from an Operational Marine Impact perspective.**	
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 291 CO2: 924 NOx: 17.31 SO2: 1.17 Vessel Energy Use: 12,534 GJ	Vessel Emissions (in tonnes): Fuel: 815 CO2: 2,583 NOx: 48.40 SO2: 3.26 Vessel Energy Use: 35,040 GJ Note: the emissions and fuel consumption data for this option includes those associated with the survey and monitoring programme. This is considered lower impact as it is spread over a long time period of around 30 years.
		N	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: Option 2C is assessed as being Neutral to Option 5 as while there are more emissions and fuel use associated with Option 5, a significant portion of this is associated with the survey and monitoring programme which is spread over around 30 years and therefor has lower impact. **Overall, both options are equally preferred from an Atmospheric Emissions & Consumptions perspective.**	
2. Environmental	2.3 Other Consumptions	Material Emissions (CO2 in tonnes): Recovered Material: 8 Remaining Material: Total: 8 Rock: N/A tonnes	Material Emissions (CO2 in tonnes): Recovered Material: 1 Remaining Material: 158 Total: 159 Rock: 32 tonnes
		N	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: Option 2C is assessed as being Neutral to Option 5 as the environmental impacts are very low and similar for both options. **Overall, both options are equally preferred from an Other Consumptions perspective.**	
2. Environmental	2.4 Seabed Disturbance	Short Term Disturbance (MFE): 24460 m2	Short Term Disturbance: N/A
		W	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Option 2C is assessed as being Weaker than Option 5 due to the greater area of seabed disturbance associated with the deburial of the line using MFE prior to reverse reeling. It is noted that this line between the platforms does not lie in any areas of special interest from an environmental perspective. **Overall, Option 5 is the preferred option from a Seabed Disturbance perspective.**	
2. Environmental	2.5 Legacy Marine Impacts	No legacy marine impact from this full removal option. Habitat Loss (Rock Cover): N/A	Degradation products remain in-situ (polymer / copper) The legacy marine impact from the slow release of these degradation products is expected to be low overall, especially as fully buried. Habitat Loss (Rock Bags): 50 m2
		S	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2C is assessed as being Stronger than Option 5 as there are no legacy environmental impacts as the line is fully removed. The impact associated with Option 5 will be limited as the line is buried and the small area of habitat change from the rock placement is considered negligible, particularly in the area between the two platforms where there is already significant rock cover. **Overall, Option 2C is the preferred option from a Legacy Marine Impacts perspective.**	

		O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk
3. Technical	3.1 Technical Risk	Concept Maturity: Well proven techniques. Subsea tools, vessel equipment and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: Limited technical risks, small diameter cable feasible to remove by reverse reel but will require deburial. (Score 3)	Concept Maturity: Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market. (Score 3) Technical Risks: Limited technical risks, Cable ends only are feasible to remove by cut and lift. (Score 3)
		W	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 2C is assessed as being Weaker than Option 5 as while both options employ routine operations, there are concerns regarding the integrity of the cable for reverse reeling and the deburial required. **Overall, both options are equally preferred option from a Technical Risk perspective.**	
4. Societal	4.1 Fishing	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the cable. (Score 3)	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the cable. (Score 3)
		N	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 2C is assessed as being Neutral to Option 5 as the impact on the fishing industry is limited and similar for both options. **Overall, both options are equally preferred option from a Societal impact on Fishing perspective.**	
4. Societal	4.2 Other Users	Copper will be recyclable, coating will likely go to landfill. (Score 3) Materials Returned: Copper: 23 tonnes (recyclable) Polymer: 5 tonnes (landfill)	Copper will be recyclable, coating will likely go to landfill. (Score 3) Materials Returned: Copper: 1 tonnes (recyclable)
		S	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 2C is assessed as being Stronger than Option 5 due to the benefit of the returned recyclable copper. **Overall, Option 2C is the preferred option from a Societal impact on Other Users perspective.**	
5. Economic	5.1 Short-term Costs	£1.085 Million	£0.854 Million
		W	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2C is assessed as being Weaker than Option 5 as the costs are around 25% higher. **Overall, Option 5 is the preferred option from a Short-term Cost perspective.**	
5. Economic	5.2 Long-term Costs	Surveys: N/A FLTC: N/A Total Legacy Cost: £0 Million	Surveys: £1.24 Million FLTC: N/A Total Legacy Cost: £1.24 Million
		S	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 2C is assessed as being Stronger than Option 5 as there are no legacy costs associated with the full removal option. **Overall, Option 2C is the preferred option from a Long-term Cost perspective.**	

Appendix E.2 Group 7 Pairwise Comparison Matrices - Safety

1.1 Operations Personnel	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

1.2 Other Users	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

1.3 High Consequence Events	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

1.4 Legacy Risk	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

Appendix E.3 Group 7 Pairwise Comparison Matrices - Environment

2.1 Operational Marine Impact	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

2.2 Atmospheric Emissions & Fuel Consumption	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

2.3 Other Consumptions	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

2.4 Seabed Disturbance	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

2.5 Legacy Marine Impacts	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

Appendix E.4 Group 7 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

Appendix E.5 Group 7 Pairwise Comparison Matrices - Societal

4.1 Fishing	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	N	50.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	N	N	50.0%

