

# LOGGS Area Decommissioning – LOGGS LDP2 – 5 Comparative Assessment Report

## Document Number: XOD-SNS-L-XX-X-HS-02-00003

## FINAL 22 Sept 2021

C6	Issued for Use	SA	22/09/21	СВ	22/09/21	MB	22/09/21
C5	Issued for Use	СМ	23/04/2021	SA	23/04/2021	MB	23/04/2021
C4	Issued for Use	СМ	15/03/2021	SA	15/03/2021	MB	15/03/2021
C3	Issued for Use	РВН	16/03/2020	СМ	24/03/2020	MB	24/03/2020
C2	Issued for Use	PBH	21/01/2020	РВН	21/01/2020	MB	21/01/2020
C1	Issued for Use	JF	21/01/2020	GJ	21/01/2020	ND	21/01/2020
B2	Re-Issued for Approval	JF	11/06/2019	ND	11/06/2019	ND	11/06/2019
B1	Issued for Approval	ND	27/07/2018	RD	27/07/2018	JF	27/07/2018
A2	Re-Issued for Review	ND	23/04/2018	PS	23/04/2018	ND	23/04/2018
A1	Issued for Review	PS	29/11/2017	ND	29/11/2017	ND	29/11/2017
lssue Rev	Issue or Revision Description	Origin By	Date	Chk'd By	Date	App'd By	Date



### CONTENTS

REV	ISION	CHANGE NOTICES	8
GLO	SSAR	Y OF TERMS	9
Abb	reviati	ions	9
Exe	cutiv	e summary	12
1	Intro	duction	19
	1.1	Overview	19
	1.2	Purpose	21
	1.3	Report Structure	21
2	Com	parative Assessment Methodology	22
	2.1	Overview	22
	2.2	Scoping	23
		2.2.1 CA Boundaries	23
		2.2.2 Physical Attributes of Equipment	23
		2.2.3 Decommissioning Groups	24
		2.2.4 Decommissioning Options	24
	2.3	Screening	25
	2.4	Preparation Phase	25
	2.5	Evaluation Phase	25
	2.6	Emerging Recommendation, Review & Submit	
3	Com	parative Assessment – Scoping	27
	3.1	Pipeline Scoping	
	3.2	Subsea Structure Scoping	32
	3.3	Mattress & Grout Bags Scoping	
	3.4	Scoping Summary	
4	Com	parative Assessment – Screening	36
	4.1	Screening Summary	45
5	Com	parative Assessment Preparation	48
	5.1	Introduction	
	5.2	Safety Studies	
	5.3	Environmental Studies	
	5.4	Societal Studies	50
	5.5	Engineering Studies	
	5.6	Stakeholder Engagement	50
6	Com	parative Assessment – Evaluation	51



6.1	CA Out	come – Group 1 – 36" Trunk Line	51
	6.1.1	Group Characteristics	51
	6.1.2	Decommissioning Options Retained for Evaluation	52
	6.1.3	Evaluation	52
	6.1.4	Recommendation	56
6.2		come – Group 2 – Mattress Covered Short-umbilical & Associated	57
	6.2.1	Group Characteristics	57
	6.2.2	Decommissioning Options for Evaluation	58
	6.2.3	Evaluation	58
	6.2.4	Recommendation	60
6.3		come – Group 3a – Trenched Interfield Non-concrete Coated ack Pipelines ≤16"	61
	6.3.1	Group Characteristics	61
	6.3.2	Decommissioning Options for Evaluation	62
	6.3.3	Evaluation	62
	6.3.4	Recommendation	65
6.4		come – Group 3b – Trenched Interfield Non-concrete Coated Non- ack Pipelines ≤16"	67
	6.4.1	Group Characteristics	67
	6.4.2	Decommissioning Options for Evaluation	68
	6.4.3	Evaluation	68
	6.4.4	Recommendation	72
6.5		come – Group 3c – Trenched Interfield Concrete Coated Piggyback es ≤16"	73
	6.5.1	Group Characteristics	73
	6.5.2	Decommissioning Options for Evaluation	74
	6.5.3	Evaluation	74
	6.5.4	Recommendation	77
6.6		come – Group 4 – Trenched Interfield Concrete Coated Piggyback es >16"	79
	6.6.1	Group Characteristics	79
	6.6.2	Decommissioning Options for Evaluation	80
	6.6.3	Evaluation	81
	6.6.4	Recommendation	83
6.7	CA Out	come – Group 7 – Trenched & Buried Umbilical	85
	6.7.1	Group Characteristics	85
	6.7.2	Decommissioning Options for Evaluation	85



	6.7.3 E	Evaluation	86
	6.7.4 F	Recommendation	88
7	Summary of F	inal Recommendations	90
8	References		93
Арр	endix A l	Evaluation Methodology	94
	Appendix A.1	Introduction	94
	Appendix A.2	Differentiating Criteria & Approach to Assessment	95
	Appendix A.3		
Арр	endix B (	Group 1 – Detailed Evaluation results	103
	Appendix B.1	Group 1 Attributes Table	103
	Appendix B.2	Group 1 Pairwise Comparison Matrices	108
	Appendix B.3	Group 1 Results Chart	
	Appendix B.4		
	Appendix B.4.1	Safety – Personnel Offshore	
	Appendix B.4.2	Safety – Personnel Onshore	
	Appendix B.4.3	Safety – Other Users	
	Appendix B.4.4	Safety – High Consequence Events	113
	Appendix B.4.5	Safety – Residual Risk	113
	Appendix B.4.6	Safety – Overall	113
	Appendix B.4.7	Environment – Operational Marine Impact	113
	Appendix B.4.8	Environment – Legacy Marine Impact	114
	Appendix B.4.9	Environment – Fuel Use & Atmospheric Emissions	114
	Appendix B.4.10	Environment – Other Consumptions	114
	Appendix B.4.11	Environment – Seabed Disturbance	115
	Appendix B.4.12	Environment – Loss of Habitat	115
	Appendix B.4.13	Environment – Overall	115
	Appendix B.4.14	Technical – Technical Feasibility	116
	Appendix B.4.15	Societal – Fishing Industry	116
	Appendix B.4.16	Societal – Communities / Amenities	117
	Appendix B.4.17	Societal – Overall	117
	Appendix B.4.18	Economic – Short-term Costs	117
	Appendix B.4.19	Economic – Long-term Costs	117
	Appendix B.4.20	Economic – Overall	118
Арр	endix C (	Group 2 – Detailed Evaluation results	119
	Appendix C.1	Group 2 Attributes Table	119
	Appendix C.2	Group 2 Pairwise Comparison Matrices	122



Appendix C.3	Group 2 Results Chart	125
Appendix C.4	Group 2 Detailed Evaluation Discussion	126
Appendix C.4.1	Safety – Personnel Offshore	126
Appendix C.4.2	Safety – Personnel Onshore	126
Appendix C.4.3	Safety – Other Users	126
Appendix C.4.4	Safety – High Consequence Events	126
Appendix C.4.5	Safety – Residual Risk	126
Appendix C.4.6	Safety – Overall	127
Appendix C.4.7	Environment – Operational Marine Impact	127
Appendix C.4.8	Environment – Legacy Marine Impact	127
Appendix C.4.9	Environment – Fuel Use & Atmospheric Emissions	127
Appendix C.4.10	0 Environment – Other Consumptions	127
Appendix C.4.1	1 Environment – Seabed Disturbance	127
Appendix C.4.12	2 Environment – Loss of Habitat	127
Appendix C.4.1	3 Environment – Overall	127
Appendix C.4.14	4 Technical – Technical Feasibility	128
Appendix C.4.1	5 Societal – Fishing Industry	128
Appendix C.4.1	6 Societal – Communities / Amenities	128
Appendix C.4.1	7 Societal – Overall	128
Appendix C.4.18	8 Economic – Short-term Costs	128
Appendix C.4.19	9 Economic – Long-term Costs	128
Appendix C.4.20	0 Economic – Overall	128
Appendix D	Group 3a – Detailed Evaluation results	129
Appendix D.1	Group 3a Attributes Table	129
Appendix D.2	Group 3a Pairwise Comparison Matrices	135
Appendix D.3	Group 3a Results Chart	138
Appendix D.4	Group 3a Detailed Evaluation Discussion	139
Appendix D.4.1	Safety – Personnel Offshore	139
Appendix D.4.2	Safety – Personnel Onshore	139
Appendix D.4.3	Safety – Other Users	139
Appendix D.4.4	Safety – High Consequence Events	139
Appendix D.4.5	Safety – Residual Risk	140
Appendix D.4.6	Safety – Overall	140
Appendix D.4.7	Environment – Operational Marine Impact	140
Appendix D.4.8	Environment – Legacy Marine Impact	140
Appendix D.4.9	Environment – Fuel Use & Atmospheric Emissions	141
Appendix D.4.10	0 Environment – Other Consumptions	141
Appendix D.4.1	1 Environment – Seabed Disturbance	141
Appendix D.4.12	2 Environment – Loss of Habitat	



Appendix D.4.13		
Appendix D.4.14	-	
Appendix D.4.15	<b>o</b>	
Appendix D.4.16		
Appendix D.4.17		
Appendix D.4.18 Appendix D.4.19		
Appendix D.4.19 Appendix D.4.20		
	Group 3b – Detailed Evaluation results	
Appendix E.1	·	
Appendix E.2	Group 3b Pairwise Comparison Matrices	
Appendix E.3	Group 3b Results Chart	152
Appendix E.4	Group 3b Detailed Evaluation Discussion	153
Appendix E.4.1	Safety – Personnel Offshore	153
Appendix E.4.2	Safety – Personnel Onshore	153
Appendix E.4.3	Safety – Other Users	153
Appendix E.4.4	Safety – High Consequence Events	154
Appendix E.4.5	Safety – Residual Risk	154
Appendix E.4.6	Safety – Overall	154
Appendix E.4.7	Environment – Operational Marine Impact	154
Appendix E.4.8	Environment – Legacy Marine Impact	155
Appendix E.4.9	Environment – Fuel Use & Atmospheric Emissions	155
Appendix E.4.10	Environment – Other Consumptions	155
Appendix E.4.11	Environment – Seabed Disturbance	156
Appendix E.4.12	Environment – Loss of Habitat	156
Appendix E.4.13		
Appendix E.4.14	Technical – Technical Feasibility	157
Appendix E.4.15	Societal – Fishing Industry	157
Appendix E.4.16		
Appendix E.4.17	Societal – Overall	158
Appendix E.4.18		
Appendix E.4.19	5	
Appendix E.4.20	Economic – Overall	158
Appendix F	Group 3c – Detailed Evaluation results	159
Appendix F.1	Group 3c Attributes Table	159
Appendix F.2	Group 3c Pairwise Comparison Matrices	164
Appendix F.3	Group 3c Results Chart	167
Appendix F.4	Group 3c Detailed Evaluation Discussion	168



Appendix F.4.1	Safety – Personnel Offshore	168
Appendix F.4.2	Safety – Personnel Onshore	168
Appendix F.4.3	Safety – Other Users	168
Appendix F.4.4	Safety – High Consequence Events	168
Appendix F.4.5	Safety – Residual Risk	169
Appendix F.4.6	Safety – Overall	169
Appendix F.4.7	Environment – Operational Marine Impact	169
Appendix F.4.8	Environment – Legacy Marine Impact	170
Appendix F.4.9	Environment – Fuel Use & Atmospheric Emissions	170
Appendix F.4.10	D Environment – Other Consumptions	170
Appendix F.4.1	1 Environment – Seabed Disturbance	170
Appendix F.4.12	2 Environment – Loss of Habitat	170
Appendix F.4.13	B Environment – Overall	171
Appendix F.4.14	1 Technical – Technical Feasibility	171
Appendix F.4.15	5 Societal – Fishing Industry	171
Appendix F.4.16	Societal – Communities / Amenities	172
Appendix F.4.17	7 Societal – Overall	172
Appendix F.4.18	B Economic – Short-term Costs	172
Appendix F.4.19	9 Economic – Long-term Costs	172
Appendix F.4.20	) Economic – Overall	173
Appendix G	Group 4 - Detailed Evaluation results	174
Appendix G.1	Group 4 Attributes Table	174
Appendix G.2	<b>2</b> Group 4 Pairwise Comparison Matrices	179
Appendix G.3	Group 4 Results Chart	182
Appendix G.4	Group 4 Detailed Evaluation Discussion	
Appendix G.4.1	Safety – Personnel Offshore	
Appendix G.4.2	-	
Appendix G.4.3	-	
Appendix G.4.4	-	
Appendix G.4.5		
Appendix G.4.6	-	184
Appendix G.4.7	Environment – Operational Marine Impact	184
Appendix G.4.8		
	Environment – Legacy Marine Impact	185
Appendix G.4.9		
Appendix G.4.9 Appendix G.4.1	Environment – Fuel Use & Atmospheric Emissions	185
	Environment – Fuel Use & Atmospheric Emissions 0 Environment – Other Consumptions	185 185
Appendix G.4.1	Environment – Fuel Use & Atmospheric Emissions 0 Environment – Other Consumptions 1 Environment – Seabed Disturbance	185 185 185
Appendix G.4.1 Appendix G.4.1	<ul> <li>Environment – Fuel Use &amp; Atmospheric Emissions</li> <li>Environment – Other Consumptions</li> <li>Environment – Seabed Disturbance</li> <li>Environment – Loss of Habitat</li> </ul>	



Appendix G.4.15 Appendix G.4.16 Appendix G.4.17 Appendix G.4.18 Appendix G.4.19 Appendix G.4.20	Societal – Communities / Amenities Societal – Overall Economic – Short-term Costs Economic – Long-term Costs	187 187 187 187 187
Appendix H (	Group 7 – Detailed Evaluation results	
Appendix H.1	Group 7 Attributes Table	
Appendix H.2	Group 7 Pairwise Comparison Matrices	194
Appendix H.3	Group 7 Results Chart	197
Appendix H.4	Group 7 Detailed Evaluation Discussion	198
Appendix H.4.1	Safety – Personnel Offshore	
Appendix H.4.2	Safety – Personnel Onshore	
Appendix H.4.3	Safety – Other Users	198
Appendix H.4.4	Safety – High Consequence Events	198
Appendix H.4.5	Safety – Residual Risk	198
Appendix H.4.6	Safety – Overall	199
Appendix H.4.7	Environment – Operational Marine Impact	199
Appendix H.4.8	Environment – Legacy Marine Impact	199
Appendix H.4.9	Environment – Fuel Use & Atmospheric Emissions	200
Appendix H.4.10	Environment – Other Consumptions	200
Appendix H.4.11	Environment – Seabed Disturbance	200
Appendix H.4.12	Environment – Loss of Habitat	200
Appendix H.4.13	Environment – Overall	200
Appendix H.4.14	Technical – Technical Feasibility	201
Appendix H.4.15	Societal – Fishing Industry	201
Appendix H.4.16	Societal – Communities / Amenities	201
Appendix H.4.17	Societal – Overall	201
Appendix H.4.18	Economic – Short-term Costs	202
Appendix H.4.19	Economic – Long-term Costs	202
Appendix H.4.20	Economic – Overall	202



### REVISION CHANGE NOTICES

Revision	Location of Change	Brief Description of Change
C1	Throughout document	Implementation of responses to OPRED comments
C2		Minor updates
C3		Minor updates
C4		Minor updates
C5		Implementation of responses to OPRED comments
C6		Implementation of responses to OPRED comments



#### GLOSSARY OF TERMS

#### Abbreviations

AHP	Analytical Hierarchy Process
BEIS	Department for Business, Energy and Industrial Strategy
Buried	Not "exposed". Covered in sediment or deposited rock
CA	Comparative Assessment
CMS	Caister Murdoch System
CO <sub>2</sub>	Carbon Dioxide
CSV	Construction Support Vessel
Cut End	refer definition for "Pipeline End"
DWC	Diamond Wire Cutting
Exposure	Pipeline exposure occurs when the crown of the pipeline or umbilical can be seen. In this document, an exposure may be spanning or non-spanning.
FAR	Fatal Accident Rate
FishSAFE	The FishSAFE database contains a host of oil & gas structures, pipelines, and potential fishing hazards. This includes information and changes as the data are reported for pipelines and cables, suspended wellheads pipeline spans, surface & subsurface structures, safety zones& pipeline gates ( <u>www.fishsafe.eu</u> ).
FLTC	UK Fisheries Offshore Oil and Gas Legacy Trust Fund Limited
HAT	Highest Astronomical Tide
HazMat	Hazardous Material
JNCC	Joint Nature Conservation Committee
LDP	LOGGS Decommissioning Programme
LOGGS	Lincolnshire Offshore Gas Gathering System
MCDA	Multi-criteria Recommendation Analysis
MeOH	Methanol
MFE	Mass Flow Excavator
NORM	Naturally Occurring Radioactive Material
NW	North West



OGA Oil and Gas Authority

OGUK Oil and Gas UK

- OPRED Offshore Petroleum Regulator for Environment and Decommissioning
- OSPAR Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic)

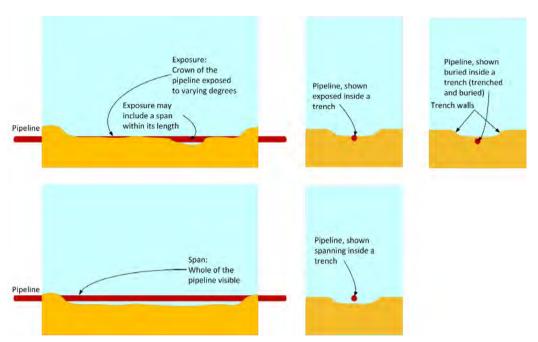
Pipeline End Point at which a pipeline is severed from infrastructure. This may be exposed or buried.

PL Pipe Line (OGA designated pipeline number)

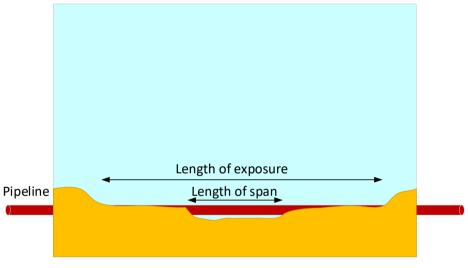
PLL Potential for Loss of Life

- Reportable span A reportable span is a significant span which meets set criteria (FishSAFE criteria) of height above the seabed and span length (10m long x 0.8m high)
- SAC Special Areas of Conservation
- SFF Scottish Fishermen's Federation
- SNS Southern North Sea
- Span Sometimes referred to as a 'freespan'. Similar to an exposure except that the whole of the section of pipeline is visible above the seabed rather than just part of it. Once the height and length dimensions meet or exceed certain criteria the span becomes a reportable span. Please also refer figure below
- Surface laid Part of pipeline (or umbilical) that was not trenched when originally installed. At installation surface laid pipeline would typically be overlain by protection and stabilisation features such as mattresses in various forms and grout bags. Such features may also be overlain by deposited rock, but this is usually at locations where the pipeline is entering a trench. Pipelines are usually "surface laid" on the final approach to an installation or pipeline manifold, for example.
- TGT Theddlethorpe Gas Terminal
- UKCS United Kingdom Continental Shelf
- UM Umbilical (as in the umbilicals UM2 and UM3)





The difference between pipeline burial, exposures, and spans<sup>1</sup>



The length of exposure may include a span length<sup>2</sup>

#### CLEAR SEABED VERIFICATION POLICY

Readers to note that OPRED's updated clear seabed verification policy now requires that nonintrusive survey methods be used where there are environmental sensitivities - this will include the 500m zones covered by this document. The appropriate method for clear seabed verification will be agreed with OPRED.