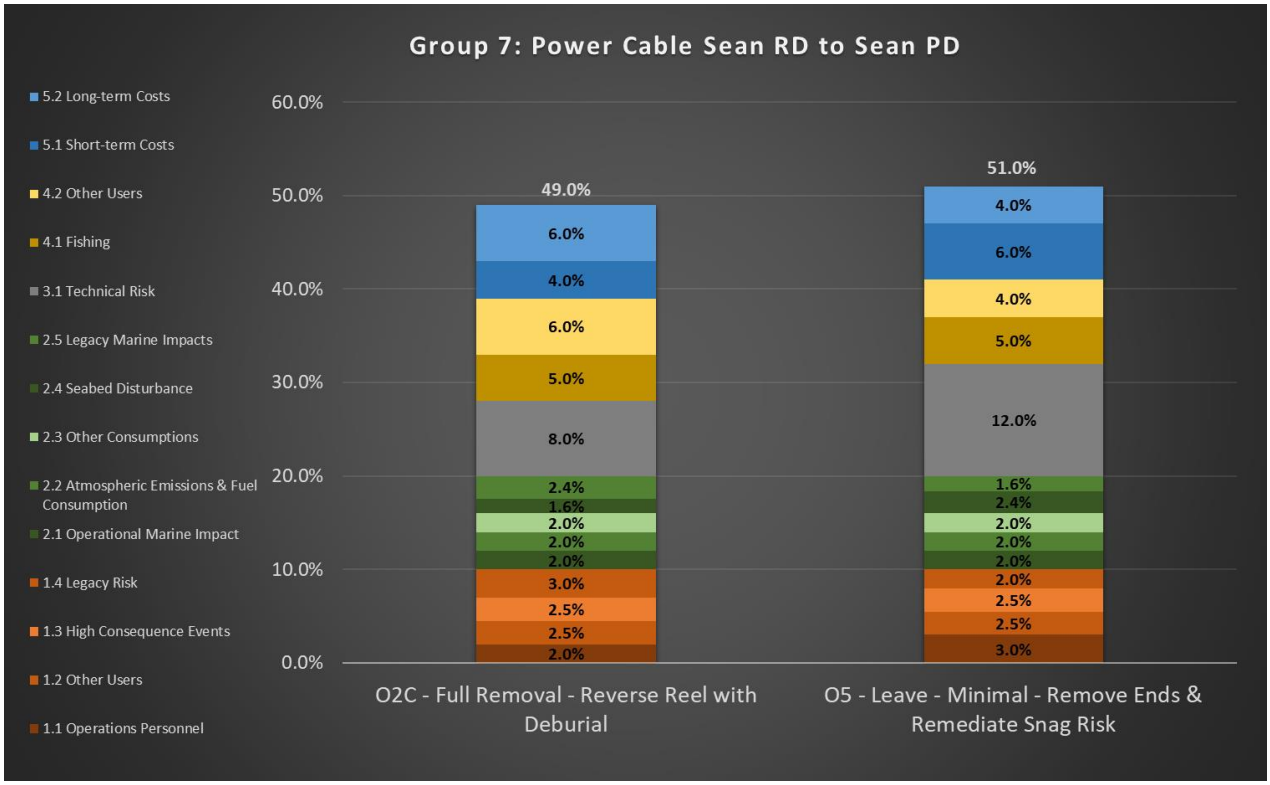
4.2 Other Users	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

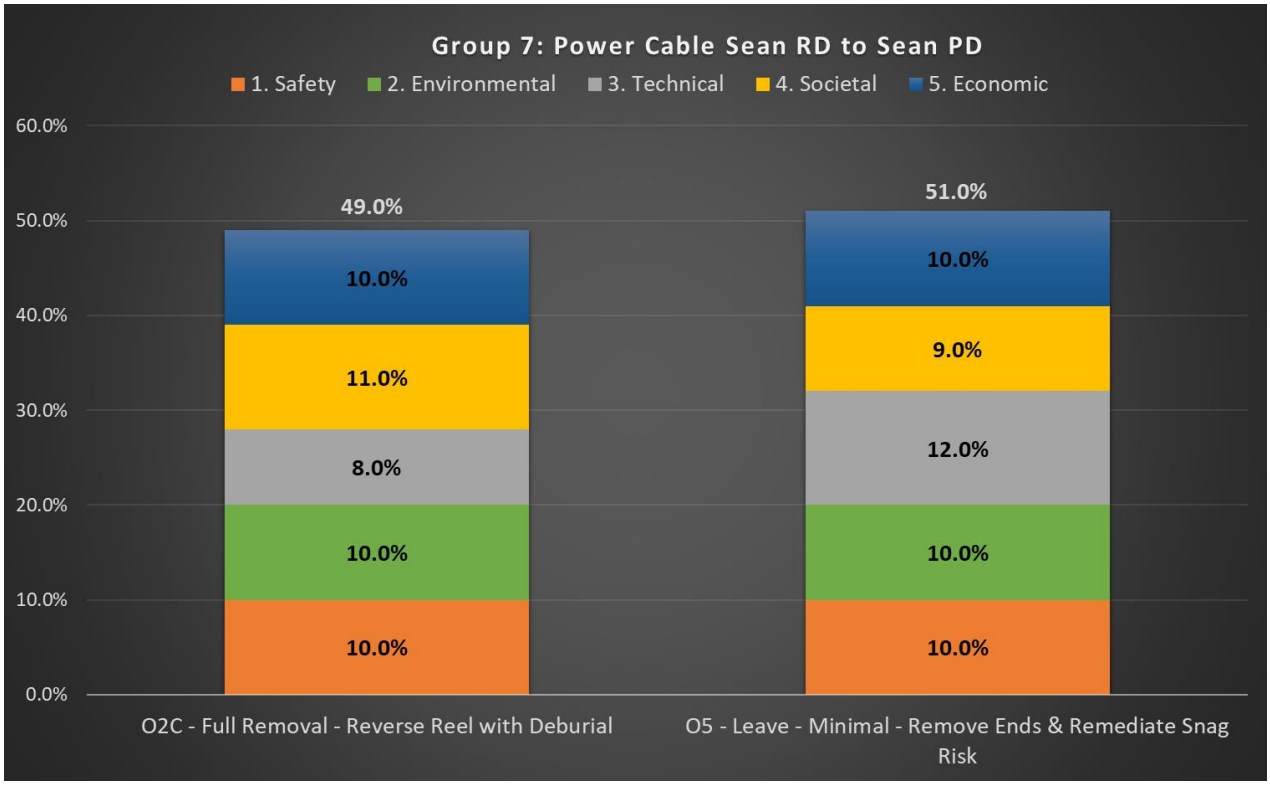
Appendix E.6 Group 7 Pairwise Comparison Matrices - Economic

5.1 Short-term Costs	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	W	40.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	S	N	60.0%

5.2 Long-term Costs	O2C - Full Removal - Reverse Reel with Deburial	O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	Weighting
O2C - Full Removal - Reverse Reel with Deburial	N	S	60.0%
O5 - Leave - Minimal - Remove Ends & Remediate Snag Risk	W	N	40.0%

Appendix E.7 Group 7 Results Charts





APPENDIX F DECOMMISSIONING METHODOLGIES & DATASHEETS

Appendix F.1 Group 1 – Option 2a

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 2A - Full Removal (Cut and Lift)

	GRAND TOTAL	£104,178,635

	SUB-TOTALS	
100	Offshore Operations	£87,514,572
200	Onshore Operations & Equipment Hire	£1,416,595
300	Project Services	£15,247,469
400	Long Term Liability	£0

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Cut and Lift Pipelines**					
	Mob / Demob (offload)	£k / Day	2.00	CSV	75	150
	Transit to Field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (1500 m/hr)	£k / Day	2.93	CSV	75	220
	Deploy MFE	£k / Day	0.04	CSV	75	3
	De-bury pipeline to provide access for cut and recovery - (3 passes)	£k / Day	62.50	CSV	75	4,688
	De-bury pipeline to provide access for cut and recovery - (2 passes)	£k / Day	23.61	CSV	75	1,771
	Recover MFE	£k / Day	0.04	CSV	75	3
	Deploy Trident cut and lift tool (0.25 hour)	£k / Day	0.01	CSV	75	1
	Cut pipelines into 12m sections (4309 dual cuts at 1 hour per dual cut)	£k / Day	179.54	CSV	75	13,466
	Relocate Trident to next cut location	£k / Day	44.89	CSV	75	3,366
	Change out diamond wire	£k / Day	74.81	CSV	75	5,611
	Recover pipeline sections to deck coral (8617 sections at 0.5 hours per section)	£k / Day	179.52	CSV	75	13,464
	Interim trips to offload pipe sections (3 day round trip, 76 trips)	£k / Day	228.00	CSV	75	17,100
	Place rock bags to remediate cut end snag risks (20 locations, 1 x 8 Te bag per location)	£k / Day	0.28	CSV	75	21
	Rock bags to remediate snag risks (20 bags at £1000 per bag)	£k / unit	20.00	Rock Bags (8Te)	1	20
	Relocate between crossing locations (average distance 2.5 km at 2.7 knots)	£k / Day	0.19	CSV	75	14
	As-left survey (1500 m/hr)	£k / Day	2.93	CSV	75	220
	Transit to Shore	£k / Day	1.00	CSV	75	75
						60,278
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	6,427
	Offshore tidal allowance	£k (LS)	30%			12,854
						19,281
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	7,956
						7,956
	SUB-TOTAL Offshore Operations					87,515

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipeline	£k / Te	33,223.30	-	-0.02	-664
						-664
202	**Equipment Procurement, Hire & Fabrication**					
	Trident Cut and Lift Tool	£k / Day	825.44	-	1.50	1,238
	Mass Flow Excavator (MFE)	£k / Day	825.44	-	0.90	743
						1,981
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
	SUB-TOTAL Onshore Operations & Equipment Hire					1,417

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	10,672
						10,672
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	4,376
						4,376
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
	SUB-TOTAL Project Services					15,247

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**0**			
	Mob / Demob	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Transit to Field	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Survey Operations (1500 m/hr)	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Transit to Shore	£k / Day	0.0	Survey Vessel (Legacy)	50	0
						0
	SUB-TOTAL Long Term Liability					0

SCHEDULE

Series	Activity	Unit	Duration
101	Cut and Lift Pipelines	Days	823.44
401	Long Term Liability Surveys	Days	0.0
			823

Option Datasheet: Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 2A - Full Removal (Cut and Lift)

SAFETY				
Offshore Personnel	Number of	76	Man Hours	732,746
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	616,064
Legacy Risk	Number of	0	Man Hours	0
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	803.5
Impact to Other Users of the Sea (Legacy)	Number of	0	Duration of Operations (Days)	0
Operational Risk Offshore	PLL	5.50E-02		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	1.09E-02		
Legacy Risk	PLL	0.00E+00		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**6.59E-02**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	803.5	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	0	0	N/A
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	22,455	71,181	1,334	90
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	137,807	2,911		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	500	160	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	391,640	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	33,223	643	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	99,708	1,929	
	Polymer	0	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market.
	Technical Risks	1	The scale of this scope would result in significant technical risks, >100km of partly buried line is feasible to remove by cut and lift with 100s of trips to offload recovered materials.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	1	Very long duration operation, large area of disturbance, Fishing operations are conducted in vicinity of the pipeline.
	Other Users	2	Returned steel can be recycled. Concrete coating likely will go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£104.18	M
	Comparative Cost Legacy	£0.00	M
	Comparative Cost Total	£104.18	M

Appendix F.2 Group 1 – Option 4a

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 4A - Leave In Situ Rock Cover Exposures

	GRAND TOTAL	£12,929,776

	SUB-TOTALS	
100	Offshore Operations	£9,008,071
200	Onshore Operations & Equipment Hire	£100,000
300	Project Services	£1,743,372
400	Long Term Liability	£2,078,333

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Remedial Rock Placement Over Exposures**					
	Mob / Demob (offload)	£k / Day	2.00	Rockdump Vessel	45	90
	Transit to Field	£k / Day	1.00	Rockdump Vessel	45	45
	DP trials	£k / Day	0.17	Rockdump Vessel	45	8
	As-found survey (1500 m/hr)	£k / Day	2.93	Rockdump Vessel	45	132
	Rock placement over exposed sections	£k / Day	11.28	Rockdump Vessel	45	508
	Interim trips to re-load rock (3 day round trip, 12 trips)	£k / Day	36.00	Rockdump Vessel	45	1,620
	Rockdump span sections (10 Te/m) (QTY @ £16.75 /Te)	£k / Te	270,720	Rockdump (£k/Te dumped)	0.02	4,535
	As-left survey (1500 m/hr)	£k / Day	2.93	Rockdump Vessel	45	132
	Transit to Shore	£k / Day	1.00	Rockdump Vessel	45	45
						7,113
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	359
	Offshore tidal allowance	£k (LS)	30%			717
						1,076
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	819
						819
SUB-TOTAL Offshore Operations						**9,008**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
						0
202	**Equipment Procurement, Hire & Fabrication**					
						0
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**100**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	1,093
						1,093
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	450
						450
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**1,743**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**6**			
	Mob / Demob	£k / Day	12.0	Survey Vessel (Legacy)	50	600
	Transit to Field	£k / Day	6.0	Survey Vessel (Legacy)	50	300
	Survey Operations (1500 m/hr)	£k / Day	17.6	Survey Vessel (Legacy)	50	878
	Transit to Shore	£k / Day	6.0	Survey Vessel (Legacy)	50	300
						2,078
SUB-TOTAL Long Term Liability						**2,078**

SCHEDULE						
Series	Activity				Unit	Duration
101	Remedial Rock Placement Over Exposures				Days	57.30
401	Long Term Liability Surveys				Days	41.6
						99

Option Datasheet: Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 4A - Leave In Situ Rock Cover Exposures

SAFETY				
Offshore Personnel	Number of	20	Man Hours	13,754
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	56,029
Legacy Risk	Number of	44	Man Hours	21,949
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	57.3
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	41.57
Operational Risk Offshore	PLL	1.03E-03		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	2.24E-04		
Legacy Risk	PLL	1.65E-03		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**2.90E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	1	57.3	Rockdump
	DSV	0	0.0	N/A
	CSV	0	0.0	N/A
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	41.57	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	2,205	6,991	131	9
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	0	153,413		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	270,720	270720 Te of Rock	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	0	33,866	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	101,637	
	Polymer	0	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Rock placement is a well proven technique for the southern sector.
	Technical Risks	3	Limited technical risks associated with option