Where there are references to overtrawl/trawl sweeps within this document these should be read as understanding that non-intrusive means of clear seabed verification will now be required where there are environmental sensitivities.

In the first instance the reader is directed to the respective Decommissioning Programmes for specifics on what is proposed for verification of a clear seabed.

<sup>&</sup>lt;sup>1</sup> Trench walls may or may not be prominent



### **EXECUTIVE SUMMARY**

Chrysaor Production (U.K.) Ltd is in the process of decommissioning its operated facilities in the LOGGS area of the Southern North Sea that ceased production in August 2018. The LOGGS area consists of the manned LOGGS Gathering Station which is comprised of five bridge linked platforms and several unmanned platforms. The platform structures are expected to be fully removed.

There is approximately 573 km of pipelines associated with the LOGGS area infrastructure of which the decommissioning approach for 48 km has already been approved as part of the LDP1 Decommissioning Programme. The remaining 525 km (255.5 km gas export, 255.5 km methanol import and 14 km umbilicals) and associated mattresses and supporting material of LDP2, LDP3, LDP4 and LDP5 Decommissioning Programmes have been subjected to a Comparative Assessment (CA) to determine the preferred decommissioning strategy in compliance with the Department for Business, Energy and Industrial Strategy (BEIS) Guidance Notes ref. [**4**].

The infrastructure covered by the CA are as follows:

- LDP2: 6 pipelines: 3 gas export pipelines, 3 methanol import pipelines
- LDP3: 10 pipelines: 4 gas export pipelines, 4 methanol import pipelines, 2 umbilicals (control fluids)
- LDP4: 8 pipelines: 4 gas export pipelines, 4 methanol import pipelines
- LDP5: 2 pipelines: 1 gas export pipeline, 1 methanol import pipeline

The Decommissioning Programmes for LDP3 were approved in May 2020 and the Decommissioning Programmes for LDP5 were approved in April 2021.

The subsea infrastructure was aggregated into groups of similar characteristics and the CA process was applied to each group. The initial groups were as follows:

- Group 1 Trunkline
- Group 2 Mattress Covered Short Umbilical & Associated Pipeline
- Group 3a Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤ 16"
- Group 3b Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16"
- Group 3c Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16"
- Group 4 Trenched Interfield Concrete Coated Piggyback Pipelines > 16"
- Group 5 Subsea structures
- Group 6 Rigid spools / Flexible jumpers
- Group 7 Trenched and Buried Umbilical
- Group 8 Mattresses and Grout Bags



Group 5, 6 and 8 of LOGGS Area (LDP2 - 5) were excluded from the CA at the Scoping and Screening stages:

- Group 5 Subsea Structures were confirmed to be subject to full removal in accordance with the Decommissioning Guidelines ref. [4], and therefore not subject to further consideration within the CA.
- Group 6: Rigid Spools and Flexible Jumpers were confirmed to be excluded from the CA process as they would be treated as part of the corresponding pipeline that they are tied into.
- Group 8: Mattresses and grout bags provide stabilisation to underlying subsea infrastructure and hence would be considered as part of the infrastructure under consideration in the CA process rather than a standalone group.
  - Where infrastructure is to be removed, the associated mattresses moved to gain access to the infrastructure will be fully removed and disposed of onshore and therefore not subject to further CA consideration.
  - Where infrastructure is to be decommissioned in-situ, the associated mattresses will be left in-situ to continue to provide the necessary stabilisation to the pipelines decommissioned in-situ. Where mattresses are left in-situ, an overtrawl test will be conducted to ensure that there is no snagging risk to fishing trawl gear.
  - Where pipeline removal exposes supporting grout bags and/ or mattresses, these will be recovered where safe to do so.

The CA process followed the 'Guidelines for CA' that were published by Oil and Gas UK in 2015 ref. [6], where seven steps to the CA process were recommended. The evaluation of the decommissioning options was undertaken by qualitatively comparing the data of five criteria using a pair-wise methodology.

The decommissioning options considered in the CA process for each pipeline grouping were as follows:

- 1. Decommission in-situ minimum intervention (Physical intervention at pipeline ends only)
  - a. Removal of pipeline ends and rock placement/ burial of cut ends only
  - b. As 1a but also the introduction of a corrosive substance to accelerate decomposition
- 2. Decommission in-situ minor intervention (Physical intervention at pipeline ends and remediation of snagging hazards only)
  - a. Removal of pipeline ends and rock placement over cut ends and all exposed pipeline sections
  - b. Removal of pipeline ends and re-trench and burial of all cut ends and exposed pipeline sections
- 3. Decommission in-situ major intervention (Physical intervention at pipeline ends and remediation of full pipeline length)
  - a. Removal of pipeline ends and rock cover over the full pipeline
  - b. Removal of pipeline ends and re-trenching and burial of the full pipeline length



- 4. Partial removal cut and lift (Physical intervention at pipeline ends and removal by cut and lift of all pipeline exposure)
  - a. Exposed pipeline sections removed by cut and lift and rock cover over exposed pipeline ends
- 5. Full removal reverse installation
  - a. Full removal by reverse reel
  - b. Full removal by reverse s-lay
- 6. Full removal cut and lift
  - a. Full pipeline removal by cut and lift techniques

Options 1b, 2b, 3a, 3b were excluded from the evaluation phase for all the pipeline groupings:

- Option 1b: Accelerated decomposition was screened out of all options as the concept is unproven and the impact of potential chemical agents into the marine environment is not understood and cannot be quantified.
- Option 2b: Burial of exposed ends and pipeline sections is not considered a permanent solution for the pipelines in this location due to the dynamic seabed movement, rendering a burial solution vulnerable to unburial over time.
- Option 3a: Rock cover over the full pipeline length is not considered a feasible solution as large magnitude rock cover is considered detrimental to the free movement of sand in the protected area.
- Option 3b: Reburial of the full pipeline length is not considered a permanent solution due to the dynamic seabed movement, rendering a burial solution vulnerable to unburial over time.

The pipelines and umbilicals being decommissioned are located within the North Norfolk Sandbanks and Saturn Reef and cross through the Inner Dowsing Race Bank and North Ridge Special Area of Conservation. Both areas have been designated for the protections of two European Annex 1 habitats. These habitats are 'Sandbanks which are slightly covered by sea water all the time' and 'Reefs', the biogenic reef Sabellaria spinulosa. The Joint Nature Conservation Committee (JNCC) has classified the North Norfolk Sandbanks and North Ridge as representing good 'conservation' examples of these habitats. Rock cover in this area is therefore restricted to situations where safety considerations deem this action necessary and the environmental impact considered insignificant.

The only areas where physical decommissioning could be taking place would be the North Norfolk Sandbanks and Saturn Reef SAC and the Southern North Sea SAC further to the north.

#### CA Evaluation and Recommendations for each pipeline group

#### Group 1: 36" Trunkline (PL454)

The emerging recommendation for the 118 km 36" trunk line is Option 1a: to decommission the gas export pipeline in-situ with minimum intervention. This would require disconnection and removal of the pipeline connected to the LOGGS PP platform and at the tee locations with local rock placement at the cut pipeline ends only. The remaining pipeline, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



The larger removal scopes (Option 4 and Option 6) would result in greater safety exposure for personnel and greater environmental impact than Option 1a due to the extended offshore operations, while Option 2a requires significant rock cover leading to habitat change making it less preferred. The larger removal scopes are also more technically challenging due to the scale of the operations. The larger removal scopes would also have greater impact societally due to the disruption to the fishing industry from the removal and the use of landfill capacity for the concrete pipeline coating.

## Group 2: NW Bell – Mattress Covered Short Umbilical & Associated Pipeline (PL1690, PL1691 and PLU4177 (UM3))

The emerging recommendation for the Mattress Covered Short Umbilical & Associated Pipeline is that both the full removal or the leave in-situ option may be progressed. Should the leave in-situ option be progressed, the remaining pipelines and umbilical, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipelines (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

## Group 3a: Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤ 16" (PL1694, PL1695, PL2234, PL2235, PL2236, PL2237)

The emerging recommendation for the Trenched Interfield Non-concrete Coated Piggyback Pipelines  $\leq 16$ " is Option 1a: to decommission the lines in-situ with minimum intervention. This comprises removal of the ends of the pipelines and placing spot rock cover at the cut ends only. The remaining pipelines, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipelines and umbilical (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

The larger removal scopes (Option 5a and Option 6) would result in greater safety exposure for personnel and greater environmental impact than Option 1a from the longer offshore durations and the MFE deburial of the lines. The larger removal scopes are also more technically challenging due to the scale of the operations and the reverse reeling of the piggybacked, rigid lines. The larger removal scopes would also have greater impact societally due to the disruption to the fishing industry from the removal and the use of landfill capacity for the pipeline coatings.

## Group 3b: Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16" (PL455)

The emerging recommendation for the 118 km 4" MeOH line is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This would require disconnection and removal of the pipeline connected to the LOGGS PP platform and at the tee locations with local rock placement at the cut pipeline ends in all cases. The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipeline, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

The larger removal scopes (Option 5a and Option 6) would result in greater safety exposure for personnel and greater environmental impact than the other options from the longer offshore durations and the MFE deburial of the line. The larger removal scopes are also more technically challenging due to the scale of the operations / integrity concerns surrounding reverse reeling. The



larger removal scopes would also have greater impact societally due to the disruption to the fishing industry from the removal and the use of landfill capacity for the pipeline coating.

## Group 3c: Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16" (PL456, PL457, PL460, PL461, PL470, PL471, PL1091, PL1092)

The emerging recommendation for the Trenched Interfield Concrete Coated Piggyback Pipelines  $\leq$  16" is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This comprises removal of the ends of the pipelines and placing spot rock cover at the cut ends in all cases. The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left insitu (Option 1a). The remaining pipelines, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipelines (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

The large removal scope (Option 6) would result in greater safety exposure for personnel and greater environmental impact than the other options from the longer offshore durations and the MFE deburial of the lines. The larger removal scope is also more technically challenging due to the scale of the operations. The larger removal scope would also have greater impact societally due to the disruption to the fishing industry from the removal and the use of landfill capacity for the concrete pipeline coatings.

## Group 4: Trenched Interfield Concrete Coated Piggyback Pipelines > 16" (PL458, PL459, PL1093, PL1094, PL2107 and PL2108)

The emerging recommendation for the Trenched Interfield Concrete Coated Piggyback Pipelines > 16" is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This comprises removal of the ends of the pipelines and placing spot rock cover at the cut ends in all cases. The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left insitu (Option 1a). The remaining pipelines, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipelines (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

The large removal scope (Option 6) would result in greater safety exposure for personnel and greater environmental impact than the other options from the longer offshore durations and the MFE deburial of the lines. The larger removal scope is also more technically challenging due to the scale of the operations. The larger removal scope would also have greater impact societally due to the disruption to the fishing industry from the removal and the use of landfill capacity for the concrete pipeline coatings.

#### Group 7: Trenched and Buried Umbilical (PLU4178 (UM2))

The emerging recommendation for the Trenched and Buried Umbilical is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This comprises removal of the ends of the umbilical and placing spot rock cover at the cut ends in all cases. The single 11 m exposure will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the



exposure will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining umbilical, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning umbilical (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

The large removal scope (Option 5a) would result in greater safety exposure for personnel and greater environmental impact than the other options from the longer offshore durations and the MFE deburial of the line. The larger removal scope is also more technically challenging due to the scale of the operations and the deburial required. The larger removal scope would also have greater impact societally due to the disruption to the fishing industry from the removal and the use of landfill capacity for polymers from the umbilical.

The table below contains a summary of the CA recommendation for all groups.

Group	Infrastructure Type	Decommissioning Recommendation
1	Trunk Line	Option 1a – Leave In-situ (Minimum Intervention)
2	Mattress Covered Short Umbilical & Associated Pipeline	Either Option 6 – Full Removal or Option 1a – Leave In-situ (Minimum Intervention may be progressed
3а	Trenched¹ Interfield Non-concrete Coated Piggyback Pipelines ≤ 16"	Option 1a – Leave In-situ (Minimum Intervention)
3b	Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16"	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a – Leave In-situ (Minimum Intervention may be progressed
Зс	Trenched¹ Interfield Concrete Coated Piggyback Pipelines ≤ 16"	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or 1a – Leave In-situ (Minimum Intervention may be progressed
4	Trenched <sup>1</sup> Interfield Concrete Coated Piggyback Pipelines > 16"	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a – Leave In-situ (Minimum Intervention may be progressed
5	Subsea Structures	Full Removal
6	Rigid Spools / Flexible Jumpers	Treated as part of the relevant pipelines group
7	Trenched and Buried Umbilical	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a – Leave In-situ (Minimum Intervention may be progressed
8	Mattresses and Grout Bags	Leave In-situ where providing pipeline stabilisation



<sup>1</sup> Trenched pipelines are those that were installed in a trench and buried. Varying degrees of exposures, crossings and rock placement occur along these pipelines.



### 1 Introduction

#### 1.1 Overview

The Lincolnshire Offshore Gas Gathering System (LOGGS), operated by Chrysaor Production (U.K.) Ltd. (Chrysaor), is in the Southern North Sea (SNS) and located near other Chrysaor operated gas areas: Viking and Caister Murdoch System (CMS). The Chrysaor operated SNS assets and the Theddlethorpe Gas Terminal (TGT) ceased production in August 2018 and are in the process of being prepared for decommissioning.

The LOGGS complex commenced operations in 1988. The facility received natural gas from the Vfields (North Valiant, South Valiant, Vangard and Vulcan), Vampire, Viscount, Valkyrie, the Saturn Unit (Mimas, Saturn and Tethys), the Jupiter area natural gas fields (Ganymede, Callisto, Europa and NW Bell) as well as third party fields. Natural gas from the Viking, Victor, Vixen and Victoria fields was also transported through the LOGGS facilities. Gas from all these fields was comingled at the LOGGS complex and transported to TGT via the LOGGS to TGT trunkline for processing.

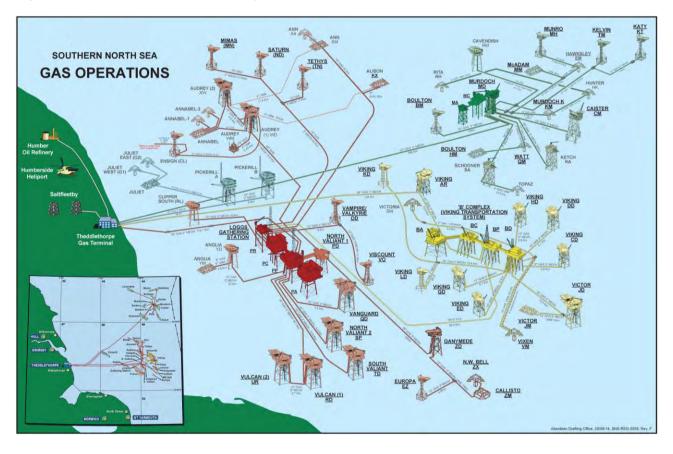


Figure 1-1 illustrates the SNS field layout and infrastructure.

Figure 1-1: Chrysaor SNS Gas Operations, incl. LOGGS Area

Decommissioning of the SNS infrastructure hubs and satellites is being carried out in a phased manner. The initial phase of decommissioning works commenced in the Viking Area followed by the LOGGS area ahead of the CMS Area. The sequencing of activities within the phased model is subject to change with the potential for decommissioning works to be undertaken in all three areas simultaneously depending on campaign related cost efficiencies and economic and commercial factors.



LDP1 (Vulcan UR, Vampire OD and Viscount VO and associated pipelines), LDP3 (Ganymede ZD Jacket, Europa EZ, Callisto ZM and NW Bell ZX & Associated Infield Pipelines), LDP3b (Ganymede ZD Topside), and LDP5 (LOGGS PR, LOGGS PC, LOGGS PP, LOGGS PA, North Valiant PD, & Associated Pipelines) Decommissioning Programmes have been approved by the Secretary of State and Chrysaor is now preparing four decommissioning programmes for the remaining LOGGS Area (LDP2 and LDP4), the grouping of which has been based on asset partnerships (LDP2, LDP3, LDP4), and decommissioning methodology (LDP5). The numbering of the LOGGS Decommissioning Programmes is not an indication of the order in which the activity is to be completed.

The majority of LOGGS infrastructure and pipelines are located within the North Norfolk Sandbanks and Saturn Reef Special Area of Conservation (SAC) which is designated for 'sandbanks which are slightly covered by seawater all of the time' and the presence of biogenic reefs (*Sabellaria spinulosa*) (JNCC, 2016). The process of designation of the North Norfolk Sandbanks and Saturn Reef as a SAC started in 2007, when the LOGGS complex was already established and operational. The Southern North Sea SAC has also been identified as an area of importance for the Annex II species the harbour porpoise.

The LOGGS assets included in LDP2, LDP3, LDP4, LDP5 are highlighted in red in the schematic in Figure 1-2. LDP3 and LDP5 were approved in 2020 and 2021 respectively.

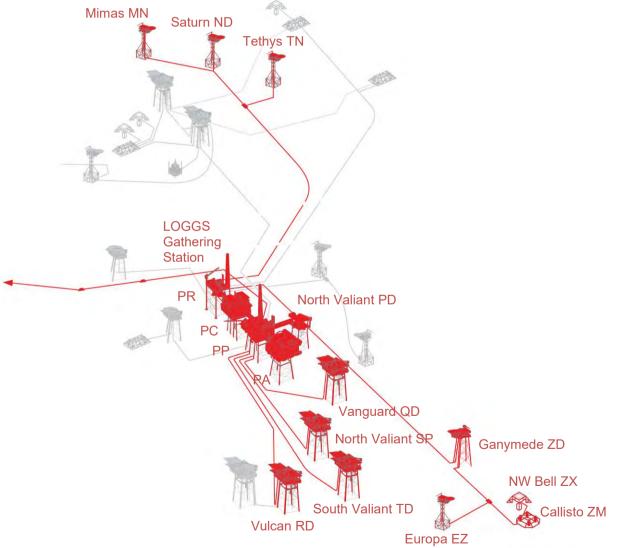


Figure 1-2: Chrysaor LDP2, LDP3, LDP4, LDP5 Decommissioning Programmes Assets in the LOGGS Area



#### 1.2 Purpose

The purpose of this document is to present a Comparative Assessment (CA) for the LOGGS Area (LDP2 - 5) subsea infrastructure in support of the decommissioning programmes. The document describes the field infrastructure, the decommissioning options considered, the overall CA process, the evaluation method used during the evaluation phase of the CA, and the emerging recommendations obtained from the CA process.

#### 1.3 Report Structure

This CA Report contains the following:

- Section 1 Introduction; this section provides an overview of the LOGGS Area and purpose of this document
- Section 2 CA Methodology; the seven-step process, as recommended within OGUK's guidelines for CA, and the specific approach taken is explained herein
- Section 1 Scoping Outcome; the results of the initial scoping exercise are summarised here to establish the infrastructure groups considered within the remainder of the document
- Section 4 Screening Outcome, the results of the option screening exercise are summarised here to detail the decommissioning options considered for each group and these that were discarded and retained
- Section 5 CA Preparation; a description of the studies conducted to inform the evaluation is provided here
- Section 6 CA Evaluation Results; organised by group, the results of the evaluation phase are presented. For each group, analysis was performed within a workshop(s) by an informed and expert group
- Section **7** Summary and recommendations; the emerging recommendations from the analysis performed for each group is summarised here
- Section 8 References
- Appendix A Pairwise Methodology Explanation; details of the analysis method are provided.
- Appendix B Detailed Group 1 evaluation results including attributes tables and pairwise comparisons
- Appendix C Detailed Group 2 evaluation results
- Appendix D Detailed Group 3a evaluation results
- Appendix E Detailed Group 3b evaluation results
- Appendix F Detailed Group 3c evaluation results
- Appendix G Detailed Group 4 evaluation results
- Appendix H Detailed Group 7 evaluation results



### 2 Comparative Assessment Methodology

#### 2.1 Overview

The LOGGS Decommissioning CA for LDP2-LDP5 followed the CA process as recommended by the Oil and Gas UK (OGUK) Guidelines ref. [6]. The guidelines recommend a 7-stage process that was followed and is summarised in Table 2-1.

Step Title	Scope	Commentary
Scoping	Identify pipeline groupings and boundaries of CA (physical and phase). Determine appropriate CA method. Establish assessment criteria. Identify stakeholders.	Preliminary Inventory and Scoping Report prepared for all LOGGS Area equipment. Criteria reviewed and agreed. CA methodology and criteria established for screening by mid-2017. Stakeholders identified and mapped.
Screening	Determine all potential decommissioning options. Review and screen out impractical options.	Screening workshops held Q3 2017 for LOGGS Area (LDP2 – 5). Review of all options available, unfeasible options were screened out. Options that were feasible were carried into CA evaluation phase. CA methodology and criteria were reviewed following screening to ensure that the option evaluation was effectively supported.
Preparation	Undertake technical, safety, environmental studies. Stakeholder engagement.	Section 2.4 highlights the relevant studies undertaken and provides a reference to the study reports listed in Section 5. Continued stakeholder engagement as part of the greater SNS-wide decommissioning campaign.
Evaluation	Evaluate the options using the chosen CA methodology.	Chrysaor conducted three internal CA workshops as part of the evaluation phase. The first, in August 2017, identified areas where further information was needed to make a recommendation (recycling to the preparation phase). A second internal workshop was held in September 2017 where the results of recent study work was used to discuss and update the recommendation tool.
		Following a project hiatus in 2018, a further, final evaluation workshop was held in Q1 2019 where the emerging recommendations detailed in this document were obtained.
Recommendation	Create recommendation in the form of narrative supported by charts explaining key trade-offs.	The workshops conducted in the Evaluation stage produced emerging recommendations that Chrysaor prepared for presentation to the stakeholders.
Review	Review the emerging recommendations with stakeholders.	This report will be issued to internal stakeholders for review. Recommendations will be shared with external stakeholders. Comments raised will be included in the report prior to formal submission to OPRED.
Submit	Submit to OPRED as part of/alongside Decommissioning Programme	This report will be submitted to OPRED with the LDP2-LDP5 Decommissioning Programmes.

Table 2-1:	CA	Process	and	Status	Overview
------------	----	---------	-----	--------	----------



Each of these steps is described briefly in the following sub-sections.

#### 2.2 Scoping

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

- Boundaries for CA
- Physical attributes of equipment
- Decommissioning options

These are addressed in the following sub-sections.

#### 2.2.1 CA Boundaries

The boundaries (battery limits) adopted by Chrysaor for the subsea infrastructure of the LOGGS Area are detailed below. Inclusions are as follows:

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

Exclusions are as follows:

- Platform riser tie-in flanges that would be removed as part of the platform removals: (LOGGS PP, LOGGS PR, North Valiant PD, Mimas MN, Saturn HD, Tethys TN, Vanguard QD, North Valiant SP, South Valiant TD, Vulcan RD, Ganymede ZD, Europa EZ)
- Subsea tie-in flanges that would be removed as part of the manifold/ tee subsea structure removal: (Europa Sinope Tee, NW Bell ZX, Callisto ZM, Saturn In-Line Tee, Tethys Tee and LOGGS Tees)
- TGT to LOGGS 36" Trunk line and TGT to LOGGS 4" MeOH line from TGT to the low water mark as this is outside the boundaries of the Offshore Decommissioning Programme and will be considered separately as part of the onshore TGT decommissioning strategy.

#### 2.2.2 Physical Attributes of Equipment

All subsea infrastructure within the scope of the LOGGS Area LDP2 - 5 is summarised in Section 1 along with the physical attributes that define the equipment. Attributes considered include the following:

- 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
- Protection & Support
  - -Fronded protection mattresses
  - Concrete protection mattresses
  - -Concrete blocks
  - -Grout bags (25 kg, 1Te)
  - Deposited rock

#### 2.2.3 Decommissioning Groups

Once the equipment to be decommissioned and their physical attributes are captured, they are grouped appropriately into common attribute classifications to allow the CA process to be streamlined.

As part of the scoping activity, those decommissioning groups that are required to be fully removed are identified. In addition, any decommissioning groups that may have the potential to be left in-situ are also specified according to the OPRED Guidelines ref. [4].

For the subsea infrastructure of the LOGGS Area LDP2 - 5, the decommissioning groups, along with a list of each individual item that makes up the population of those groups, and the assessment whether these items are to be fully removed or subject to full comparative assessment is summarised in section 1.

#### 2.2.4 Decommissioning Options

With the decommissioning groups established, all potential decommissioning options for each of the groups are identified. The base case for all groups is full removal as per the OPRED Guidelines ref. [4] and it is only those decommissioning groups where default full removal is not considered to be the clear optimum solution, that alternative decommissioning options are considered.

Alongside full removal options, the following decommissioning scenarios should be considered as specified in the OPRED Guidelines ref. [4]:

- Re-use
- Minimal Intervention i.e. exposed end removal
- Minor Intervention i.e. exposed end / spans / exposure removal
- Major Intervention i.e. full re-trench or rock placement



The decommissioning options proposed for those groups where full removal was not considered the clear optimum solution, are summarised in section 4.

#### 2.3 Screening

The CA screening phase considers the identified decommissioning options for each group being fully comparatively assessed against the recommended primary criteria, as defined within the CA Guidelines ref. [6]. These are:

- Safety
- Environmental
- Technical
- Societal
- Economic

LOGGS Area LDP2 – 5 the screening phase was carried out during a series of workshops held in 2017 and updated in 2019. The methodology adopted is summarised below:

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

The assessment was performed using a coarse assessment method, as recommended in the CA Guidelines ref. [6]. A summary of the outcomes obtained from the screening activity are summarised in section 4.

#### 2.4 Preparation Phase

Once the decommissioning options remaining after the screening phase were identified, detailed studies and analyses were identified to provide information to support the evaluation phase of the CA. The studies identified and conducted are detailed in section 5.

The studies produced were identified early in the CA process and were supplemented by additional work identified during the screening phase of the CA.

#### 2.5 Evaluation Phase

The evaluation phase of the CA is where the decommissioning options remaining after the screening phase for each group were assessed against each other. Evaluation was conducted according to the OGUK Guidelines ref. [6] and employed the data obtained during the preparation phase as described above.

The evaluation phase incorporated a number of workshops attended by the decommissioning project team, where each of the remaining decommissioning groups was assessed individually, with options scored against five key criteria and their respective sub-criteria (see **Appendix A.2** for detailed criteria descriptions).

Weighting of the individual criteria was removed from the assessment to avoid subjectivity and bias when determining the preferred decommissioning options. Environmental data including seabed



disturbance, habitat loss and underwater noise was equally considered when compared to other options in line with the conservation objectives and sensitivities of the protected areas.

Options were scored against each other on a pair-wise basis, using the qualitative terms Neutral, Stronger, Much Stronger, Very Much Stronger, Weaker, Much Weaker and Very Much Weaker.

By this means the assessment team was able to debate the strengths and weaknesses of each option at the sub-criteria level and reach a consensus without having to apply quantitative scoring. The preferences were processed within the worksheet to produce a percentage split for each sub-criterion and this was cumulatively displayed to provide a score for each option.

The main criteria have been weighted equally. Given the differing, and sometimes conflicting, considerations that are represented by the criteria it was considered appropriate that they be weighted equally to one another to avoid favouring any particular aspect or group. Similarly, the sub-criteria have been weighted neutrally within their primary criterion.

More detail of the methodology adopted for the evaluation phase of the LOGGS Area LDP2 -5 is detailed in **Appendix A**. The outcomes obtained from the evaluation phase are detailed in section 6.

#### 2.6 Emerging Recommendation, Review & Submit

The outcomes obtained from the evaluation phase were presented as emerging recommendations for each group to OPRED and key stakeholders followed by discussion. Formal minutes of these discussions were taken and any relevant feedback captured.



### 3 Comparative Assessment – Scoping

All LOGGS Area infrastructure from Decommissioning Programmes LDP2 through LDP5, being considered under this comparative assessment is listed in Table 3-1 for Pipelines, Table 3-2 for Subsea Structures and

		Mattre	esses <sup>1</sup>		Grout		Selected Decommissioning				
DP	Concrete	Frond	Linklok	Unknown	Bags <sup>1</sup> (in meters)	Associated Pipeline	Selected Decommissioning Group	Justification			
	11	20	0	0	2	PL2234 / PL2235					
LDP2	44	15	0	0	3	PL2236 / PL2237					
	12	1	1	0	4	PL2107 / PL2108					
	31	8	0	0	0	PL1091 / PL1092		Mattresses of all types and grout bags are grouped together			
	4	0	0	0	1	PL1093 / PL1094	Group 8 – Mattresses and Grout Bags				
	21	13	0	0	0	PL1690 / PL1691					
LDP3	15	28	0	0	0	PL1694 / PL1695					
	8	1	0	0	0	PLU4178 (UM2)					
	18	6	0	0	2	PLU4177(UM3)					
	0	0	Unknown	0	0	PL456 / PL457					
LDP4	0	0	0	0	7	PL458 / PL459					
	0	0	0	0	10	PL460 / PL461					
	0	0	0	0	9	PL470 / PL471					
LDP5	0	0	1	1	0	PL454 / PL455					
Total	164	91	3	1	38		•	·			

Table 3-3: Mattress & Grout Bag Scoping

Note 1: LDP3 and LDP5 were approved in 2020 and 2021 respectively.

<sup>1</sup> Quantities of mattresses and grout bags are detailed in the LOGGS Pipeline Burial and Stabilisation Material Report ref. [9]. The quantities in this report are based on observed historical inspection data, and are also referenced in the LOGGS Environmental Appraisal.The



decommissioning programmes reference the quantities found in the original as-built drawings. for Mattresses and Grout Bags. These tables are a summary of the scoping process conducted. They show the key characteristics of the equipment and the decommissioning group that they have been grouped together in along with the associated justification. The burial profiles for each pipeline are provided in the appendices of the relevant Decommissioning Programmes.

#### 3.1 Pipeline Scoping

		Description	CA Battery Limits		Diameter Longth (m)			Selected	1	
DP	ID	Description	From	То	(inches)	Length (m)	Exposure (m)	Decommissioning Group	Justification	
	PL2107	Saturn ND to LOGGS PR 14" Gas Line	Saturn ND	LOGGS PR	14 Note 1	43,240	14		Gas export pipeline diameter greater than 16"	
		LOGGS PR to Saturn					Piggyback to	Group 4 – Trenched Interfield Concrete Coated	Gas export pipeline has concrete coating	
	PL2108	ND 3" MeOH	LOGGS PR	Saturn ND	3	43,250	PL2107	Piggyback Pipelines > 16"	Main line has associated methanol line in piggyback arrangement	
LDP2	PL2234	Tethys TN to Saturn ND / LOGGS PR Tee 10" Gas Line	Tethys TN	Saturn ND / LOGGS PR Tee	10	3,877	18		Gas export pipeline diameter	
		LOGGS PR / Saturn	Saturn ND /				Piggyback to	Group 3a – Trenched	less than 16"	
	PL2235	ND Tee to Tethys TN 3" MeOH	LOGGS PR Tee	Tethys TN	3	3,878	Plggyback to PL2234	Interfield Non-concrete Coated Piggyback	Gas export pipeline has no concrete coating	
	PL2236	Mimas MN to Saturn ND 10" Gas Line	Mimas MN	Saturn ND	10	13,603	7	Pipelines ≤ 16"	Gas export line has associated methanol line in piggyback arrangement	
	PL2237	Saturn ND to Mimas MN 3" MeOH Line	Saturn ND	Mimas MN	3	13,606	Piggyback to PL2236			



22			CA Battery Limits		Diameter		-	Selected	
DP	ID	Description	From	То	(inches)	Length (m)	Exposure (m)	Decommissioning Group	Justification
	PL1091	Callisto ZM to Ganymede ZD 12" Gas Line	Callisto ZM	Ganymede ZD	12	14,300	132	Group 3c – Trenched	Gas export pipeline diameter less than 16" Gas export pipeline has
	PL1092	Ganymede ZD to Callisto ZM 3" MeOH Line	Ganymede ZD	Callisto ZM	3	14,300	Piggyback to PL1091	Interfield Concrete Coated Piggyback Pipelines ≤ 16"	concrete coating Gas export line has associated methanol line in piggyback arrangement
	PL1093	Ganymede ZD to LOGGS PR 18" Gas Line	Ganymede ZD	LOGGS PR	18	19,501	75	Group 4 – Trenched	Gas export pipeline diameter greater than 16" Gas export pipeline has
	PL1094	LOGGS PR to Ganymede ZD 3" MeOH	LOGGS PR	Ganymede ZD	3	19,492	Piggyback to PL1093	Interfield Concrete Coated Piggyback Pipelines > 16"	concrete coating Gas export line has associated methanol line in piggyback arrangement
LDP3	PL1690	NW Bell ZX to Callisto ZM 8" Gas Line	NW Bell ZX	Callisto ZM	8	80	8	Group 2 – Mattress Covered Short Umbilical &	Linco are very chart in length
	PL1691	Callisto ZM to NW Bell ZX 3" MeOH Line	Callisto ZM	NW Bell ZX	3	80	Connected to PL1690	Associated Pipeline	Lines are very short in length
	PL1694	Europa EZ to Callisto ZM / Ganymede ZD Tee 12" Gas Line	Europa EZ	PL1091 Tee	12	4,498	4	Group 3a – Trenched	Gas export pipeline diameter less than 16" Gas export pipeline has no
	PL1695	Ganymede ZD / Callisto ZM Tee to Europa EZ 3" MeOH Line	PL1091 Tee	Europa EZ	3	4,500	Piggyback to PL1694	Interfield Non-concrete Coated Piggyback Pipelines ≤ 16"	concrete coating Gas export line has associated methanol line in piggyback arrangement
	PLU4178 (UM2)	Ganymede ZD to Callisto ZM Umbilical	Ganymede ZD	Callisto ZM	4.3	14,000	11	Group 7 – Trenched and Buried Umbilical	Significant length umbilical
	PLU4177 (UM3)	Callisto ZM to NW Bell ZX Umbilical	Callisto ZM	NW Bell ZX	4.3	80	0	Group 2 – Mattress Covered Short Umbilical & Associated Pipeline	Lines are very short in length



22	10		CA Batt	ery Limits	Diameter		<b>-</b>	Selected	luce tifice et i e re	
DP	ID	Description	From	То	(inches)	Length (m)	Exposure (m)	Decommissioning Group	Justification	
	PL456	Vanguard QD to LOGGS PP 10" Gas Line	Vanguard QD	LOGGS PP	10	7,548	102		Gas export pipeline diameter less than 16"	
								Group 3c – Trenched Interfield Concrete Coated	Gas export pipeline has concrete coating	
	PL457	LOGGS PP to Vanguard QD 3" MeOH Line	LOGGS PP	Vanguard QD	3	7,510	Piggyback to PL456	Piggyback Pipelines ≤ 16"	Gas export line has associated methanol line in piggyback arrangement	
	PL458	Vulcan RD to LOGGS PP 18" Gas Line	Vulcan RD	LOGGS PP	18	16,147	253	Onum 4. Trus had	Gas export pipeline diameter greater than 16"	
		Line						Group 4 – Trenched Interfield Concrete Coated	Gas export pipeline has concrete coating	
LDP4	PL459	LOGGS PP to Vulcan RD 3" MeOH Line	SPP to Vuican LOGGS PP Vuican PD 3 16 100 Piggyback to	Piggyback Pipelines > 16"	Gas export line has associated methanol line in piggyback arrangement					
	PL460	South Valiant TD to LOGGS PP 10" Gas Line	South Valiant TD	LOGGS PP	10	10,663	120		Gas export pipeline diameter	
	PL461	LOGGS PP to South Valiant TD 3" MeOH Line	LOGGS PP	South Valiant TD	3	10,662	Piggyback to PL460	Group 3c – Trenched Interfield Concrete Coated	less than 16" Gas export pipeline has	
	PL470	North Valiant SP to LOGGS PP 10" Gas Line	North Valiant 2 SP	LOGGS PP	10	4,395	130	Piggyback Pipelines ≤ 16"	concrete coating Gas export line has associated methanol line in piggyback	
	PL471	LOGGS PP to North Valiant SP 3" MeOH Line	LOGGS PP	North Valiant 2 SP	3	4,395	Piggyback to PL21070470		arrangement	
	PL454	LOGGS PP to TGT 36" Gas	LOGGS PP	Shore approach low water line	36	118,382	28,741	Group 1 – Trunk Line	Pipeline is large diameter trunk line	
LDP5	PL455	TGT to LOGGS PP 4" MeOH Line	TGT	LOGGS PP	4	118,382	338	Group 3b – Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16"	Pipeline is long length, small diameter methanol line	

Table 3-1: Pipeline Scoping



- Note 1: Whilst this group is for pipelines greater than 16" in diameter, it was agreed to include PL2107 in this group as, once the concrete coating is included, the overall diameter is greater than 16".
- Note2: LDP3 and LDP5 were approved in 2020 and 2021 respectively.



#### 3.2 Subsea Structure Scoping

DP	ltem	Description	Selected Decommissioning Group	Justification
LDP2	Tethys / Saturn Tee Structure	Tee Protection Structure on pre-installed "Tethys" tee for pipeline tie-ins from Tethys TN.		
	Subsea Valve Assembly (Tethys Tee)	Valve assemblies pre-installed on Tethys pipelines for Saturn pipeline tie-ins via Tethys Tee.		
	N.W. Bell WHPS	Wellhead protection Structure (WHPS) protecting the N.W. Bell wellhead and manifold.		
	Callisto ZM WHPS	WHPS protecting the Callisto ZM wellhead and manifold.		Subsea structures of all types are grouped together
LDP3	Subsea Pigging	Subsea pigging skid installed to allow Europa EZ pipeline tie into	Gloup 5 – Subsea Siluciules	
	Skid (Sinope Tee)	the Callisto Pipelines via Sinope Tee.		
	ZM Tee Structure	Tee Protection Structure on pre-installed "Sinope" tees for pipeline		
	(Sinope Tee)	tie-ins from Europa EZ.		
LDP4		No subsea structures associated with LDP4.		
LDP5	Tee Structures (Subsea Housing No.1 & 2)	2 Tee Protection Structures on pre-installed subsea tees for possible future pipeline tie-ins.		