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	1	Large area of disturbance, Fishing operations are conducted in vicinity of the pipeline.
	Other Users	1	Minimal societal benefits / impacts with this option.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£10.85	M
	Comparative Cost Legacy	£2.08	M
	Comparative Cost Total	£12.93	M

Appendix F.3 Group 1 – Option 4c

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 4C - Leave in-situ - Minor Intervention (Remove Areas of Exposures)

	GRAND TOTAL	£95,010,050

	SUB-TOTALS	
100	Offshore Operations	£70,488,570
200	Onshore Operations & Equipment Hire	£9,160,794
300	Project Services	£13,282,352
400	Long Term Liability	£2,078,333

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Cut and Lift Pipelines**					
	Mob / Demob (offload)	£k / Day	2.00	CSV	75	150
	Transit to Field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (1500 m/hr)	£k / Day	2.93	CSV	75	220
	Deploy diamond wire cutting machine (67 times)	£k / Day	2.79	CSV	75	209
	Cut areas of exposure (4580 cuts)	£k / Day	190.83	CSV	75	14,313
	Reposition diamond wire cutting machine (4579 repositions)	£k / Day	95.40	CSV	75	7,155
	Retrieve diamond wire cutting machine (67 times)	£k / Day	0.70	CSV	75	52
	Deploy and attach pipe grab tool and lift cut sections (2290 sections at 0.5 hours per section)	£k / Day	47.71	CSV	75	3,578
	Place rock bags to remediate cut end snag risks (4580 locations, 1 x 8 Te bag per location)	£k / Day	62.98	CSV	75	4,723
	Rock bags to remediate snag risks (4580 bags at £1000 per bag)	£k / unit	4,580	Rock Bags (8Te)	1	4,580
	Interim trips to re-load rock bags (3 day round trip, 45.8 trips)	£k / Day	138	CSV	75	10,350
	As-left survey (1500 m/hr)	£k / Day	2.93	CSV	75	220
	Transit to Shore	£k / Day	1.00	CSV	75	75
						45,712
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	6,123
	Offshore tidal allowance	£k (LS)	30%			12,246
						18,369
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	6,408
						6,408
SUB-TOTAL Offshore Operations						**70,489**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipeline	£k / Te	8,698	-	-0.02	-174
						-174
202	**Equipment Procurement, Hire & Fabrication**					
	Diamond Wire Cutter	£k / Day	5130	-	0.95	4,874
	Suction Dredger	£k / Day	5130	-	0.85	4,361
						9,235
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**9,161**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	9,558
						9,558
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	3,524
						3,524
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**13,282**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**6**			
	Mob / Demob	£k / Day	12.0	Survey Vessel (Legacy)	50	600
	Transit to Field	£k / Day	6.0	Survey Vessel (Legacy)	50	300
	Survey Operations (1500 m/hr)	£k / Day	17.6	Survey Vessel (Legacy)	50	878
	Transit to Shore	£k / Day	6.0	Survey Vessel (Legacy)	50	300
						2,078
SUB-TOTAL Long Term Liability						**2,078**

SCHEDULE

Series	Activity	Unit	Duration
101	Cut and Lift Pipelines	Days	548.42
401	Long Term Liability Surveys	Days	41.6
			590

Option Datasheet: Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 4C - Leave in-situ - Minor Intervention (Remove Areas of Exposures)

SAFETY				
Offshore Personnel	Number of	76	Man Hours	500,168
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	473,088
Legacy Risk	Number of	44	Man Hours	21,949
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	548.4
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	41.57
Operational Risk Offshore	PLL	3.75E-02		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	4.10E-03		
Legacy Risk	PLL	1.65E-03		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**4.33E-02**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	548.4	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	41.57	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	16,567	52,516	984	66
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	36,081	114,009		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	114,500	4580 x 4te rock bags	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	8,699	25,168	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	26,105	75,531	
	Polymer	0	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market.
	Technical Risks	2	The scale of this scope would result in significant technical risks, ~27km of exposed line is feasible to remove by cut and lift with 10s of trips to offload recovered materials.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	1	Long duration operation, large area of disturbance, Fishing operations are conducted in vicinity of the pipeline.
	Other Users	2	Returned steel can be recycled. Concrete coating likely will go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£92.93	M
	Comparative Cost Legacy	£2.08	M
	Comparative Cost Total	£95.01	M

Appendix F.4 Group 1 – Option 5

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

	GRAND TOTAL	£3,322,340

	SUB-TOTALS	
100	Offshore Operations	£712,143
200	Onshore Operations	£115,849
300	Project Services	£416,182
400	Long Term Liability	£2,078,167

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Pipeline Ends Removal & Rockdump**					
	Mob / Demob	£k / Day	2.00	CSV	75	150
	Transit to field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (0.5 hours per end)	£k / Day	0.02	CSV	75	2
	Deploy diamond wire cutting equipment and install at cut location (1 hr) (1 location)	£k / Day	0.04	CSV	75	3
	Cut pipeline end into approximately 20m sections (1 cuts, 0.5 hr per cut)	£k / Day	0.02	CSV	75	2
	Recover hydraulic shear (0.25 hr)	£k / Day	0.02	CSV	75	2
	Attach Lifting Gear & Lift Cut Sections (1 sections, 0.5 hr per section)	£k / Day	0.02	CSV	75	2
	Place 4 Te rockbags to remediate snag risk (4 bags required)	£k / Day	0.06	CSV	75	4
	As-left survey operations (0.5 hr per end)	£k / Day	0.13	CSV	75	9
	Transit to shore	£k / Day	1.00	CSV	75	75
						335
102	**Mid-Line Free Span Rectification**					
	Mob / Demob	£k / Day	2.00	Rockdump Vessel	45	90
	Transit to field	£k / Day	1.00	Rockdump Vessel	45	45
	DP trials	£k / Day	0.13	Rockdump Vessel	45	6
	As-found survey, 6 locations	£k / Day	0.13	Rockdump Vessel	45	6
	Deploy rock at 6 locations	£k / Day	0.23	Rockdump Vessel	45	11
	Rockdump span sections (10 Te/m) (QTY @ £16.75 /Te)	£k / Te	5,630	Rockdump (£k/Te dumped)	0.02	94
	As left survey	£k / Day	0.13	Rockdump Vessel	45	6
	Transit	£k / Day	1.00	Rockdump Vessel	45	45
						302
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	3
	Offshore tidal allowance	£k (LS)	30%			7
						10
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			65
						65
SUB-TOTAL Offshore Operations						712

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Concrete Coated Pipeline	£k / Te	25.71	-	0.05	1.29
	Pipe Cleaning	£k / m	20.00		0.25	5
	Concrete Disposal	£k / Te	19.29		0.02	0.4
						7
202	**Equipment Procurement, Hire & Fabrication**					
	Hydraulic Shears	£k / Day	6.47	-	0.75	5
	Pipe Grab	£k / Day	6.47	-	0.05	0
	Rock Bags	£k each	4		1.00	4
						9
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100	100
						100
SUB-TOTAL Onshore Operations						116

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	99
						99
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	36
						36
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	27	-	3.00	81
						81
SUB-TOTAL Project Services						416

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**6**			
	Mob / Demob	£k / Day	12.0	Survey Vessel (Legacy)	50	600
	Transit to Field	£k / Day	6.0	Survey Vessel (Legacy)	50	300
	Survey Operations (1500 m/hr)	£k / Day	17.6	Survey Vessel (Legacy)	50	878
	Transit to Shore	£k / Day	6.0	Survey Vessel (Legacy)	50	300
						2,078
SUB-TOTAL Long Term Liability						2,078

SCHEDULE			
Series	Activity	Unit	Duration
101	Pipeline Ends Removal & Rockdump	Days	4.47
102	Mid-Line Free Span Rectification	Days	0.00
103	Post Decommissioning Survey	Days	0.00
104	Trawl Sweep	Days	0.00
105	Offshore weather allowance	Days	0.00
106	Offshore weather allowance	Days	0.00
401	Long Term Liability Surveys	Days	41.6
			46

Option Datasheet: Group 1: 30" Export Pipeline Sean PP to Bacton Terminal, Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

SAFETY				
Offshore Personnel	Number of	76	Man Hours	5,445
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	3,968
Legacy Risk	Number of	44	Man Hours	21,949
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	6.0
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	41.57
Operational Risk Offshore	PLL	4.08E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	2.35E-05		
Legacy Risk	PLL	1.65E-03		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**2.08E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	6.0	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	41.57	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	1,378	4,368	82	6
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	27	153,384		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	2,825	113 x 4te rock bags	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	6	33,860	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	19	101,617	
	Polymer	0	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market.
	Technical Risks	3	Limited technical risks, Pipeline end only is feasible to remove by cut and lift with a single trip to offload recovered materials.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	3	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the pipeline.
	Other Users	3	Minimal returned steel can be recycled. Concrete coating likely will go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£1.18	M
	Comparative Cost Legacy	£2.08	M
	Comparative Cost Total	£3.26	M

Appendix F.5 Group 6 – Option 2a

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 6: 20" Export Pipeline Sean RD to Sean PD, Option 2A - Full Removal (Cut and Lift)

	GRAND TOTAL	£4,794,404

	SUB-TOTALS	
100	Offshore Operations	£3,767,069
200	Onshore Operations & Equipment Hire	£166,905
300	Project Services	£860,430
400	Long Term Liability	£0

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Cut and Lift Pipelines**					
	Mob / Demob (offload)	£k / Day	2.00	CSV	75	150
	Transit to Field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (1500 m/hr)	£k / Day	0.13	CSV	75	10
	Deploy MFE	£k / Day	0.04	CSV	75	3
	De-bury pipeline to provide access for cut and recovery - (3 passes)	£k / Day	1.99	CSV	75	149
	Recover MFE	£k / Day	0.04	CSV	75	3
	Deploy Trident cut and lift tool (0.25 hour)	£k / Day	0.01	CSV	75	1
	Cut pipelines into 12m sections (120 dual cuts at 1 hour per dual cut)	£k / Day	5.00	CSV	75	375
	Relocate Trident to next cut loction	£k / Day	1.25	CSV	75	94
	Recover pipeline sections to deck coral (241 sections at 0.5 hours per section)	£k / Day	5.02	CSV	75	377
	Interim trips to offload pipe sections (3 day round trip, 5 trips)	£k / Day	15.00	CSV	75	1,125
	As-left survey (1500 m/hr)	£k / Day	0.13	CSV	75	10
	Transit to Shore	£k / Day	1.00	CSV	75	75
						2,459
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	322
	Offshore tidal allowance	£k (LS)	30%			644
						966
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	342
						342
SUB-TOTAL Offshore Operations						3,767

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipeline	£k / Te	828.80	-	-0.02	-17
						-17
202	**Equipment Procurement, Hire & Fabrication**					
	Trident Cut and Lift Tool	£k / Day	34.78	-	1.50	52
	Mass Flow Excavator (MFE)	£k / Day	34.78	-	0.90	31
						83
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						167

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	472
						472
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	188
						188
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						860

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**0**			
	Mob / Demob	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Transit to Field	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Survey Operations (1500 m/hr)	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Transit to Shore	£k / Day	0.0	Survey Vessel (Legacy)	50	0
						0
SUB-TOTAL Long Term Liability						0

SCHEDULE			
Series	Activity	Unit	Duration
101	Cut and Lift Pipelines	Days	32.78
401	Long Term Liability Surveys	Days	0.0
			33

Option Datasheet: Group 6: 20" Export Pipeline Sean RD to Sean PD, Option 2A - Full Removal (Cut and Lift)

SAFETY				
Offshore Personnel	Number of	76	Man Hours	29,904
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	25,501
Legacy Risk	Number of	0	Man Hours	0
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	32.8
Impact to Other Users of the Sea (Legacy)	Number of	0	Duration of Operations (Days)	0
Operational Risk Offshore	PLL	2.24E-03		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	3.15E-04		
Legacy Risk	PLL	0.00E+00		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**2.56E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	32.8	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	0	0	N/A
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	876	2,777	52	4
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	3,030	0		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	23,850	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	829	0	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	2,097	0	
	Polymer	0	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market.
	Technical Risks	3	Limited technical risks, <5km of buried line is feasible to remove by cut and lift with several trips to offload recovered materials.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	3	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the pipeline.
	Other Users	3	Returned steel can be recycled. Concrete coating likely will go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£4.79	M
	Comparative Cost Legacy	£0.00	M
	Comparative Cost Total	£4.79	M

Appendix F.6 Group 6 – Option 5

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 6: 20" Export Pipeline Sean RD to Sean PD, Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

	GRAND TOTAL	£2,076,706

	SUB-TOTALS	
100	Offshore Operations	£434,067
200	Onshore Operations	£105,510
300	Project Services	£298,321
400	Long Term Liability	£1,238,808