Table 3-2: Subsea Structure Scoping

Note 1: LDP3 and LDP5 were approved in 2020 and 2021 respectively.



#### 3.3 Mattress & Grout Bags Scoping

		Mattre	sses <sup>1</sup>		Grout		Selected Decommissioning	Justification
DP	Concrete	Frond	Linklok	Unknown	Bags <sup>1</sup> (in meters)	Associated Pipeline	Group	
	11	20	0	0	2	PL2234 / PL2235		
LDP2	44	15	0	0	3	PL2236 / PL2237		
	12	1	1	0	4	PL2107 / PL2108		
	31	8	0	0	0	PL1091 / PL1092		Mattresses of all types and grout bags are grouped together
	4	0	0	0	1	PL1093 / PL1094	Group 8 – Mattresses and Grout Bags	
LDP3	21	13	0	0	0	PL1690 / PL1691		
LDF3	15	28	0	0	0	PL1694 / PL1695		
	8	1	0	0	0	PLU4178 (UM2)		
	18	6	0	0	2	PLU4177(UM3)		
	0	0	Unknown	0	0	PL456 / PL457		
LDP4	0	0	0	0	7	PL458 / PL459		
	0	0	0	0	10	PL460 / PL461		
	0	0	0	0	9	PL470 / PL471		
LDP5	0	0	1	1	0	PL454 / PL455		
Total	164	91	3	1	38			

Table 3-3: Mattress & Grout Bag Scoping

Note 1: LDP3 and LDP5 were approved in 2020 and 2021 respectively.

<sup>1</sup> Quantities of mattresses and grout bags are detailed in the LOGGS Pipeline Burial and Stabilisation Material Report ref. [9]. The quantities in this report are based on observed historical inspection data, and are also referenced in the LOGGS Environmental Appraisal. The decommissioning programmes reference the quantities found in the original as-built drawings.



#### 3.4 Scoping Summary

Grouping similar types of pipelines together resulted in the following decommissioning groups:

- Group 1 Trunkline
- Group 2 Mattress Covered Short Umbilical & Associated Pipeline
- Group 3a Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤ 16"
- Group 3b Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16"
- Group 3c Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16"
- Group 4 Trenched Interfield Concrete Coated Piggyback Pipelines > 16"
- Group 7 Trenched and Buried Umbilical

Note on trenching: When the pipelines were originally installed, they would have been trenched and backfilled to suit design requirements. If the depth of cover did not suit design requirements, it would have been remediated at the time. The data to support this assumption is not available, but usually they are mechanically backfilled for these types of pipelines. Inspection data evaluated the burial profile of the pipelines thereafter.

All subsea structures and mattresses & grout bags were grouped together respectively resulting in the following additional groups:

- Group 5 Subsea Structures
- Group 8 Mattresses and Grout Bags

Group 8, Mattresses and Grout Bags, were taken out of the CA. Where these need to be moved to gain access to underlying infrastructure they will be fully removed and disposed of onshore. Where these are providing stabilisation of pipelines or sections of pipelines that will be left in-situ, no further action is required.

• Group 6 – Rigid Spools / Flexible Jumpers

A group was added for the rigid spools and flexible jumpers associated with the pipelines and umbilicals. These items were treated as part of the pipelines to which they were connected and not assessed as separate items within the remainder of the CA.

The pipeline groups were subject to comparative assessment in accordance with OPRED Guidance Note requirements to determine the proposed decommissioning outcome. The assessment is summarised in Table 3-4.

Group	Infrastructure Type	Basis for Group	Scoping Recommendation
1	Trunk Line	Long large diameter pipeline. This pipeline is significantly dissimilar to all other field infrastructure.	Subject to full CA
2	Mattress Covered Short Umbilical & Associated Pipeline	Short step out. These lines were considered to be significantly dissimilar to all other field infrastructure.	Subject to full CA
3a	Trenched Interfield Non- concrete Coated Piggyback Pipelines ≤ 16"	Non-concrete coated pipelines less than 16" diameter may be recovered by reverse reeling.	Subject to full CA



Group	Infrastructure Type	Basis for Group	Scoping Recommendation
3b	Trenched Interfield Non- concrete Coated Non- piggyback MeOH Pipeline ≤ 16"	Non-concrete coated MEOH pipeline less than 16" diameter may be recovered by reverse reeling.	Subject to full CA
Зс	Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16"	Concrete coated pipelines less than 16" diameter may be recovered by cut and lift. Not applicable for reverse installation due to concrete coating.	Subject to full CA
4	Trenched Interfield Concrete Coated Piggyback Pipelines > 16"	Concrete coated pipelines greater than 16" diameter. Not applicable for reverse installation due to concrete coating.	Subject to full CA
5	Subsea Structures	Any discrete item which is not a pipeline, umbilical or jumper.	Full Removal, in accordance with Decommissioning Guidelines ref. [4]
6	Rigid Spools / Flexible Jumpers	Short connecting spools and jumpers.	Incorporated into each associated pipeline group
7	Trenched and Buried Umbilical	Single long field umbilical.	Subject to full CA
8	Mattresses and Grout Bags	Protection and supporting materials.	Full Removal <sup>3</sup>

Table 3-4: LOGGS Area (LDP2 – 5) Infrastructure Groups

<sup>&</sup>lt;sup>3</sup> Unless providing pipeline stabilisation, in which case mattresses and grout bags would be left in-situ



# 4 Comparative Assessment – Screening

The LOGGS Area (LDP2-5) infrastructure groups identified as being subject to full CA were progressed to the screening phase. All potential decommissioning options considered are summarised in Table 4-1.

Category	Option	Description
		- Disconnection of line ends
		- Cut line ends on seabed into short sections,
1	1aDo 'Nothing'	- Bundle cut sections together and recover
Leave in-situ		- Place rock to mitigate snag hazard from cut ends
(minimal intervention)		- Post decommissioning survey and trawl sweep
		- Disconnection of line ends
	1b Accelerated Decomposition	- Introduce accelerant to decompose the lines
	Decempeenen	- Lines to be left in-situ
		- Disconnection of line ends
		- Cut line ends on seabed into short sections
	2a Rock Cover	- Bundle cut sections together and recover
	Exposures	- Place rock to mitigate snag hazard from cut ends
Leave in-situ		- Place rock to cover areas of exposure
(minor intervention)		- Post decommissioning survey and trawl sweep
intervention		- Disconnection of line ends
	2b Trench & Bury	- Trench and bury line ends on seabed
	Exposures	- Trench and bury areas of exposure
		- Post decommissioning survey and trawl sweep
		- Disconnection of line ends
	3a Rock Cover Full Line	- Rock cover full length of line
Leave in-situ	Eino	- Post decommissioning survey and trawl sweep
(major intervention)		- Disconnection of line ends
intervention	3bTrench & Bury Full Line	- Trench and bury full length of line
		- Post decommissioning survey and trawl sweep
		- Disconnection of line ends
		- Cut line ends on seabed into short sections
Partial	4 Remove	- Bundle cut sections together and recover
Removal	Exposures	- Cut and remove areas of exposure
		- Place rock to mitigate snag hazard from cut ends
		- Post decommissioning survey and trawl sweep



Category	Option	Description
		- Disconnection of line ends
	Fa Davaraa Daal	- De-burial of entire line using Mass Flow Excavator (MFE)
	5a Reverse Reel	- Removal of line by reverse reel
		- Post decommissioning survey and trawl sweep
		- Disconnection of line ends
	Eh Deverse Clev	- De-burial of entire line using MFE
Full removal	5bReverse S-lay	- Removal of line by reverse s-lay
		- Post decommissioning survey and trawl sweep
		- Disconnection of line ends
		- De-burial of entire line using MFE
	6 Cut & Lift	- Cut entire line into short sections
		- Bundle cut sections together and recover
		- Post decommissioning survey and trawl sweep

 Table 4-1: Potential Decommissioning Options

Each of the decommissioning options were assessed for suitability against each of the decommissioning groups in a workshop environment. Table 4-2 shows a summary of each group, the decommissioning options considered, and the results from the screening.



									Leav	ve In-situ			Partial			
								imal ention	Minor In	tervention	Major In	tervention	Removal	F	ull remova	
Grp	Group Description	ID	Description	Diameter (inches)	Length (m)	Exposure (m)	1a – Do ' Nothing'	1b – Accelerated Decomposition	2a – Rock Cover Exposures	2b – Trench & Bury Exposures	3a – Rock Cover Full Line	3b – Trench & Bury Full Line	4 – Remove Exposures	5a – Reverse Reel	5b – Reverse S- lay	6 – Cut & Lift
1	Trunk Line	PL454	36" Gas Trunkline LOGGS PP to TGT	36	118,382	28,741	Screened In – potentially viable execution and as-left	Screened Out – the concept is un- proven	Screened In – potentially viable execution and as-left	Screened Out – mobile seabed may lead to future pipeline exposure despite re-trench and burial so not considered a permanent solution	Screened Out – extensive rock placement in this sensitive area not appropriate	Screened Out – mobile seabed may lead to future pipeline exposure despite re-trench and burial so not considered a permanent solution	Screened In – potentially viable execution and as-left	Screened Out – no track record of reverse reel of concrete coated pipeline in North Sea	Screened Out – no track record of reverse s-lay of concrete coated pipeline in North Sea	Screened In – potentially viable execution and as-left
		PL1690	8" Gas Pipeline NW Bell ZX to Callisto ZM	8	80	8	ially viable s-left	on does not cals	re are no	re are no	re are no	– there are no sures	re are no	such short e preferred	such short e preferred	ially viable s-left
2	Mattress Covered Short Umbilical & Associated Pipeline	PL1691	3" MeOH Pipeline Callisto ZM to NW Bell ZX	3	80	Connected to PL1690	ened In – potentially viable execution and as-left	Not Applicable – option does not apply to umbilicals	ed Out – there exposures	ed Out – there exposures	ed Out – there exposures	ed Out – the	Screened Out – there are no exposures	Screened Out – for such short ines cut & lift would be preferred solution	Screened Out – for such short lines cut & lift would be preferred solution	Screened In – potentially viable execution and as-left
		PLU4177 (UM3)	Umbilical Callisto ZM to NW Bell ZX	4.3	80	0	Screened In executi	Not Applic app	Screened	Screened Out expo	Screened Out expo	Screened Out expos	Screene	Screene lines cut 8	Screened lines cut &	Screened exec



									Leav	ve In-situ			Partial			
								imal ention	Minor In	tervention	Major In	tervention	Removal	F	ull remova	1
Grp	Group Description	ID	Description	Diameter (inches)	Length (m)	Exposure (m)	1a – Do ' Nothing'	1b – Accelerated Decomposition	2a – Rock Cover Exposures	2b – Trench & Bury Exposures	3a – Rock Cover Full Line	3b – Trench & Bury Full Line	4 – Remove Exposures	5a – Reverse Reel	5b – Reverse S- lay	6 – Cut & Lift
		PL2234	10" Gas Pipeline Tethys TN to Saturn ND / LOGGS PR Tee	10	3,877	18	as-left		remaining	no remaining	remaining	remaining	remaining	-left	ate albeit	-left
		PL2235	3" MeOH Pipeline LOGGS PR / Saturn ND Tee to Tethys TN	3	3,878	Piggybacked to PL2234	execution and as	un-proven	there are no r	are	there are no r	are no	there are no r	ttion and as	ore appropri pipelines.	ttion and as-left
3a	Trenched Interfield Non- concrete	PL2236	10" Gas Pipeline Mimas MN to Saturn ND	10	13,603	7	viable execu	concept is u	ands removed the	ends removed there exposures	ends removed the exposures	ends removed there exposures	ands removed the	potentially viable execution and as-left	reverse reel considered more appropriate albeit iically challenging for steel pipelines.	potentially viable execution
за	Coated Piggyback Pipelines ≤ 16"	PL2237	3" MeOH Pipeline Saturn ND to Mimas MN 3"	3	13,606	Piggybacked to PL2236	potentially v	- the	line ends expo	once line ends r expos	line	once line ends r expos	line ends expc	ootentially v	but – reverse reel consider technically challenging for	ootentially v
		PL1694	12" Gas Pipeline Europa EZ to Callisto ZM / Ganymede ZD Tee	12	4,498	4	Screened In – I	Screened Out	l Out – once	Out -	l Out – once	Ī	l Out – once	Screened In – I	Out – techr	Screened In – I
		PL1695	3" MeOH Pipeline Ganymede ZD / Callisto ZM Tee to Europa EZ	3	4,500	Piggybacked to PL1694	Scr		Screened	Screened	Screened	Screened Out	Screened	Scr	Screened	Scr

									Leav	ve In-situ			Partial			
			Description		Length (m)	Exposure (m)		Minimal Intervention		tervention	Major Intervention		Removal	l	<sup>-</sup> ull remova	I
Grp	Group Description	ID		Diameter (inches)			1a – Do ' Nothing'	1b – Accelerated Decomposition	2a – Rock Cover Exposures	2b – Trench & Bury Exposures	3a – Rock Cover Full Line	3b – Trench & Bury Full Line	4 – Remove Exposures	5a – Reverse Reel	5b – Reverse S- Iay	6 – Cut & Lift
3b	Trenched Interfield Non- concrete Coated Non- piggyback MeOH Pipeline ≤ 16"	PL400	4" MeOH Pipeline TGT to LOGGS PP	4	118,382	338	Screened In – potentially viable execution and as-left	Screened Out – the concept is un- proven	Screened In – potentially viable execution and as-left	Screened Out – mobile seabed may lead to future pipeline exposure despite re-trench and burial so not considered a permanent solution	Screened Out – extensive rock placement in this sensitive area not appropriate	Screened Out – mobile seabed may lead to future pipeline exposure despite re-trench and burial so not considered a permanent solution	Screened In – potentially viable execution and as-left	Screened In – potentially viable execution and as-left	Screened Out – reverse reel considered more appropriate albeit technically challenging for steel pipelines.	Screened In – potentially viable execution and as-left

Page 40



									Leav	ve In-situ			Partial			
								imal rention	Minor In	tervention	Major In	tervention	Removal	F	ull remova	I
Grp	Group Description	ID	Description	Diameter (inches)	Length (m)	Exposure (m)	1a – Do ' Nothing'	1b – Accelerated Decomposition	2a – Rock Cover Exposures	2b – Trench & Bury Exposures	3a – Rock Cover Full Line	3b – Trench & Bury Full Line	4 – Remove Exposures	5a – Reverse Reel	5b – Reverse S- Iay	6 – Cut & Lift
		PL1091	12" Gas Pipeline Callisto ZM to Ganymede ZD	12	14,300	132				-trench	ate	-trench		North	North	
		PL1092	3" MeOH Pipeline Ganymede ZD to Callisto ZM	3	14,300	Piggybacked to PL1091				exposure despite re-trench t solution	t appropriate	despite re-trench		reverse reel of concrete coated pipeline in North Sea	ipeline in	
		PL456	10" Gas Pipeline Vanguard QD to LOGGS PP	10	7,548	102	ıd as-left	ven	id as-left	cposure d	e area not	exposure c t solution	ıd as-left	coated pi	coated p	ıd as-left
		PL457	3" MeOH Pipeline LOGGS PP to Vanguard QD 3" MeOH Line	3	7,510	Piggybacked to PL456	cution ar	s un-proven	execution and		sensitive	re pipeline ex permanent s	cution ar	concrete o	concrete	cution ar
3c	Trenched Interfield Concrete	PL460	10" Gas Pipeline South Valiant TD to LOGGS PP	10	10,663	120	iable exe	concept is	iable exe	futur ed a	ent in this	futu ∋d a	iable exe	e reel of c ea	s-lay of	iable exe
	Coated Piggyback Pipelines ≤ 16"	PL461	3" MeOH Pipeline LOGGS PP to South Valiant TD 3" MeOH Line	3	10,662	Piggybacked to PL460	potentially viable execution and as-left	- the	potentially viable	ay lead to t conside	k placeme	ay lead to t conside	potentially viable execution and	of reverse Se	of reverse Se	potentially viable execution and as-left
		PL470	10" Gas Pipeline North Valiant SP to LOGGS PP	10	4,395	130		Screened Out	L I	mobile seabed may lead to futur and burial so not considered a	extensive rock placement	mobile seabed may lead to and burial so not consider	l I	– no track record of	k record o	
		PL471	3" MeOH Pipeline LOGGS PP to North Valiant SP 3" MeOH Line	3	4,395	Piggybacked to PL470	Screened In -	Scr	Screened In	Screened Out – mobile s and bu	Screened Out – exter	Screened Out – mobile s and bu	Screened In	Screened Out – no trac	Screened Out – no track record of reverse s-lay of concrete coated pipeline in North Sea	Screened In -



									Leav	ve In-situ			Partial			
							Min Interv	imal ention	Minor In	tervention	Major In	tervention	Removal	F	ull remova	I
Grp	Group Description	ID	Description	Diameter (inches)	Length (m)	Exposure (m)	1a – Do ' Nothing'	1b – Accelerated Decomposition	2a – Rock Cover Exposures	2b – Trench & Bury Exposures	3a – Rock Cover Full Line	3b – Trench & Bury Full Line	4 – Remove Exposures	5a – Reverse Reel	5b – Reverse S- Iay	6 – Cut & Lift
		PL458	18" Gas Pipeline Vulcan RD to LOGGS PP 18" Gas Line	18	16,147	253	s-left	ſ	as-left	pipeline dered a	ensitive	pipeline dered a	as-left	concrete	concrete	s-left
		PL459	3" MeOH Pipeline LOGGS PP to Vulcan RD 3" MeOH Line	3	16,100	Piggybacked to PL458	ution and a	un-proven	execution and a	may lead to future pipeline burial so not considered a solution	ent in this s	I may lead to future pipeline I burial so not considered a solution	and	se reel of c Sea	se s-lay of Sea	ution and a
	4 – Trenched Interfield Concrete		19" Gas Pipeline Ganymede ZD to LOGGS PR	18	19,501	75	potentially viable execution and as-left	Out - the concept is	potentially viable exec	ed In – potentially viable exec Out – mobile seabed may lea despite re-trench and burial s permanent solution	extensive rock placement in this sensitive area not appropriate		viable execution	rd of rever e in North (	rd of revers e in North (	iable exect
	Interfield		3" MeOH Pipeline LOGGS PR to Ganymede ZD 3" MeOH	3	19,492	Piggybacked to PL1093						mobile seabed e re-trench and permanent s	potentially v	- no track record of reverse reel of concrete coated pipeline in North Sea	· no track record of reverse s-lay of concrete coated pipeline in North Sea	potentially viable execution and as-left
		PL2107	10" Gas Pipeline Saturn ND to LOGGS PR	14 Note 1	43,240	14	Screened In – p	Screened C	Screened In – p	id Out – m e despite r	Ĩ	oite n	Screened In – p	1 -	Out -	Screened In – p
		PL2108	3" MeOH Pipeline LOGGS PR to Saturn ND 3" MeOH	3	43,250	Piggybacked to PL2107	Scree	J	Scree	Screened exposure	Screened Out	Screened Out exposure desp	Scree	Screened Out	Screened	Scree



									Leav	ve In-situ			Partial			
								Minimal Intervention		tervention	Major Intervention		Removal	F	ull remova	1
Grp	Group Description	ID	Description	Diameter (inches)	Length (m)	Exposure (m)	1a – Do ' Nothing'	1b – Accelerated Decomposition	2a – Rock Cover Exposures	2b – Trench & Bury Exposures	3a – Rock Cover Full Line	3b – Trench & Bury Full Line	4 – Remove Exposures	5a – Reverse Reel	5b – Reverse S- Iay	6 – Cut & Lift
7		PLU4178 (LIM2)	Umbilical Ganymede ZD to Callisto ZM	4.3	13,875	11	Screened In – potentially viable execution and as-left	Not Applicable – option does not apply to umbilicals	Screened In – potentially viable execution and as-left	Screened Out – mobile seabed may lead to future pipeline exposure despite re-trench and burial so not considered a permanent solution	Screened Out – extensive rock placement in this sensitive area not appropriate	Screened Out – mobile seabed may lead to future pipeline exposure despite re-trench and burial so not considered a permanent solution	Screened In – potentially viable execution and as-left	Screened In – potentially viable execution and as-left	Screened Out – reverse reel considered more appropriate for umbilicals.	Screened Out – retained option to reverse reel as more attractive

Table 4-2: Screening Outcome

- Note 1: Whilst this group is for pipelines greater than 16" in diameter, it was agreed to include PL2107 in this group as, once the concrete coating is included, the overall diameter is greater than 16";
- Note 2: Option 2b refers to retrenching and burial of cut pipeline ends along with exposures, in cases where the pipeline is cut at surface and thereafter the section in transition between surface and trench depth would be (post or re-) trenched and buried. Experience would suggest that pipelines do not always remain buried if trenched in areas where the seabed sediment is mobile, however stable burial is possible in immobile sediment;
- Note 3: Option 3b refers to retrenching of the whole pipeline. Experience would suggest that pipelines do not always remain buried if trenched in areas where the seabed sediment is mobile, however stable burial is possible in immobile sediment;
- Note 4: The pipelines in Group 3a, 3c, 4 were trenched and backfilled.