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Pipeline Ends Removal & Rockdump**					
	Mob / Demob	£k / Day	2.00	CSV	75	150
	Transit to field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (1500 m/hr)	£k / Day	0.13	CSV	75	10
	Deploy hydraulic shear cutting equipment and install at cut location (1 hr) (2 locations)	£k / Day	0.08	CSV	75	9
	Cut pipeline ends into approximately 20m sections (6 cuts, 0.5 hr per cut)	£k / Day	0.12	CSV	75	9
	Reposition hydraulic shear (6 cuts, 0.5 hr per cut)	£k / Day	0.12	CSV	75	9
	Attach Lifting Gear & Lift Cut Sections (6 sections, 0.5 hr per section)	£k / Day	0.12	CSV	75	9
	Place 4 Te rockbags to remediate snag risk (2 locations, 4 bags per location, 0.33 hr to install)	£k / Day	0.11	CSV	75	8
	As-left survey operations (0.5 hr per end)	£k / Day	0.04	CSV	75	3
	Transit to shore (km from field at knots)	£k / Day	1.00	CSV	75	75
						369
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	8
	Offshore tidal allowance	£k (LS)	30%			17
						25
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			39
						39
SUB-TOTAL Offshore Operations						434

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipeline	£k / Te	0.00	-	-0.02	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Hydraulic Shears	£k / Day	6.89	-	0.75	5
	Pipe Grab	£k / Day	6.89	-	0.05	0
						6
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100	100
						100
SUB-TOTAL Onshore Operations						106

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	65
						65
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	22
						22
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	4	-	3.00	12
						12
SUB-TOTAL Project Services						298

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**6**			
	Mob / Demob	£k / Day	12.0	Survey Vessel (Legacy)	50	600
	Transit to Field	£k / Day	6.0	Survey Vessel (Legacy)	50	300
	Survey Operations (1500 m/hr)	£k / Day	0.8	Survey Vessel (Legacy)	50	39
	Transit to Shore	£k / Day	6.0	Survey Vessel (Legacy)	50	300
						1,239
SUB-TOTAL Long Term Liability						1,239

SCHEDULE			
Series	Activity	Unit	Duration
101	Pipeline Ends Removal & Rockdump	Days	4.89
102	Offshore weather allowance	Days	0.00
103	Post Decommissioning Survey	Days	0.00
104	Trawl Sweep	Days	0.00
105	Offshore weather allowance	Days	0.00
106	Offshore weather allowance	Days	0.00
401	Long Term Liability Surveys	Days	24.8
			30

Option Datasheet: Group 6: 20" Export Pipeline Sean RD to Sean PD, Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

SAFETY				
Offshore Personnel	Number of	76	Man Hours	4,460
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	2,922
Legacy Risk	Number of	44	Man Hours	13,084
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	4.9
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	24.78
Operational Risk Offshore	PLL	3.34E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	1.17E-05		
Legacy Risk	PLL	9.81E-04		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**1.33E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	4.9	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	24.78	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	806	2,555	48	3
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	72	3,330		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	50	8 x Rock Bags 4te	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	20	809	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	50	2,047	
	Polymer	0	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market.
	Technical Risks	3	Limited technical risks, Pipeline ends only are feasible to remove by cut and lift with a single trip to offload recovered materials.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	3	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the pipeline.
	Other Users	3	Minimal returned steel can be recycled. Concrete coating likely will go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£0.84	M
	Comparative Cost Legacy	£1.24	M
	Comparative Cost Total	£2.08	M

Appendix F.7 Group 7 – Option 2c

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 7: 1" Electrical Cable, Sean RD to Sean PD, Option 2C - Full Removal - Reverse Installation (Reel) with Deburial

	GRAND TOTAL	£1,085,198

	SUB-TOTALS	
100	Offshore Operations	£513,877
200	Onshore Operations	£253,538
300	Project Services	£317,784
400	Long Term Liability	£0

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Reverse Reeling Preparation**					
	Mob / Demob	£k / Day	2.00	CSV	75	150
	Transit to field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (1500 m/hr)	£k / Day	0.14	CSV	75	10
	Deploy MFE	£k / Day	0.04	CSV	75	3
	De-bury cable to provide access for cut and recovery - (2 passes)	£k / Day	6.12	CSV	75	124
	Recover MFE	£k / Day	0.04	CSV	75	3
	Deploy hydraulic shears	£k / Day	0.04	CSV	75	3
	Cut umbilical at recovery point	£k / Day	0.02	CSV	75	2
	Recover hydraulic shears	£k / Day	0.01	CSV	75	1
	Relocate to opposite end of cable	£k / Day	0.08	CSV	75	6
	Deploy hydraulic shears	£k / Day	0.04	CSV	75	3
	Cut umbilical at recovery point	£k / Day	0.04	CSV	75	3
	Recover hydraulic shears	£k / Day	0.02	CSV	75	2
	Deploy cable recovery grab and connect to cable	£k / Day	0.08	CSV	75	6
	Recover cable end and initiate reverse reel	£k / Day	0.25	CSV	75	19
	Reerse reel of cable	£k / Day	0.68	CSV	75	51
	As-left survey operations (1500 m/hr)	£k / Day	0.14	CSV	75	10
	Transit to shore	£k / Day	1.00	CSV	75	75
						155
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	37
	Offshore tidal allowance	£k (LS)	30%			74
						111
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			47
						47
	SUB-TOTAL Offshore Operations					**514**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Flexibles / Umbilicals / Cables	£k / Te	73.38	-	0.00	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Deck Reel / Reel Drive System / Tensioner	£k / Day	13.91	-	10.00	139
	Mass Flow Excavator (MFE)	£k / Day	4.45	-	0.90	4
	Hydraulic Shears	£k / Day	13.91	-	0.75	10
						154
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
	SUB-TOTAL Onshore Operations					**254**

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	92
						92
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	26
						26
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0.00	-	3	0
						0
	SUB-TOTAL Project Services					**318**

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**0**			
	Mob / Demob	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Transit to Field	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Survey Operations (1500 m/hr)	£k / Day	0.0	Survey Vessel (Legacy)	50	0
	Transit to Shore	£k / Day	0.0	Survey Vessel (Legacy)	50	0
						0
	SUB-TOTAL Long Term Liability					**0**

SCHEDULE			
Series	Activity	Unit	Duration
101	Reverse Reeling Preparation	Days	9.84
102	Reverse Reeling	Days	0.00
103	Offshore weather allowance	Days	0.00
104	Offshore weather allowance	Days	0.00
105	Offshore weather allowance	Days	0.00
106	Offshore weather allowance	Days	0.00
401	Long Term Liability Surveys	Days	0.0
			10

Option Datasheet: Group 7: 1" Electrical Cable, Sean RD to Sean PD, Option 2C - Full Removal - Reverse Installation (Reel) with Deburial

SAFETY				
Offshore Personnel	Number of	76	Man Hours	10,862
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	3,892
Legacy Risk	Number of	0	Man Hours	0
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	11.9
Impact to Other Users of the Sea (Legacy)	Number of	0	Duration of Operations (Days)	0
Operational Risk Offshore	PLL	8.15E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	3.84E-05		
Legacy Risk	PLL	0.00E+00		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**8.53E-04**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	11.9	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	0	0	N/A
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	292	924	17	1
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	8	0		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	24,460	N/A	
	Short Term Disturbance (MFE)	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	0	0	
	Aluminium Alloy	0	0	
	Copper	22	0	
	Concrete	0	0	
	Polymer	5	0	
	Mattress/Grout Bag	0	0	
	Life Cycle	**Value**		
	Disposal Time	6.1 days		
	Persistence	Hundreds of years		