Options 1b, 2b, 3a, 3b were excluded from the evaluation phase for all the pipeline groupings:

- Option 1b: Accelerated decomposition was screened out of all options as the concept is unproven and the impact of potential chemical agents into the marine environment is not understood and cannot be quantified.
- Option 2b: Burial of exposed ends and pipeline sections is not considered a permanent solution for the pipelines in this location due to the dynamic seabed movement, rendering a burial solution vulnerable to unburial over time.
- Option 3a: Rock cover over the full pipeline length is not considered a feasible solution as large magnitude rock cover is considered detrimental to the free movement of sand in the protected area.
- Option 3b: Reburial of the full pipeline length is not considered a permanent solution due to the dynamic seabed movement, rendering a burial solution vulnerable to unburial over time.

Trench and re-burial (Options 2b and 3b) was discounted because there is no information that is known of these pipelines to suggest that sufficient burial will result in no subsequent exposure in this area where dynamic seabed conditions persist (shallow water, strong tidal influence with mega-ripple sediment features).

There is a lot of uncertainty associated with the chance of success in the achievement of burial of pipeline ends and exposures in this dynamic seabed environment. As the assets were trenched and buried in construction phase, it is unlikely that re-burial will achieve permanent burial of exposures. Despite advances in pipelaying techniques since the time of installation, the methods used for the burial of these types of pipelines within the dynamic area have not changed significantly to increase the level of assurance that the pipelines will remain buried. Furthermore, in this locality the dynamic seabed is the dominant factor that influences pipeline exposure (with the exception of the 36" trunkline which was trenched and left to backfill naturally, also contributing to the exposures present).

The analysis of the pipeline depth of cover survey information does not appear to correlate between installation burial depth and areas of exposure. This is evident in the LOGGS area where surficial soils are generally hard and sandy but of varying depths overlaying clay. If reburial were to be attempted, the localised variability of the soil and seabed profile contributes to the uncertainty of success of permanent burial.

The burial under natural sediment of pipeline ends has also been discounted for the same reasons (Options 2b and 3b) as this option will require an unknown length and depth of pipeline trenching and excavation back to sufficient depth to ensure some degree of success. Furthermore trenching and burial will result in widespread, short term disturbance of the seabed within the marine protected area with limited long term success.

Due to the dynamic seabed environment, rock remediation on pipeline ends is expected to provide the safest profile for other users of the sea. Burial is not considered a permanent solution in the dynamic seabed conditions exposing other users of the sea to potential snag hazards should unburial of ends occur.

Rock cover over the full pipeline was excluded from the evaluation phase for all the pipeline groupings. The key reason for discounting this option was the impact of permanent habitat loss associated with the deposit of hard substrate within the marine protected area. The placement of rock material is still considered feasible in other options selected for further consideration on the basis that the options provide a high certainty of long term success whilst the impact of habitat loss through the deposit of hard substrate is localised in comparison. Whilst rock deposits provide long



term success, the potential for rock influenced scour adjacent to the deposits has been considered in the comparative assessment of the feasible options.

# 4.1 Screening Summary

Following the screening activity, the decommissioning options that were screened out, and those that were retained for evaluation are summarised in Table 4-3.

Group	Retained for Evaluation	Screened Out
1 – Trunkline	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>6 Full removal by cut and lift</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>5a Full removal by reverse reel</li> <li>5b Full removal by reverse s-lay</li> </ul>
2 – Mattress Covered Short Umbilical & Associated Pipeline	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>6 Full removal by cut and lift</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>5a Full removal by reverse reel</li> <li>5b Full removal by reverse s-lay</li> </ul>
3a – Trenched Interfield Non- concrete Coated Piggyback Pipelines ≤ 16"	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>5a Full removal by reverse reel</li> <li>6 Full removal by cut and lift</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>5b Full removal by reverse s-lay</li> </ul>



Group	Retained for Evaluation	Screened Out
3b – Trenched Interfield Non- concrete Coated Non- piggyback MeOH Pipeline ≤ 16"	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>5a Full removal by reverse reel</li> <li>6 Full removal by cut and lift</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>5b Full removal by reverse s-lay</li> </ul>
3c – Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>6 Full removal by cut and lift</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>5a Full removal by reverse reel</li> <li>5b Full removal by reverse s-lay</li> </ul>
4 – Trenched Interfield Concrete Coated Piggyback Pipelines > 16	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>6 Full removal by cut and lift</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>5a Full removal by reverse reel</li> <li>5b Full removal by reverse s-lay</li> </ul>



Group	Retained for Evaluation	Screened Out
7 – Trenched and Buried Umbilical	<ul> <li>1a Removal of pipeline ends and rock placement on cut ends only</li> <li>2a Removal of pipeline ends and rock placement on all exposures</li> <li>4 Partial removal – cut &amp; lift exposures and rock placed on all cut ends</li> <li>5a Full removal by reverse reel</li> </ul>	<ul> <li>1b Accelerated decomposition</li> <li>2b Burial of exposed ends and all exposures</li> <li>3a Removal of exposed ends and full rock cover of pipeline</li> <li>3b Reburial of full pipeline length</li> <li>5b Full removal by reverse s-lay</li> <li>6 Full removal by cut and lift</li> </ul>

Table 4-3: Screening Summary



# 5 Comparative Assessment Preparation

# 5.1 Introduction

A range of safety, environmental, societal, engineering and economic studies were carried out in support of the evaluation phase of the CA. The findings of the studies / analyses were gathered in preparation for the evaluation phase of the CA. The key information obtained from these studies / analyses used during the evaluation phase are provided in data sheets included within the LOGGS Area Decommissioning Method Statement ref. [1].

# 5.2 Safety Studies

Personnel safety risk associated with each option was identified as follows:

- Offshore personnel exposure (diver activity and vessel operations)
- Onshore personnel exposure for the scope duration including disposal and recycling
- Legacy activities (future surveys and remediation activities)
- Unique high consequence events from major accident hazards. (Major accident hazards were defined as those events with the potential for serious injury or fatality to more than 4 personnel)
- Residual risk associated with other users of the sea that are impacted by, but not directly linked to, the decommissioning operations

Options were evaluated by determining the Potential Loss of Life (PLL) for each criterion. The Fatal Accident Rates (FAR) for each personnel type defined within Safetec's Risk Analysis of Decommissioning Activities study ref. [5] were used to provide a consistent approach to assessing Potential Loss of Life (PLL) values.

The resultant quantitative data (PLLs) produced allowed for a direct comparison of personnel risk associated with each option. The results are recorded for each option in the attributes tables in Appendix B to Appendix H.

The Fisheries Impact Assessment, conducted by Brown & May, also contributed to the evaluation. It provided an indication of the extent and type of fishing activity in the LOGGS area ref. [7]. This provided an indication of the level of risk to fishermen during decommissioning operations and the degree of residual risk for decommissioning options where it was proposed to leave infrastructure in-situ.

The safety hazards identified a balance between the short-term project personnel risks of the decommissioning operations and the long-term risk to mariners from snagging on spanning pipelines left in-situ. All the hazards are expected to be managed to be as low as reasonably practicable (ALARP) and therefore no significant hazard was identified from any decommissioning option. The quantitative results were associated with the degree of removal operations in comparison to the degree of spanning associated with that pipeline group.

# 5.3 Environmental Studies

Most of the pipelines and umbilicals being decommissioned are located within the North Norfolk Sandbanks and Saturn Reef special Area of Conservation. The PL454 and PL455 trunklines also cross through the Inner Dowsing Race Bank and North Ridge Special Area of Conservation and the Greater Wash Special Protection Area. Both SACs have been designated for the protection of two



European Annex 1 habitats. These habitats are 'Sandbanks which are slightly covered by sea water all the time' and 'Reefs', the biogenic reef Sabellaria spinulosa. The Joint Nature Conservation Committee (JNCC) has classified the North Norfolk Sandbanks and North Ridge as representing good 'conservation' examples of these habitats. Rock cover in this area is therefore restricted to situations where safety considerations deem this the only solution and the environmental impact considered insignificant.

This infrastructure is also within the Southern North Sea Special Area of Conservation for harbour porpoise and one of the conservation objectives relates to their supporting habitat.

The environmental and societal assessment considered the impacts of the decommissioning options.

Short-term environmental impacts included:

- Atmospheric emissions and fuel use to deliver the decommissioning options (quantity of fuel used, amount of energy used and atmospheric emissions such as CO<sub>2</sub>, SO<sub>x</sub> and NO<sub>x</sub>)
- Marine discharges (quantity of pipeline contents discharged into the water column during pipeline severing operations, vessel waste discharge from oil, sewage and macerated food, vessel ballast uptake and discharge into the water column)
- Underwater noise (level / extent of noise and the subsequent impact on marine mammals)
- Seabed disturbance (indirect disturbance such as anchoring of vessels and direct disturbance related to the quantity of area disturbed by dredging and trenching activities on the seabed)
- Onshore recycling and disposal (CO<sub>2</sub> emissions, impact on the local community traffic disturbance on minor roads and use of landfill capacity)

Long-term environmental impacts included:

- Loss of Habitat (quantity of the marine protected area lost due to the introduction of hard substrate such as rock)
- Consumption of resources for example quarried rock and replacement material for left in-situ infrastructure
- Impact associated with the degradation of material left in-situ

All calculations were performed by discipline specialists and are documented within the Decommissioning Method Statement ref. [1].

The analysis indicated that the associated atmospheric emissions are unlikely to significantly contribute to greenhouse gas emissions or global warming impacts as the  $CO_2$  released from any decommissioning option (approximately 19,000 tonnes for all options) is significantly lower than the CO2 produced from UKCS vessel operations of 7.8 million tonnes from 2017 UK Greenhouse Gas Emissions ref. [8], at less than 0.3%. In addition, any physical disturbance to the seabed was considered temporary due to the dynamic nature of the currents that result in rapid seabed recovery.

The most significant environmental impact was associated with the long-term loss of habitat in the marine protected environment due to the introduction of rock for the burial of exposed infrastructure. Since the LOGGS infrastructure is located within the North Norfolk Sandbanks and Saturn Reef and in the Inner Dowsing Race Bank and North Ridge Special Area of Conservation, the introduction of a large quantity of rock could represent a localised change to the seabed environment and qualifying features of the SAC.



# 5.4 Societal Studies

Societal studies were qualitative and based on the impact to commercial fishing and onshore socioeconomic benefits.

Societal impacts that benefitted from the decommissioning options were socio-economic in nature, relating to employment and development of facilities to execute the decommissioning options. The magnitude on societal impact relating to full removal (which is likely to have the greatest impact on employment) is assessed as being low and therefore not considered a differentiator between options. This assessment was based on the expectation that pipeline decommissioning operations are expected to result in a continuation of existing services, and consequently existing employment, rather than the creation of new services and opportunities.

Offshore decommissioning operations may result in the disruption to commercial fishing activity through the prevention of access to fishing areas, resulting in the loss of revenue. Full removal is expected to have a greater loss of access due to the greater extent of offshore operations and therefore greater impact to revenue loss in the short term. Long term impacts relate to the loss in revenue due to the presence of survey vessels required to inspect legacy infrastructure remaining in-situ.

# 5.5 Engineering Studies

The technical feasibility and risk of project failure assessment that supports the technical assessment required the following information to be available and is documented in the LOGGS Area Decommissioning Method Statement ref. [1] for each option:

Execution Method Statement, including:

- Sequence of operations
- List of vessels and equipment specifications and durations
- Materials requirements
- Execution Schedule
- Cost estimate
- Long term liability estimation (considering material remaining in-situ, material degradation, seabed mobility)

The technical evaluation was a qualitative comparison of the feasibility of each method and the risk of major operational failure in relation to the complexity (ability to proceed without major consequence, or failure, if it is adequately planned and executed).

# 5.6 Stakeholder Engagement

Throughout the SNS decommissioning campaign, Chrysaor has striven to comply with regulations and guidelines and achieve a common understanding amongst stakeholders. The LOGGS decommissioning campaign is part of the greater SNS-wide decommissioning campaign. Stakeholder engagement has therefore been ongoing throughout the campaign to identify stakeholder priorities rather than specifically ahead of the CA workshops.



# 6 Comparative Assessment – Evaluation

# 6.1 CA Outcome – Group 1 – 36" Trunk Line

# 6.1.1 Group Characteristics

Group 1 consists of the 36" gas export trunk-line (PL454) from the LOGGS PP platform to the Theddlethorpe Gas Terminal (TGT). The pipeline is a large diameter, 118 km long, concrete-coated trunkline that was constructed in 1987. The pipeline has multiple pipeline crossings along its length and exhibits exposure of approximately 24% that is consistent with the construction methodology (trench laid to the top of the pipe and left to backfill). A single anomalous span has been identified on the pipeline length that has been caused by scour around a pipeline crossing. The anomaly has been marked on FishSafe. (First observed as reportable in 2016:  $46m \times 0.7m$ ; also in 2017: 14.3 m x 0.75m and not reportable in 2018: 36.6 m x 0.4m. Due to the variability in length, the exposure has been cited in the Decommissioning Programme at an average length of 20m).

The pipeline is shown in context in Figure 6-1 and its key characteristics are shown in Table 6-1.

ID	Description	CA Batte	ry Limits	Diameter	Length	Crossings	Exposure
U	Description	From	То	(inches)	(km)		(km)
PL454	LOGGS PP to Theddlethorpe Gas Terminal (TGT) 36" Gas	LOGGS PP	Shore approach low water line	36	118	13	29

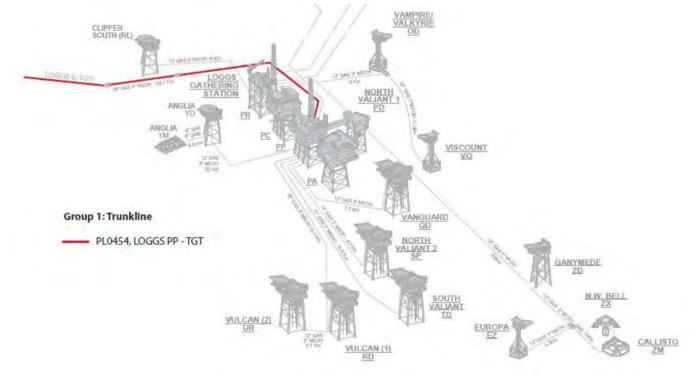


Table 6-1: Group 1 Characteristics

Figure 6-1: LOGGS Area (LDP2 – 5) Group 1



# 6.1.2 Decommissioning Options Retained for Evaluation

Ten options were presented at CA screening stage with six of those screened out. The four decommissioning options retained for CA evaluation were:

- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 2a: Leave in-situ (Minor Intervention) Removal of pipeline ends and rock placement on all ends and exposures
- Option 4: Partial Removal Cut and lift exposures and rock placed on all cut ends
- Option 6: Full Removal Cut and lift

#### 6.1.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 1 - Trunkline were assessed using the evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 1 is shown in Figure 6-2.

The evaluation process identified Option 1a, the leave in-situ option (minimum intervention), to be preferred for the environmental, technical, societal and economic criteria of the trunkline. The safety criteria favours leave in-situ albeit that there is a preference for minor intervention requiring rock cover over the exposed areas to remove the long-term legacy risk that may result from pipeline exposure. The 36" diameter 118km concrete coated trunkline poses technical challenges to the full removal option and a greater safety risk during extensive removal operations. Partial removal and in-situ (minor intervention) require the introduction of large quantities of rock considered environmentally damaging as it will result in the extensive loss of habitat in a marine protected area.

The evaluation indicated that the preferred option for the trunkline is leave in-situ (minimum intervention). Leaving the pipeline in-situ is expected to be managed through an agreed post decommissioning inspection plan that will identify existing and emerging snag hazards to fishermen.



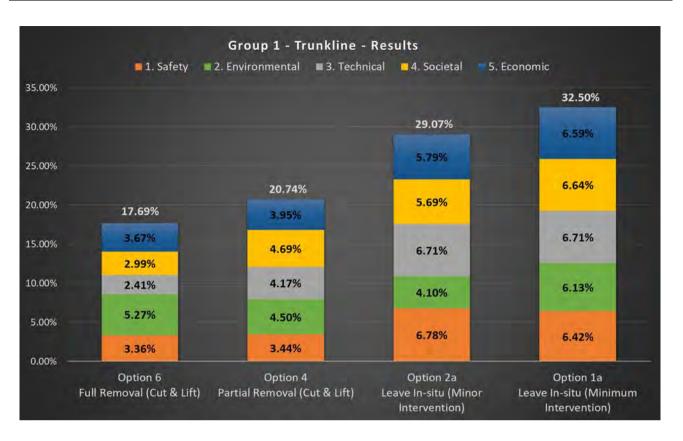


Figure 6-2: Group 1 Evaluation Results

A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

# 6.1.3.1 Safety Criteria Discussion

The workshops considered the leave in-situ options (Options 1a and 2a) to be less hazardous (therefore assessed as stronger) than either of the removal options, Options 4 (Partial Removal) and 6 (Full Removal).

The results of the evaluation of the short-term safety sub-criteria favoured the Option 1a leave-insitu option because of the lower operational activity associated with this option:

- The smaller offshore scope and minor diving scope required for leaving the trunkline in-situ and hence reduced offshore personnel safety risk.
- The minimal material removed for the in-situ option that limits the amount of material required to be handled, transported and processed onshore hence minimising the onshore personnel risk.
- The limited number of additional vessels required reducing the number of vessel transits and hence low additional risk to other marine users (shipping, fishing vessels). Full removal would result in additional offshore activity that may lead to transient obstructions to existing marine traffic movements and a heightened risk of collision.
- The minor exposure to dropped object hazards due to the low number of heavy lifts required for in-situ decommissioning. In comparison, the full and partial removal options results in large scale cut and lift operations of the 36" trunkline that will provide increased exposure to personnel to high consequence events relating to the dropped object hazard offshore and onshore.