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools, vessel equipment and vessel requirements are broadly supported across the market.
	Technical Risks	3	Limited technical risks, small diameter cable feasible to remove by reverse reel.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	3	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the cable.
	Other Users	3	Copper will be recyclable, coating will likely go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£1.09	M
	Comparative Cost Legacy	£0.00	M
	Comparative Cost Total	£1.09	M

Appendix F.8 Group 7 – Option 5

PROJECT	Sean Field Decommissioning
CLIENT	ONE Dyas
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400309-S00
CALCULATION NUMBER	A-400309-S00-CALC-001
REVISION	A02

Group 7: 1" Electrical Cable, Sean RD to Sean PD, Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

	GRAND TOTAL	£2,094,192

	SUB-TOTALS	
100	Offshore Operations	£457,899
200	Onshore Operations	£105,372
300	Project Services	£290,487
400	Long Term Liability	£1,240,433

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Pipeline Ends Removal & Rockdump**					
	Mob / Demob	£k / Day	2.00	CSV	75	150
	Transit to field	£k / Day	1.00	CSV	75	75
	DP trials	£k / Day	0.17	CSV	75	13
	As-found survey (1500 m/hr)	£k / Day	0.14	CSV	75	10
	Dredge cable ends to base of trench	£k / Day	0.50	CSV	75	38
	Deploy hydraulic shear cutting equipment and install at cut location (1 hr) (2 locations)	£k / Day	0.08	CSV	75	3
	Cut cable ends into approximately 20m sections (2 cuts, 0.5 hr per cut)	£k / Day	0.04	CSV	75	3
	Reposition hydraulic shear (2 cuts, 0.5 hr per cut)	£k / Day	0.04	CSV	75	3
	Attach Lifting Gear & Lift Cut Sections (2 sections, 0.5 hr per section)	£k / Day	0.04	CSV	75	3
	Place 4 Te rockbags to remediate snag risk (2 locations, 4 bags per location, 0.33 hr to install)	£k / Day	0.11	CSV	75	8
	As-left survey operations (0.5 hr per end)	£k / Day	0.04	CSV	75	3
	Transit to shore (km from field at knots)	£k / Day	1.00	CSV	75	75
						384
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	11
	Offshore tidal allowance	£k (LS)	30%			21
						32
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			42
						42
SUB-TOTAL Offshore Operations						**458**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Flexibles / Umbilicals / Cables	£k / Te	0.60	-	0.00	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Hydraulic Shears	£k / Day	7.16	-	0.75	5
						5
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100	100
						100
SUB-TOTAL Onshore Operations						**105**

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	68
						68
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	23
						23
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**290**

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**6**			
	Mob / Demob	£k / Day	12.0	Survey Vessel (Legacy)	50	600
	Transit to Field	£k / Day	6.0	Survey Vessel (Legacy)	50	300
	Survey Operations (1500 m/hr)	£k / Day	0.8	Survey Vessel (Legacy)	50	40
	Transit to Shore	£k / Day	6.0	Survey Vessel (Legacy)	50	300
						1,240
SUB-TOTAL Long Term Liability						**1,240**

SCHEDULE			
Series	Activity	Unit	Duration
101	Pipeline Ends Removal & Rockdump	Days	5.16
102	Offshore weather allowance	Days	0.00
103	Post Decommissioning Survey	Days	0.00
104	Trawl Sweep	Days	0.00
105	Offshore weather allowance	Days	0.00
106	Offshore weather allowance	Days	0.00
401	Long Term Liability Surveys	Days	24.8
			30

Option Datasheet: Group 7: 1" Electrical Cable, Sean RD to Sean PD, Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

SAFETY				
Offshore Personnel	Number of	76	Man Hours	4,715
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	3,128
Legacy Risk	Number of	44	Man Hours	13,100
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	5.2
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	24.81
Operational Risk Offshore	PLL	3.54E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	2.01E-05		
Legacy Risk	PLL	9.82E-04		
Fishing Risk	PLL	HOLD		
Overall Risk	**ΣPLL**	**1.36E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	5.2	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	24.81	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	815	2,583	48	3
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**		
	1	158		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	50	8 x 4te rock bags	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance (MFE)	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	0	0	
	Aluminium Alloy	0	0	
	Copper	0.2	22	
	Concrete	0	0	
	Polymer	0.0	4.9	
	Mattress/Grout Bag	0	0	
	Life Cycle	**Value**		
	Disposal Time	2 days		
	Persistence	Hundreds of years		

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Concept Maturity**	3	Well proven techniques. Subsea tools and vessel requirements are broadly supported across the market.
	Technical Risks	3	Limited technical risks, Cable ends only are feasible to remove by cut and lift.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short operation, small area of disturbance, Fishing operations are conducted in vicinity of the cable.
	Other Users	3	Copper will be recyclable, coating will likely go to landfill.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£0.85	M
	Comparative Cost Legacy	£1.24	M
	Comparative Cost Total	£2.09	M

Appendix F.9 Estimate Basis

PROJECT	**Sean Field Decommissioning**
CLIENT	**ONE Dyas**
SUBJECT	**Decommissioning Method Statements**
ASSIGNMENT NUMBER	**A400309-S00**
CALCULATION NUMBER	**A-400309-S00-CALC-00X**
REVISION	**A01**

Estimate Basis

Vessel Rates	Unit	Rate £k
Survey Vessel	£k/day	50
Trenching Vessel	£k/day	150
Rockdump Vessel	£k/day	45
Rockdump (£k/Te dumped)	£k/Te	0.02
Rock Bags (8Te)	Each	1.00
DSV	£k/day	140
CSV	£k/day	75
Reel Vessel	£k/day	140
Trawler	£k/day	5
Survey Vessel (Legacy)	£k/day	50
Cargo Barge/Pipehaul	£k/day	90
Tug	£k/day	15

Equipment Rates	Unit	Rate £k
Suction Dredger	£k/day	0.85
Mass Flow Excavator (MFE)	£k/day	0.90
Mechanical / Jet Trencher	£k/day	0.90
Hydraulic Shears	£k/day	0.75
Diamond Wire Cutter	£k/day	0.95
Trident Cut and Lift Tool	£k/day	1.50
Speed Loaders Hire	£k/day	0.04
Speed Loader Rigging	Each	0.24
Pipe Grab	£k/day	0.05
Subsea Basket	£k/day	0.12
Deck Reel / Reel Drive System / Tensioner	£k/day	10.00
Note: Equipment costs do not account for qualified technicians required to operate the equipment.		

Offshore Operations	Unit	Value
All Operations		
Mob / Demob	day	2
Transit to Field	day	1
DP trials	hour	4
Transit to Shore	day	1
Interim trips (inc. transits and mob / demob)	day	3
Trip duration	day	28
Interfield transits	hour	4
Suction Dredger Operations		
Allowance for deburial of pipeline section required to be cut	hour	1
Mass Flow Excavating Operations		
Deburial of trenched and buried line using MFE (whole length)	m / hour	100
Allowance for deburial of pipeline section required to be cut	hour	2
Time required to deploy / retrieve MFE equipment	hour	1
Number of passes required for fully buried / rock covered sections	QTY	3
Number of passes required for partially buried / rock covered sections	QTY	2

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REVISION	**A01**

Estimate Basis

Offshore Operations	Unit	Value
Remedial Trenching Operation		
Time required for jet trenching and burying exposure (only applies to trenching and burying exposure spots)	hour	1
Time required to deploy / retrieve and set up jet trenching equipment	hour	2
Time required to reposition jet trenching equipment	hour	1
Time required for jet trenching surface laid lines	m / hour	200
Time required for backfilling surface laid lines	m / hour	225
Length of trench transitions	m	50
Length of trench run in / out	m	30
Cutting and Lifting Operations		
Section length to be cut - Hydraulic Shears	m	20
Section length to be cut - Diamond Wire Saw	m	10
Section length to be cut - Trident Cut and Lift Tool	m	12
No. of hours required to perform one cut - hydraulic shears	hour	0.50
Hydraulic Shear Deployment Time	hour	1
Hydraulic Shears Repositioning Time	hour	0.50
Hydraulic shears retrieval time	hour	0.25
No. of hours required to perform one cut - Diamond Wire Cutter	hour	1
Diamond Wire Saw deployment time	hour	1
Diamond Wire Cutter Repositioning Time	hour	0.50
Diamond Wire Cutter Recovery Time	hour	0.25
Subsea basket deployment time	hour	0.50
Subsea basket retrieval time	hour	0.50
Time required to lift cut section of Pipeline / Spool / Flexible / Umbilical back to vessel - Pipe Grab	hour	0.50
Time required to lift cut section into subsea basket	hour	0.50
Time for combined cut pipe and lift (12m sections / 2 cuts) - Trident	hour	1.50
Time for a dual cut - Trident	hour	1
Time for a single pipe lift - Trident	hour	0.50
Trident deployment time	hour	0.25
Trident relocation time	hour	0.25
Allowance for concrete spalling	%	25%
Time required to recover concrete at each location	hour	0.5
Change out diamond wires every	cuts	6.0
Change out diamond wires	hour	2.0
Survey Operations		
As-found / post-decommissioning pipeline survey	m / hour	1500
As-found / as-left cut end survey - rock cover	hour / end	0.5
Rock Placement		
Rock quantity for pipelines / umbilical	Te / m	10
Time required to rock cover line	Te / hour	1000
Rock quantity for cut ends	Te / end	25
Time required to rock cover section	hour / section	2
No. of rock bag placement per end	QTY	4
No. hours to place rock bags per location	hour	0.33

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REVISION	**A01**

Estimate Basis

Offshore Operations	Unit	Value
Reverse Installation Operation		
Time required to lift and attach recovery head and rigging	hour	4
Time required to initiate reverse reel	hour	6
Time required to carry out reverse reeling of flexible / umbilical	m / hour	300
Time required to carry out reverse reeling of rigid pipeline	m / hour	400
Time required to carry out reverse s-lay of rigid pipeline	m / hour	400
Allowance for diver intervention	day	2
Offshore weather allowance	%	15%
Offshore tidal allowance	%	30%
Decommissioning Contractors Engineering and Management	%	10%

Onshore Rates	Unit	Rate £k
Recycling / Disposal Rates		
Concrete Coated Pipeline	£ / Te	0.02
Rigid Steel Pipe	£ / Te	-0.03
Flexibles / Umbilicals / Cables	£ / Te	0.00

Personnel Rates & Misc. Costs	Unit	Rate £k
Ops Support Personnel	£k/day	0.68

Assumptions	Unit	Value
Disturbance		
Rock placement disturbance - length of pipeline	m (width)	10
Rock placement disturbance - pipeline ends	m^2	100
Rock bags (4Te) ~2.4m dia in-place	m^2	25
Trench and bury disturbance	m (width)	10
Mass flow excavation disturbance	m (width)	5
Reverse install without deburial disturbance	m (width)	2
Note: Any seabed dredging is considered to be localised and to have a negligible impact on the seabed in comparison to rockdumping, MFE etc and therefore is not included in the estimate for seabed disturbance/impact.		

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REVISION	**A01**

Estimate Basis

Vessel Information	Unit	Value
Vessel Deck Area		
Olympic Ares (CSV)	m^2	1,300
Seven Atlantic (DSV)	m^2	1,200
Seven Arctic (CSV)	m^2	2,600
Seven Pegasus (DSV)	m^2	1,200
Vessel Deck Area Utilisation	%	50%
Maximum Pipe Storage Height	m	1.5
Vessel Deck Weight Capacity		
Olympic Ares (CSV)	Te	7,150
Seven Atalantic (DSV)	Te	12,000
Seven Arctic (CSV)	Te	7,000
Seven Pegasus (DSV)	Te	7,800
Vessel Rock Capacity		
Nordnes (Flexible Fallpipe Vessel)	Te	24,000

Project Services	Unit	Value
Project Management / Supervision / Owner Costs	%	12%
Insurance	%	5%
Misc. Onshore Costs (Port charges, storage etc.)	£k LS	100
3rd Party Verification	£k LS	200

Fees	Unit	Value
UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	3.00

Personnel on Board (PoB) & Fatal Accident Rate (FAR)	PoB	Hours Exposure	FAR
HLV	120	12	5.5
DSV	110	12	7.5
Barge / Pipehaul	20	12	5.5
Tug	7	12	13.2
Divers	18	24	97
Trawler	5	12	7.5
Survey Vessel	44	12	7.5
CSV	76	12	7.5
Light CSV	76	12	5.5
SLV	200	12	5.5
Rockdump Vessel	20	12	7.5
Trenching Vessel	55	12	7.5
Large Deck CSV	76	12	5.5
Reel Vessel	76	12	7.5
Supply Vessel	76	12	18.1
Survey Vessel (Legacy)	44	12	7.5
Rockdump Vessel (Legacy)	20	12	7.5