The full removal option removed all residual long-term safety risk. Pipelines remaining in-situ present greater risk to fishermen with trawl gear, as anomalous spans are a snagging hazard to these fishermen, hence full removal negates this outcome. However, the pipeline infrastructure contains a single anomalous span that has been recorded on FishSafe and any emerging issues will be identified during decommissioning inspections.

Option 1a is stronger from a short-term safety perspective owing to the reduced activity associated with this option. The residual long-term safety risk associated with leaving the pipelines in-situ is highest for option 1a as existing exposures are not eliminated (by removal or rock), however the long-term risk associated with leaving the pipelines in-situ is mitigated by adopting an inspection plan and rigorous communication of any anomalies to fishermen.

# 6.1.3.2 Environmental Criteria Discussion

The workshops considered the leave in-situ option 1a to have the least environmental impact than any other option.

This result was related to the in-situ option 1a having the least operational activity:

- Low vessel usage reducing the negative impact of noise and discharges to sea.
- Limited pipeline remediation and hence a lower seabed disturbance with limited requirement for pipeline unburial by Mass Flow Excavation and minor rock consumption.

Of primary environmental concern in this area is the vulnerability of the protected habitat that is potentially lost by the introduction of a hard substrate (rock) within the existing sandbank. The Option 1a leave in-situ option and full removal Option 6 score best as there is limited rock placement resulting from these options. The greatest negative environmental impact from habitat loss is associated with the options that require large scale rock placement Option 4 (50,000 m<sup>2</sup>) and Option 2a (300,000 m<sup>2</sup>).

The long-term marine impact from the degradation of remaining in-situ pipeline infrastructure is the only evaluation sub-criteria where Option 1a does not score strongest. In Option 1a and 2a, the remaining 118 km pipeline length is left to degrade and release degradation products into the water column over time. The full removal Option 6 scores best due to full pipeline removal.

The combined short-term and long-term environmental impact of the options associated with the decommissioning of the trunkline favours in-situ, minimum intervention (Option 1a) predominantly due to this option having the lowest short-term operational marine impact and minor long-term impact from minimal rock at the cut pipeline ends only. Option 2a delivers the greatest negative environmental impact because the full pipeline length remains in-situ to degrade and approximately 28 km of rock is placed over the exposed sections of the pipeline leading to potentially extensive habitat loss.

# 6.1.3.3 Technical Criteria Discussion

Both leave in-situ options - Option 1a (disconnection of the pipeline ends only) and Option 2a (disconnection of the 36" pipeline end and rock placement over 28km exposure) - are equally feasible activities that are performed as part of existing operations and hence are mature operations with the low technical risk.

Cut and lift techniques are undertaken in the UKCS on concrete pipelines as part of existing decommissioning operations (pipeline disconnection from the platform). Partial removal (Option 4 - removal of all spans) and full removal (Option 6), however, requires large scale diving intensive Diamond Wire Cutting (DWC) operations to sever multiple sections of the concrete coated 36"



trunkline. There is no track record of this magnitude of DWC diving operations in the UKCS and therefore carries high technical risk for the removal options. In addition, the integrity of the concrete coating on this pipeline is unknown and concrete spalling may occur during cutting operations, further complicating cutting operations and exposing divers to additional risk. Further development of new technologies to improve the efficiency of existing DWC techniques and automation of the operations to reduce diver exposure is required to improve the viability of this scale of operations on a large diameter concrete-coated pipeline.

# 6.1.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.

Option 1a has the least impact on commercial fishing as this option requires disconnection to the platform 500m end only without impediment to fishing activity. Option 6, however, is the least attractive option to commercial fishing as the pipeline removal operations would disrupt fishing activity (although this disruption would be temporary in nature) and in addition static creel pots would require to be removed near-shore to facilitate pipeline removal (again, a temporary disruption). The trunkline is generally overtrawlable in its current state with approximately 72% of its length buried and only one anomalous span at a pipeline crossing that has been recorded on FishSafe. The fishing intensity in the LOGGS area is low-to-moderate and vessel traffic survey reports indicated that trawling activity is currently taking place across the trunkline. Removal of the trunkline is therefore unlikely to result in a significant increase to the current commercial fishing activity.

The legacy impact of pipeline exposure to fishermen that could potentially result in damage or loss of gear when being overtrawled associated with Option 1a, should be mitigated by an appropriate post-decommissioning monitoring regime.

Leaving the pipeline in-situ was shown to have a more positive impact on the societal criteria compared to the removal options, driven by the higher quantity of material that would be required to be recycled if full or partial removal took place. The greater the quantity of material that is removed, the greater the amount of material that will be brought to shore. Although recycling is a positive societal impact, it is outweighed by the requirement to use landfill because the trunkline is coated with concrete and coal tar enamel that reduces its applicability for recycling. Since the leave in-situ options 1a and 2a require less recycling (and therefore no use of landfill and no traffic disruption onshore) these options are more favourable than removal (Options 6 and 4).

Overall Option 1a is the most attractive option from both a societal (recycling) and commercial fishing (disruption) perspective. The removal options are the least attractive because they contribute to large-scale landfill use and are likely to lead to disruptions in current fishing activity.

# 6.1.3.5 Economic Criteria Discussion

The economic criteria compare the short-term execution cost of undertaking the decommissioning options and the long-term legacy cost of undertaking post decommissioning monitoring surveys, contribution to the Fisheries Legacy Trust Fund to support pipeline snagging hazard awareness amongst fishermen and potential remedial works for leave-in-situ options. Overall, the leave in-situ options are more favourable economically than the removal options driven by the short-term costs which are a much higher magnitude than the long-term monitoring costs.

The short-term full removal cost for Option 6 is £350 million compared to £2.5 million for leave insitu Option 1a. The high cost of the full removal is derived from the scale of activity required to remove the large diameter, 118 km length pipeline.



#### 6.1.4 Recommendation

The leave in-situ options (Option 1a and Option 2a) were considered more attractive than the partial and full removal options (Option 4 and Option 6) for the Safety, Technical and Societal criteria. In addition, Option 1a was most attractive, followed by Option 6 for the Environmental criterion.

The larger removal scopes (Option 4 and 6) would result in greater safety exposure for personnel, both onshore and offshore. There is also a greater exposure to other users from the partial and full removal options compared to the leave in-situ options due to the greater number of vessel days leading to a greater number of transits to and from site. Only with residual risk was there a preference for the full removal option, as with the pipeline fully removed there would be no residual risk; however, it is noted that as part of any partial removal or leave in-situ solution being selected, any potential hazards along the pipeline would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

From an environmental perspective the larger scope associated with the partial or full removal options generally results in the leave in-situ options being preferable. This is skewed somewhat by the environmental impact associated with the significant use of rock placement to deliver Option 2a which introduces a hard substrate to the area that has a potential to prevent the free movement of sediment within the protected area..

Technically, both the leave in-situ options are equally preferable than either the full or partial removal options, as there is far less technical risk associated with them. However, there are no novel techniques involved with the full or partial removal options other than the scale of the operations.

With the site shown to be currently over-trawlable, there is no discernible advantage to the fishing industry from removal of the pipeline, with the larger scopes resulting in greater disruption to the fishing industry. From a communities / amenities perspective Options 4 and 6 were seen as less attractive than the leave in-situ options due to the use of landfill for the returned pipeline coating.

The emerging preference for Option 1a was further enhanced when the Economic criterion was included. This is due to the cost for implementing Option 1a being significantly less than the next closest option (2a) and vastly less than the partial or full removal options.

The emerging recommendation from the CA is therefore to leave the trunk-line in-situ with minimum intervention. This would entail disconnection and removal of the LOGGS end of the pipeline and the ends at the tee locations. Spot rock placement would be installed at the cut pipeline ends only to mitigate any potential snag hazard. The remaining pipeline, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 6.2 CA Outcome – Group 2 – Mattress Covered Short-umbilical & Associated Pipeline

# 6.2.1 Group Characteristics

Group 2 consists of a single 8" gas pipeline (PL1690) with a 3" MeOH pipeline (PL1691) piggybacked to it. They connect the NW Bell ZX well to the Callisto ZM manifold and are approximately 80 m in length. Group 2 also includes the 4" hydraulic umbilical (PLU4177 (UM3)), which is situated near PL1690 and PL1691 and is of a similar length. These short lines were installed in 1990 and are mattress covered.

The lines are shown in context in Figure 6-3 and their key characteristics are shown in Table 6-2

ID	Description	CA Battery Limits		Diameter	Length	Exposure
		From	То	(inches)	(m)	(m)
PL1690	NW Bell ZX to Callisto ZM 8" Gas Line	NW Bell ZX	Callisto ZM	8	80	8
PL1691	Callisto ZM to NW Bell ZX 3" MeOH Line	Callisto ZM	NW Bell ZX	3	80	Connected to PL1690
PLU4177 (UM3)	Callisto ZM to NW Bell ZX Umbilical	Callisto ZM	NW Bell ZX	4.3	80	0

Table 6-2: Group 2 Characteristics

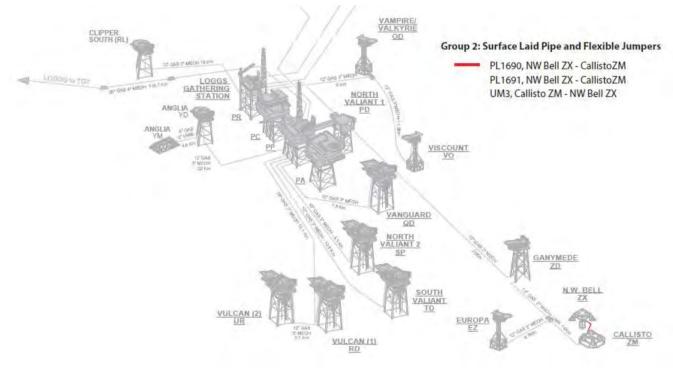


Figure 6-3: LOGGS Area (LDP2 – 5) Group 2



#### 6.2.2 Decommissioning Options for Evaluation

Ten options were presented at CA screening stage with eight of those screened out. The two decommissioning options retained for CA evaluation were:

- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 6: Full Removal Cut and lift

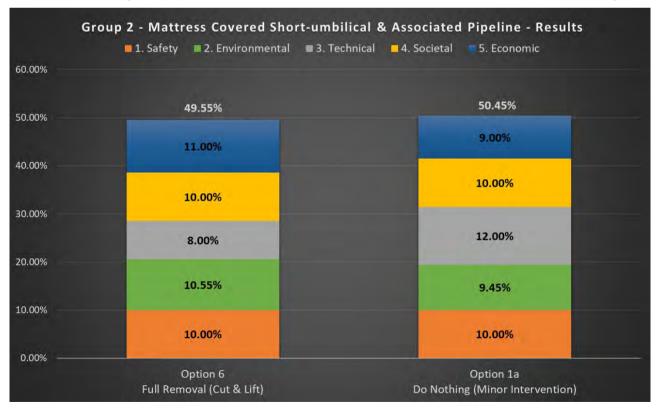
#### 6.2.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 2 – Mattress Covered Short-umbilical & Associated Pipeline were assessed using the evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 2 is shown in Figure 6-4.

The evaluation process identified both the leave in-situ option (minimum intervention) Option 1a and the full removal Option 6 to be equally preferred from a safety and societal perspective.

The full removal option scored marginally higher from reduced long term environmental marine impacts (removal of pipelines removes the pipeline and associated degradation material as well as eliminating the requirement to introduce additional rock into the protected habitat). Balancing this, the full removal option scored weaker from the technical feasibility perspective due to the challenges associated with the large-scale mattress removal required to unbury the pipelines. Once economics were added, the small preference for Option 1a was reduced.

Given the closeness of the assessment outcome, and the short nature of the lines in this group, there is a reasonable argument that there is no preference for an individual option indicated for this group.







A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

#### 6.2.3.1 Safety Criteria Discussion

The workshops considered the leave in-situ option and the full removal option to be equally preferred.

Despite Leave In-Situ (Option 1a) requiring less operational effort and less risk exposure to onshore personnel for materials handling, there is no appreciable offshore or marine risk from the removal of these pipelines due to their short length (80m) and the requirement to undertake subsea operations to remove the manifolds proximate to the pipelines.

Full removal (Option 6) clears the seabed of potential snagging hazards for fishermen and therefore minimises the residual risk. However, these pipelines are buried by sand on mattresses and therefore the in-situ option is not expected to present a high risk to fishing operations.

#### 6.2.3.2 Environmental Criteria Discussion

The workshops considered the full removal option 6 to have a slightly lower environmental impact than the leave in-situ option.

There is no difference between the options as regards the environmental impact from the operations due to similar vessel usage (fuel use, emissions, consumption of natural resources). Although there is a short-term impact from marine disturbance for full removal (Option 6), leaving the pipeline in-situ scored marginally lower than full removal due to the long-term environmental impact of the remaining pipeline:

- The requirement for rock placement to stabilise pipeline ends for the remaining pipeline. This introduction of rock would result in additional habitat loss in the marine protected area.
- The long-term marine impact from the degradation of remaining in-situ pipeline infrastructure.

#### 6.2.3.3 Technical Criteria Discussion

The leave in-situ (Option 1a) has been assessed as being marginally stronger than full removal (Option 6).

The feasibility of Option 6 is less well understood as this option requires extensive mattress removal of these surface-laid pipelines. This presents greater technical difficulty as the mattresses require unburial and degradation may present challenges to the pipeline removal.

#### 6.2.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.

Both options are equally preferred for both criteria as the operational activities are similar and material brought to shore for handling was considered small.

#### 6.2.3.5 Economic Criteria Discussion

The economic criteria indicated that there is a preference for the full removal (Option 6) over the leave in-situ (Option 1a). The short-term execution costs are a little higher for Option 6, but not enough to express a preference, however the long-term legacy cost of undertaking post



decommissioning monitoring surveys and the contribution to the Fisheries Legacy Trust Fund associated with Option 1a was sufficient to express a preference for Option 6.

#### 6.2.4 Recommendation

Both options were equally preferred against the Safety and Societal criteria. Option 6 was narrowly preferred from an Environmental perspective, driven by the reduced legacy impact from the full removal option and the lower impact in terms of Loss of Habitat. The narrow preference for Option 6 was more than offset by the preference for Option 1a from a Technical perspective due to the challenges associated with de-burial and mattress removal in Option 6. This indicated that Option 1a would be the overall preferred option.

Once the Economic criterion was included, despite Option 6 being preferred from an Economic perspective, this was insufficient to overturn the overall small preference for Option 1a.

However, given the closeness of the assessment and the short length of these lines, there is a reasonable argument to support the full removal of these lines, despite the outcome of the CA showing a small preference for leave in-situ.

The emerging recommendation from the CA is that either leave in-situ or full removal may be selected. It is noted that, should the leave in-situ option be progressed, the remaining lines, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning line (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 6.3 CA Outcome – Group 3a – Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤16"

# 6.3.1 Group Characteristics

Group 3a consists of three non-concrete coated, rigid pipelines that are 16 inches or less in diameter (PL1694, PL2234 and PL2236). Each of the gas lines has an associated piggyback methanol line (PL1695, PL2235 and PL2237 respectively). Each of the gas lines were laid within a trench and buried and have minimal areas of exposure. These areas of exposure are located at the pipeline ends and would be removed under all decommissioning options. The Europa lines were installed in 1999 and the Saturn lines in 2006 / 2007. There are no crossings associated with these lines.

The pipeline is shown in context in Figure 6-5 and its key characteristics are shown in Table 6-3.

ID	Description	CA Battery Limits		Diameter	Length	Exposure
		From	То	(inches)	(m)	(m)
PL2234	Tethys TN to Saturn ND / LOGGS PR Tee 10" Gas Line	Tethys TN	Saturn ND / LOGGS PR Tee	10	3,877	18
PL2235	LOGGS PR / Saturn ND Tee to Tethys TN 3" MeOH	Saturn ND / LOGGS PR Tee	Tethys TN	3	3,878	Piggybacked to PL2234
PL2236	Mimas MN to Saturn ND 10" Gas Line	Mimas MN	Saturn ND	10	13,603	7
PL2237	Saturn ND to Mimas MN 3" MeOH Line	Saturn ND	Mimas MN	3	13,606	Piggybacked to PL2236
PL1694	Europa EZ to Callisto ZM / Ganymede ZD Tee 12" Gas Line	Europa EZ	Callisto ZM / Ganymede ZD Tee	12	4,498	4
PL1695	Ganymede ZD / Callisto ZM Tee to Europa EZ 3" MeOH Line	Callisto ZM / Ganymede ZD Tee	Europa EZ	3	4,500	Piggybacked to PL1694

 Table 6-3: Group 3a Characteristics



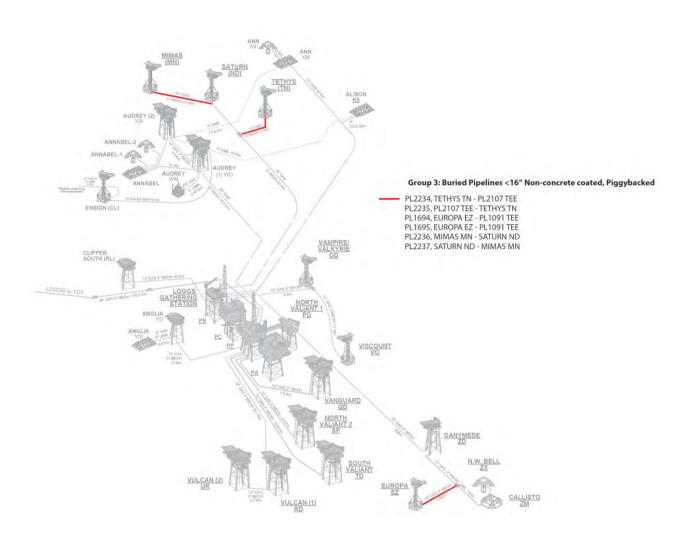


Figure 6-5: LOGGS Area (LDP2 – 5) Group 3a

# 6.3.2 Decommissioning Options for Evaluation

Ten options were presented at CA screening stage with seven of those screened out. The three decommissioning options retained for CA evaluation were:

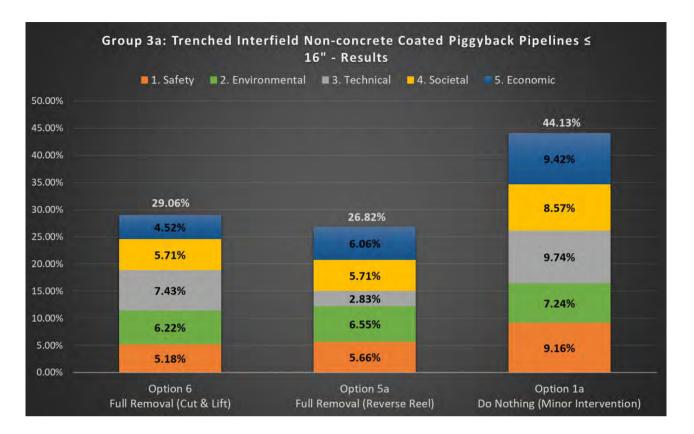
- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 5a: Full Removal Reverse reel
- Option 6: Full Removal Cut and lift

#### 6.3.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 3a - Trenched Interfield Non-concrete Coated Piggyback Pipelines  $\leq 16$ " were assessed using the evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 3a is shown in Figure 6-6.

The evaluation process identified Option 1a, the leave in-situ option (minimum intervention) to be preferred for all criteria.







A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

# 6.3.3.1 Safety Criteria Discussion

The workshops considered the leave in-situ options (Options 1a) to be less hazardous (therefore assessed as stronger) than either of the full removal options, Options 5a (Reverse Reel) and 6 (Cut and Lift).

The results of the evaluation of the short-term safety sub-criteria favoured the Option 1a leave insitu option because of the lower operational activity associated with this option:

- The smaller offshore scope and minor vessel usage required for leaving the lines in-situ and hence reduced offshore personnel safety risk.
- The minimal material removed for the in-situ option that limits the amount of material required to be handled, transported and processed onshore hence minimising the onshore personnel risk.
- The minor exposure to dropped object hazards due to the low number of heavy lifts required for in-situ decommissioning. In comparison, the full removal options required significantly greater lifting and deck operations for the reverse reel activities to recover the pipelines thus increasing the exposure of personnel to high consequence events.

The full removal options removed all residual long-term safety risk. Pipelines remaining in-situ present greater risk to fishermen with trawl gear, as anomalous spans are a snagging hazard to these fishermen, hence full removal negates this outcome. However, no anomalous spans have been identified and any emerging issues will be identified during decommissioning inspections.



Option 1a is stronger from a short-term safety perspective owing to the reduced activity associated with this option. The residual long-term safety risk associated with leaving the pipelines in-situ is similar for all the options as no snagging hazard remains regardless of the option.

# 6.3.3.2 Environmental Criteria Discussion

The workshops considered the leave in-situ option 1a to have the least environmental impact than any other option.

This result was related to the in-situ option 1a having the least operational activity:

- Low vessel usage reducing the negative environmental impact of noise and discharges to sea.
- Limited pipeline remediation and hence a lower seabed disturbance with no requirement for pipeline unburial by Mass Flow Excavation and minor rock consumption.

The long-term marine impact from the degradation of remaining in-situ pipeline infrastructure is the only evaluation sub-criteria where Option 1a does not score strongest. In Option 1a, the remaining pipelines are left to degrade and release degradation products into the water column over time. The full removal Option 5a and 6 score best for this criterion due to full pipeline removal.

The full removal operations using cut and lift (Option 6) and reverse reel (Option 5a) results in greatest marine disturbance and noise from mass flow excavation activities required to unbury the pipeline prior to removal. Both removal operations are vessel intensive over extended periods that negatively impacts the marine environment due to vessel noise, discharges, fuel use and atmospheric emissions.

Overall, the combined short-term and long-term environmental impact of the options associated with the decommissioning of these pipelines, favours in-situ, minimum intervention (Option 1a) predominantly due to this option having the lowest short-term operational marine impact and minor long-term impact from minimal rock at the cut pipeline ends only.

# 6.3.3.3 Technical Criteria Discussion

Leave in-situ - Option 1a (disconnection of the pipeline ends only) scored as the most feasible both in terms of concept maturity and technical risk.

The full removal options have comparatively greater risk as the operations would be conducted over large pipeline lengths requiring de-burial which may present difficulties that lengthen the removal duration. Of greatest technical risk and least technical maturity is the reverse reel option (Option 5a) of the rigid piggybacked pipelines which is yet to be proven operationally. In addition, the integrity of the degraded pipelines may present complications during the plastic deformation applied during reel recovery.

# 6.3.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.

Option 1a has the least impact on commercial fishing as this option requires disconnection to the platform 500m ends only presenting the least disruption and disturbance to the fishing industry. However, the full removal options require extended offshore operations and hence greater disruption to the fishing activities that are highest in the Europa EZ and Tethys TN areas predominantly



conducted by Dutch beam trawlers. The legacy impact of pipeline exposure to fishermen that could potentially result in damage or loss of gear when being overtrawled associated with Option 1a, is to be mitigated by an appropriate post-decommissioning monitoring regime.

Leaving the pipeline in-situ was shown to have a more positive impact on the societal criteria compared to the removal options, driven by the higher quantity of material that would be required to be recycled if full removal took place. The greater the quantity of material that is removed, the greater the amount of material that will be bought to shore. Although recycling is a positive societal impact, it is outweighed by the requirement to use landfill because of the polymer contents within the pipelines that reduces its applicability for recycling. Since the leave in-situ options 1a requires less recycling (and therefore no use of landfill and no traffic disruption onshore) this option was more favourable than full removal (Options 5a and 6).

Overall Option 1a is the most attractive option from both a societal (recycling) and commercial fishing (disruption) perspective. The removal options are the least attractive because they contribute to large-scale landfill use and are likely to lead to disruptions in current fishing activity.

#### 6.3.3.5 Economic Criteria Discussion

The economic criteria compare the short-term execution cost of undertaking the decommissioning options and the long-term legacy cost of undertaking post decommissioning monitoring surveys, contribution to the Fisheries Legacy Trust Fund to support pipeline snagging hazard awareness amongst fishermen and potential remedial works for leave in-situ options. Overall, the leave in-situ option 1a is more favourable economically than the removal options driven by the short-term costs. The pipelines are fully buried and therefore no additional long-term legacy costs will be attributable to the Leave in-situ Option 1a.

The short-term full removal cost for Option 6 is  $\pounds$ 29 million compared to  $\pounds$ 2.5 million for leave in -situ Option 1a. Reverse reel, Option 5a, is a lower cost ( $\pounds$ 10 million) than cut and lift operations, but higher than the cost of leaving the pipelines in-situ with the risk of cost escalation for difficulties associated with the reeling operations.

#### 6.3.4 Recommendation

The leave in-situ option (Option 1a) was considered more attractive than the full removal options (Option 5a and Option 6) for the Safety, Environmental, Technical, and Societal criteria.

The larger removal scopes (Option 5a and 6) would result in greater safety exposure for personnel, both onshore and offshore. Only with residual risk was there a preference for the full removal options, as with the pipeline fully removed there would be no residual risk; however, it is noted that as part of any partial removal or leave in-situ solution being selected, any potential hazards along the pipeline would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

From an environmental perspective the larger scope associated with the full removal options generally results in the leave in-situ option being preferable.

Technically, the leave in-situ option is preferred to either of the full removal options, as there is less technical risk and the operations are routine.

With the site shown to be currently over-trawlable, there is no discernible advantage to the fishing industry from removal of the pipeline, with the larger scopes resulting in greater disruption to the fishing industry. From a communities / amenities perspective Options 5a and 6 were less attractive than the leave in-situ option due to the use of landfill for the returned pipeline coatings.



The emerging preference for Option 1a was further enhanced when the Economic criterion was included. This is due to the cost for implementing Option 1a being significantly less than the other options.

The emerging recommendation from the CA is therefore to leave the trenched interfield, nonconcrete coated, piggyback pipelines less than or equal to 16" in diameter in-situ with minimum intervention. This would entail disconnection and removal of the pipeline ends. Spot rock placement would be installed at the cut pipeline ends only to mitigate any potential snag hazard. The remaining pipeline, which is fully trenched and buried, would be left in its current state, marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 6.4 CA Outcome – Group 3b – Trenched Interfield Non-concrete Coated Nonpiggyback Pipelines ≤16"

### 6.4.1 Group Characteristics

Group 3b consists of a single 4" methanol pipeline (PL455) from TGT to the LOGGS PP platform. The pipeline is 118 km long, non-concrete-coated and is trenched and buried along the majority of its length, with only minimal areas of exposure. It was installed in 1987. There are multiple pipeline crossings. PL455 is piggybacked on PL454 for the first 400m from LOGGS PP and for ~2km from KP116.685 to HAT at KP118.724.

The pipeline is shown in context in Figure 6-7 and its key characteristics are shown in Table 6-4.

ID	Description	CA Battery Limits		Diameter	Length	Exposure
		From	То	(inches)	(km)	(m)
PL455	TGT to LOGGS PP 4" MeOH Line	TGT	LOGGS PP	4	118	338

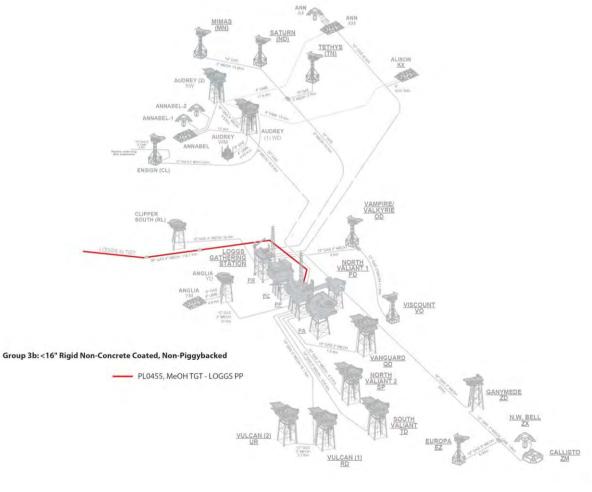


Table 6-4: Group 3b Characteristics

Figure 6-7: LOGGS Area (LDP2 – 5) Group 3b



#### 6.4.2 Decommissioning Options for Evaluation

Ten options were presented at CA screening stage with five of those screened out. The five decommissioning options retained for CA evaluation were:

- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 2a: Leave in-situ (Minor Intervention) Removal of pipeline ends and rock placement on all ends and exposures;
- Option 4: Partial Removal Cut and lift exposures and rock placed on all cut ends
- Option 5a: Full Removal Reverse reel
- Option 6: Full Removal Cut and lift

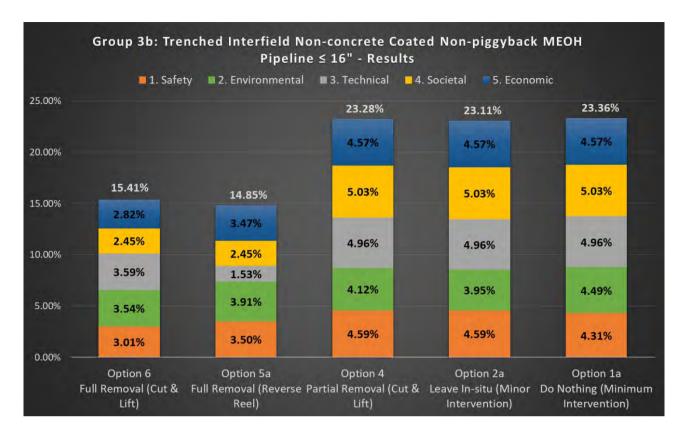
#### 6.4.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 3b – Trenched Interfield Non-concrete Coated Non-piggyback Pipelines  $\leq 16$ " were assessed using the evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 3b is shown in Figure 6-8.

The evaluation process identified the leave in-situ option (minimum intervention) to be the highest score by a narrow margin as it is preferred for all criteria, apart from a slight reduction in the safety criteria due to the legacy risk that the exposed pipeline presents. Option 2a and Option 4 that rock cover or remove the exposures in the pipeline, derive similar results to Option 1a. However, both these options require the introduction of rock into the marine protected environment resulting in habitat loss and although these options remove pipeline exposure, the long-term legacy risk to fishermen associated with the existing pipeline exposure is ranked as low due to the short overall length of a small diameter pipeline and lack of reported free spans on this pipeline.

Full removal by reverse reel (option 5a) and by cut and lift (option 6) were not preferred against partial removal and in-situ. This pipeline is a rigid 118 km length line, has an unknown integrity resulting in significant safety and technical challenges when considering the removal options.







A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

# 6.4.3.1 Safety Criteria Discussion

Option 2a and Option 4 removes all exposures to snag hazards for fishermen with minimal intervention, and hence scores highest in terms of safety compared to all the other options.

The results of the evaluation of the short-term safety sub-criteria favoured the Option 1a (minimum intervention), Option 2a (rock remediation) and Option 4 (partial removal) because of the lower operational activity associated with these options.

The 118 km 4" methanol pipeline has been reported as being predominantly buried with various minor exposures totalling around 338 m. Therefore, the activity required to support the removal of the exposure (either by rock cover or removal of exposed sections) is relatively small. Hence negligible additional short-term safety risk is expressed for executing the operations compared to leaving the pipeline in-situ (minimum intervention), Option 1a.

The full removal options, result in greater exposure to short term operational safety risks during execution:

- Longer offshore scope durations therefore higher offshore personnel safety risk (durations and hence safety exposure higher for cut and lift than for reverse reeling).
- Greater amounts of material required to be handled, transported and processed onshore hence higher onshore personnel risk.



- Greater number of additional vessels required for cut and lift removal, increasing the number of vessel transits and a heightened risk of collision. This risk was significant for the cut and lift operations only as the increase in vessel traffic was not expected to be substantial for the reverse reel operations compared to existing marine traffic.
- Increased exposure offshore and onshore to dropped object hazards due to the high number of heavy lifts required for full removal of the 118 km methanol pipeline.

Conversely, the results of the evaluation of the long-term safety sub-criteria favoured the full removal options because it eliminates the residual long-term safety risk. Pipelines remaining in-situ present greater risk to fishermen with trawl gear, as anomalous spans are a potential snagging hazard to these fishermen.

Overall, the most attractive options from a safety perspective are the options that intervene by removing the exposures (remediating the exposure with rock placement: 2a and partial removal: 4), hence reducing the long-term residual risk, the long term residual risk is also mitigated by the trenched nature of these pipelines. There is minor exposure reported on this pipeline and hence additional scopes to remove exposure does not increase the safety risk appreciably.

#### 6.4.3.2 Environmental Criteria Discussion

The workshops considered the leave in-situ option 1a to have the least environmental impact although the alternative options were evaluated to have a similar cumulative environmental impact with little obvious preference between them.

Option 1a leave in-situ (minimum intervention) was most attractive overall due to this option having the least operational activity:

- Low vessel usage reducing the negative environmental impact of noise and discharges to sea.
- Limited pipeline remediation and hence a lower seabed disturbance with no requirement for pipeline unburial by Mass Flow Excavation and minor rock consumption.

The long-term marine impact from the degradation of remaining in-situ pipeline infrastructure is the evaluation sub-criteria where Option 1a does not score strongest. In Option 1a, the remaining pipelines are left to degrade and release degradation products into the water column over time. The full removal Option 5a and 6 score best for this criterion due to full pipeline removal.

The full removal operations using reverse reel (Option 5a) results in greatest marine disturbance and noise from mass flow excavation activities required to unbury the pipeline prior to removal. Both removal operations are vessel intensive over extended periods that negatively impacts the marine environment due to vessel noise, discharges, fuel use and atmospheric emissions.

Partial removal of the exposures (Option 4) and leave in-situ, minor intervention (Option 2a) score weakest in terms of habitat loss as they require the application of rock introducing hard substrate into the existing sandbank.

Overall, the combined short-term and long-term environmental impact of the options associated with the decommissioning of these pipelines, favours in-situ, minimum intervention (Option 1a) predominantly due to this option having the lowest short-term operational marine impact and minor long-term habitat loss from minimal rock at the cut pipeline ends only. Full removal options (5a and 6) score weakly due to the extensive marine disturbance over the 118 km pipeline from unburial and



removal activities and exposure remediation (options 4 and 2a) score weakly due to habitat loss from rock placement.

#### 6.4.3.3 Technical Criteria Discussion

The Leave in-situ options (1a and 2a) and partial removal (option 4) scored the most feasible both in terms of concept maturity and technical risk.

The full removal options have comparatively greater risk as the operations would be conducted over large pipeline lengths requiring de-burial which may present difficulties that lengthen the removal duration. Of greatest technical risk and least technical maturity is the reverse reel option (Option 5a) of the rigid pipeline which is yet to be proven operationally. In addition, the integrity of the degraded pipelines may present complications during the plastic (non-elastic) deformation of the steel pipeline applied during reel recovery.

#### 6.4.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.

The partial removal, Option 4 and leave in-situ options (Option 1a and Option 2a) have the least impact on commercial fishing as they present the least disruption and disturbance to the fishing industry. Conversely, the full removal options require extended offshore operations and hence greater disruption to the fishing activities most significantly to near-shore fishing operations where static creel pots may need to be removed to allow access for full pipeline removal.

Leaving the pipeline in-situ was shown to have a more positive impact on the societal criteria compared to the removal options, driven by the higher quantity of material that would be required to be recycled if full removal took place. The greater the quantity of material that is removed, the greater the amount of material that will be bought to shore. Although recycling is a positive societal impact, it is outweighed by the requirement to use landfill because of the polymer contents within the pipelines that reduces its applicability for recycling. Since the leave in-situ options 1a, 2a and partial removal of the negligible 338 m of exposure require less recycling (and therefore minor use of landfill and no traffic disruption onshore) these options were more favourable than full removal (Options 5a and 6).

Overall Option 1a, Option 2a and Option 4 are the equal most attractive options from both a societal (recycling) and commercial fishing (disruption) perspective. The removal options are the least attractive because they contribute to large-scale landfill use and are likely to lead to disruptions in current fishing activity.

# 6.4.3.5 Economic Criteria Discussion

The economic criteria compare the short-term execution cost of undertaking the decommissioning options and the long-term legacy cost of undertaking post decommissioning monitoring surveys, contribution to the Fisheries Legacy Trust Fund to support pipeline snagging hazard awareness amongst fishermen and potential remedial works for leave in-situ options. Overall, the leave in-situ options (1a and 2a) and the partial removal option 4 are more favourable economically than the removal options driven by the short-term costs.

The short-term full removal cost for Option 6 is £132 million compared to £2.3 million for leave in-situ Option 1a. Reverse reel, Option 5a, is a lower cost (£28 million) than cut and lift operations, but higher than the cost of leaving the pipelines in-situ with the risk of cost escalation for difficulties associated with the reeling operations.



#### 6.4.4 Recommendation

The leave in-situ and partial removal options all scored relatively closely with Option 1a, the leave in-situ option (pipeline disconnected at the LOGGS end and at the tee locations only) being marginally the most attractive option overall. This is due to it being assessed as the most preferred option in the Environmental, Technical and Societal criteria, largely due to it having the shortest offshore durations of all the options. Option 1a was also very close to being the most attractive option from a safety perspective, again due to the shorter durations offshore and lower quantity of material returned, with only the legacy risk element from leaving the line in place with areas of exposure resulting Option 4 and Option 2a being marginally preferred.

Although the leave in-situ options 1a and 2a as well as the partial removal option 4, were the most attractive from an economic perspective, the inclusion of the economic criterion did not impact the overall preference for Option 1a.

Option 4, the partial removal option where the line ends and the exposures are removed was next most attractive, followed closely by Option 2a, where the line ends are removed and the areas of exposure are rock covered. These options were slightly less preferred to Option 1a in the Environmental, Technical and Societal criteria due to the habitat loss from the increased rock required and the additional disturbance to the fishing industry from the extended offshore work scopes. They were marginally preferred over Option 1a from a safety perspective, with the key differentiator being the residual risk presented by the left in-situ pipeline with the exposures remediated by removal (Option 4) or rock cover (Option 2a).

The full removal options were considered significantly less attractive than the leave in-situ or partial removal options with Option 6, full removal by cut & lift being preferred over Option 5a, full removal by reverse reel. This is mainly due to the increased offshore work scopes increasing the safety risk, the environmental impact and the disruption to the fishing industry. In addition, the extra material being returned by removing the full pipeline had additional impact in terms of onshore personnel safety exposure and use of landfill from the polymer returned. There was also a significant impact from the de-burial of the line to allow removal. The positive attributes of these full removal options such as no residual safety risk and no legacy environmental impact were insufficient to offset the impacts.

Overall, given the similar total score for the leave in-situ options (Option 1a and Option 2a) and partial removal (Option 4), these options are considered equally preferred. As such, the emerging recommendation from the CA is that any of these options may be executed as the decommissioning solution. Common to each of these options is the disconnection and removal of the LOGGS end of the pipeline and the ends around the two tee locations. Spot rock placement would be installed at the cut pipeline ends to mitigate any potential snag hazard.

The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipeline, would be marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 6.5 CA Outcome – Group 3c – Trenched Interfield Concrete Coated Piggyback Pipelines ≤16"

## 6.5.1 Group Characteristics

Group 3c consists of four concrete coated, rigid pipelines that are 16 inches or less in diameter (PL456, PL460, PL470 and PL1091). Each of the gas lines has an associated piggyback methanol line (PL457, PL461, PL471 and PL1092 respectively). Each of the gas lines were laid within a trench and buried and have minimal areas of exposure. The Ganymede lines were installed in 1999 and the other lines connected to LOGGS PP were installed in 1987. There are no crossings associated with these lines.

The pipeline is shown in context in Figure 6-9 and its key characteristics are shown in Table 6-5.

ID	Description	CA Batte	ry Limits	Diameter	Length	Exposure	
טו	Description	From	То	(inches)	(m)	(m)	
PL1091	Callisto ZM to Ganymede ZD 12" Gas Line	Callisto ZM	Ganymede ZD	12	14,300	132	
PL1092	Ganymede ZD to Callisto ZM 3" MeOH Line	Ganymede ZD	Callisto ZM	3	14,300	Piggybacked to PL1091	
PL456	Vanguard QD to LOGGS PP 10" Gas Line	Vanguard QD	LOGGS PP	10	7,548	102	
PL457	LOGGS PP to Vanguard QD 3" MeOH Line	LOGGS PP	Vanguard QD	3	7,510	Piggybacked to PL456	
PL460	South Valiant TD to LOGGS PP 10" Gas Line	South Valiant TD	LOGGS PP	10	10,663	120	
PL461	LOGGS PP to South Valiant TD 3" MeOH Line	LOGGS PP	South Valiant TD	3	10,662	Piggybacked to PL460	
PL470	North Valiant SP to LOGGS PP 10" Gas Line	North Valiant 2 SP	LOGGS PP	10	4,395	130	
PL471	LOGGS PP to North Valiant SP 3" MeOH Line	LOGGS PP	North Valiant 2 SP	3	4,395	Piggybacked to PL470	

Table 6-5: Group 3c Characteristics



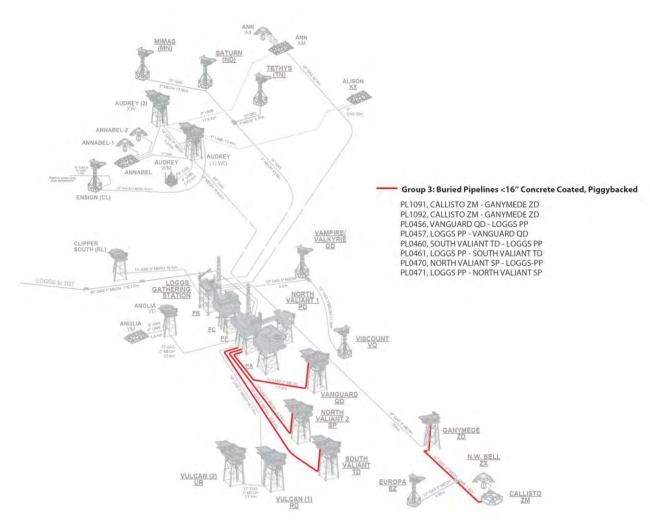


Figure 6-9: LOGGS Area (LDP2 – 5) Group 3c

# 6.5.2 Decommissioning Options for Evaluation

Ten options were presented at CA screening stage with six of those screened out. The four decommissioning options retained for CA evaluation were:

- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 2a: Leave in-situ (Minor Intervention) Removal of pipeline ends and rock placement on all ends and exposures
- Option 4: Partial Removal Cut and lift exposures and rock placed on all cut ends. Exposed pipeline disposed of onshore
- Option 6: Full Removal Cut and lift

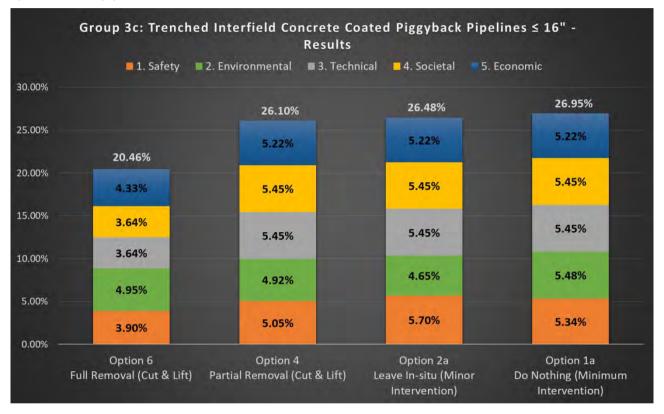
#### 6.5.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 3c – Trenched Interfield Concrete Coated Piggyback Pipelines ≤16" were assessed using the



evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 3c is shown in Figure 6-10.

The evaluation process identified the leave in-situ option (minimum intervention) to be the highest score by a narrow margin as it is to be preferred for all criteria, apart from a slight reduction in the safety criteria due to the legacy risk that the exposed pipeline presents. Option 2a and 4 that remove the exposures in the pipeline, derive similar results to Option 1a. However, both these options require the introduction of rock into the marine protected environment resulting in habitat loss and although these options remove pipeline exposure, the long-term legacy risk to fishermen associated with the existing pipeline exposure is ranked as low due to the short overall length and lack of reported free spans on this pipeline.



#### Figure 6-10: Group 3c Evaluation Results

A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

# 6.5.3.1 Safety Criteria Discussion

Option 2a is the most attractive option overall. The short-term operational safety risk associated with remediating approximately 500m of exposures with rock cover can be undertaken in a relatively short duration, thereby limiting the risk exposure to offshore personnel, with minor materials handling onshore minimising the onshore personnel risk. In addition, the marine vessel support to place the rock is not substantial therefore the risk to other users of the sea does not increase from this activity. The long-term safety risk posed by pipeline exposures is reduced for Option 2a as the current exposures would be eliminated by the rock.

Option 1a leave in-situ, indicates similar low short-term risks as for Option 2a, although the exposures are retained, which penalises this option with respect to Option 2a for the long-term residual risk element.



Option 4 was less attractive than Option 1a and 2a due the additional onshore safety risk posed by the materials handling onshore, the greater offshore scope, although the long-term safety risk is minimised by the partial removal of the exposures.

Full removal, Option 6, is the least attractive for all safety criteria except for the long-term safety element as full removal eliminates the residual risk posed by pipeline exposures.

Overall, the most attractive options from a safety perspective is the option that intervenes by removing the exposures (remediating the exposure with rock placement: 2a), hence reducing the long-term residual risk, whilst also requiring minimal offshore and onshore support to execute. The long term residual risk is also mitigated by the trenched nature of the pipelines in this group.

#### 6.5.3.2 Environmental Criteria Discussion

The workshops considered the leave in-situ option 1a to have the least environmental impact although the alternative options were evaluated to have a similar cumulative environmental impact with little obvious preference between them.

Option 1a leave in-situ (minimum intervention) was most attractive overall due to this option having the least operational activity:

- Low vessel usage reducing the negative environmental impact of noise and discharges to sea.
- Limited pipeline remediation and hence a lower seabed disturbance with limited requirement for pipeline unburial by Mass Flow Excavation (unburial limited to disconnection from the infrastructure, which is a common requirement for all options) and minor rock consumption.

The long-term marine impact from the degradation of remaining in-situ pipeline infrastructure is the evaluation sub-criteria where Option 1a does not score strongest. In Option 1a, the remaining pipelines are left to degrade and release degradation products into the water column over time. The full removal Option 6 scores best for this criterion due to full pipeline removal.

Partial removal of the exposures (Option 4) and leave in-situ, minor intervention (Option 2a) score weakest in terms of habitat loss as they require the application of rock introducing hard substrate into the existing sandbank.

Overall, the combined short-term and long-term environmental impact of the options associated with the decommissioning of these pipelines, favours in-situ, minimum intervention (Option 1a) predominantly due to this option having the lowest short-term operational marine impact and minor long-term habitat loss from minimal rock at the cut pipeline ends only. Full removal Option 6 scores marginally less attractively than 1a due to the extensive marine disturbance from unburial and removal activities. Options 4 and 2a score the least attractively due to habitat loss from rock placement.

#### 6.5.3.3 Technical Criteria Discussion

The Leave in-situ options (1a and 2a) and partial removal (option 4) scored the most feasible both in terms of concept maturity and technical risk as a result of the routine nature of these operations.

The full removal option has comparatively greater risk as the operations would be conducted over a longer duration and requires de-burial which may present difficulties that lengthen the removal duration further.



#### 6.5.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.

Option 1a, 2a and 4 have the least impact on commercial fishing as this option requires the least disruption and disturbance to the fishing industry. Conversely, the full removal option requires extended offshore operations and hence greater disruption to the fishing activities.

Leaving the pipeline in-situ was shown to have a more positive impact on the societal criteria compared to the removal options, driven by the higher quantity of material that would be required to be recycled if full removal took place. The greater the quantity of material that is removed, the greater the amount of material that will be bought to shore. Although recycling is a positive societal impact, it is outweighed by the requirement to use landfill because of the polymer contents within the pipelines that reduces its applicability for recycling. Since the leave in-situ options 1a, 2a and partial removal of the 500m of exposure requires less recycling (and therefore minor use of landfill and no traffic disruption onshore) these options were more favourable than full removal (Options 6).

Overall Option 1a, 2a and 4 are equally attractive from both a societal (recycling) and commercial fishing (disruption) perspective. The removal option 6 is the least attractive because it contributes to large-scale landfill use and is likely to lead to disruptions in current fishing activity during execution.

#### 6.5.3.5 Economic Criteria Discussion

The economic criteria compare the short-term execution cost of undertaking the decommissioning options and the long-term legacy cost of undertaking post decommissioning monitoring surveys, contribution to the Fisheries Legacy Trust Fund to support pipeline snagging hazard awareness amongst fishermen and potential remedial works for leave in-situ options. Overall, the leave in-situ options (1a and 2a) and the partial removal option 4 are more favourable economically than the removal options driven by the short-term costs. The short-term full removal cost for Option 6 is £43 million compared to £2.9 million for leave in -situ Option 1a.

#### 6.5.4 Recommendation

The partial removal (Option 4) and leave in-situ options (Options 1a and 2a) all score relatively closely and were significantly preferred over the full removal option. These close scores reflect the similar nature of the partial and leave in-situ options in terms of scope. The most attractive option by a narrow margin is Option 1a, where the line ends are removed with the remainder left in-situ. This was the most attractive option from an environmental perspective due to the limited scope and lack of rock cover compared to some of the other options. It was also equally preferred for Option 2a and Option 4 from a technical and societal perspective as they are all similar to execute and have similar fishing and other societal impacts. Option 1a was not the most attractive from a safety perspective due to the residual risk of leaving the lines with exposures but was close enough to still be the overall preferred option. The emerging preference for Option 1a was maintained when the Economic criterion was included.

The full removal option 6 was considered significantly less attractive than the leave in-situ or partial removal options. This is in mainly due to the increased offshore work scopes required for full removal increasing the safety risk, the environmental impact and the disruption to the fishing industry. In addition, the extra material being returned by removing the full pipeline had additional impact in terms of onshore personnel safety exposure and use of landfill from the polymer returned. There was also a significant impact from the de-burial of the line to allow removal. The positive attributes of these



full removal options such as no residual safety risk and no legacy environmental impact were insufficient to offset the impacts.

Overall, given the similar total score for the leave in-situ options (Option 1a and Option 2a) and partial removal (Option 4), these options are considered equally preferred. As such, the emerging recommendation from the CA is that any of these options may be executed as the decommissioning solution. Common to each of these options is the disconnection and removal of the pipeline ends. Spot rock placement would be installed at the cut pipeline ends to mitigate any potential snag hazard.

The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipelines, would be marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning pipelines (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 6.6 CA Outcome – Group 4 – Trenched Interfield Concrete Coated Piggyback Pipelines >16"

## 6.6.1 Group Characteristics

Group 4 consists of three concrete coated, rigid pipelines that are greater than 16 inches in diameter (PL458, PL1093 and PL2017). Each of the gas lines has an associated piggyback methanol line (PL459, PL1094 and PL2108 respectively). Each of the gas lines were laid within a trench and buried to 1m and have minimal areas of exposure. The Vulcan lines were installed in 2011 and the Saturn and Ganymede lines in 2015. The Saturn lines have seven pipeline crossings and the Ganymede lines have two pipeline crossings.

The pipeline is shown in context in Figure 6-11 and its key characteristics are shown in Table 6-6.

ID	Description	CA Batte	ry Limits	Diameter	Length	Exposure
	Description	From	То	(inches)	(m)	(m)
PL458	Vulcan RD to LOGGS PP 18" Gas Line	Vulcan RD	LOGGS PP	18	16,147	253
PL459	LOGGS PP to Vulcan RD 3" MeOH Line	LOGGS PP	Vulcan RD	3	16,100	Piggybacked to PL458
PL1093	Ganymede ZD to LOGGS PR 18" Gas Line	Ganymede ZD	LOGGS PR	18	19,501	75
PL1094	LOGGS PR to Ganymede ZD 3" MeOH	LOGGS PR	Ganymede ZD	3	19,492	Piggybacked to PL1093
PL2107 Saturn ND to LOGGS PR 14" Gas Line		Saturn ND	LOGGS PR	14 Note 1	43,240	14 Note 3
PL2108	LOGGS PR to Saturn ND 3" MeOH	LOGGS PR	Saturn ND	3	43,250	Piggybacked to PL2107

Table 6-6: Group 4 Characteristics

- Note 1: Whilst this group is for pipelines greater than 16" in diameter, if was agreed to include PL2107 in this group as, whilst its diameter is 14", once the concrete coating is included, the overall diameter is greater than 16".
- Note 2: All pipelines are believed to have been trenched and mechanically backfilled during construction. No "as-built " data have been found to confirm this. However, extensive sediment coverage indicates trenching and backfill was carried out.
- Note 3: The exposure detailed for the pipelines PL2107/ PL2108 is at the pipeline ends only.



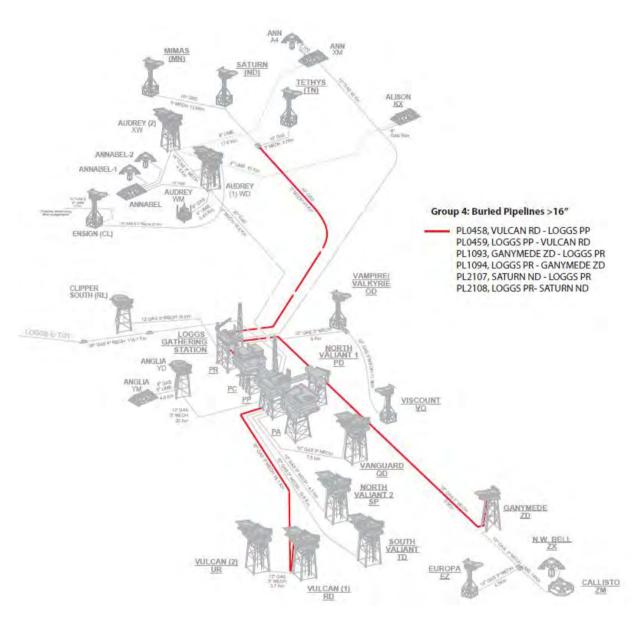


Figure 6-11: LOGGS Area (LDP2 – 5) Group 4

# 6.6.2 Decommissioning Options for Evaluation

Ten options were presented at CA screening stage with six of those screened out. The four decommissioning options retained for CA evaluation were:

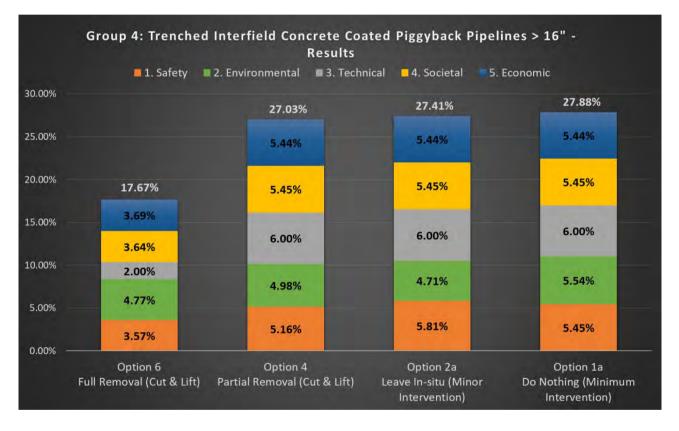
- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 2a: Leave in-situ (Minor Intervention) Removal of pipeline ends and rock placement on all ends and exposures
- Option 4: Partial Removal Cut and lift exposures and rock placed on all cut ends
- Option 6: Full Removal Cut and lift



## 6.6.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 4 – Trenched Interfield Concrete Coated Piggyback Pipelines >16" were assessed using the evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 4 is shown in Figure 6-12.

The evaluation process identified the leave in-situ option 1a (minimum intervention) to be the highest score by a narrow margin as it is preferred for all criteria, apart from a slight reduction in the safety criteria due to the legacy risk that the exposed pipeline presents. Option 2a and 4 that remove the exposures in the pipeline, derive similar results to Option 1a. However, both these options require the introduction of rock into the marine protected environment resulting in habitat loss to remove pipeline exposure. The leave in-situ Option 1a retains the long-term legacy risk to fishermen associated with pipeline exposure, however this will be risk assessed and remediated and/ or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.





A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

# 6.6.3.1 Safety Criteria Discussion

Option 2a is the most attractive option overall. The short-term operational safety risk associated with remediating approximately 500m of exposures with rock cover can be undertaken in a relatively short duration, reducing the risk to offshore personnel, with minor materials handling onshore minimising the onshore personnel risk. In addition, the marine vessel support to place the rock is not substantial therefore the risk to other users of the sea does not increase from this activity. The long-term safety risk posed by pipeline exposures is reduced for Option 2a as the current exposures would be eliminated by the rock.



Option 1a leave in-situ, indicates similar low short-term risks as for Option 2a, although the exposures are retained, which penalises this option with respect to Option 2a for the long-term residual risk element.

Option 4 was less attractive than Option 1a and 2a due the additional onshore safety risk posed by the materials handling onshore, the greater offshore scope, although the long-term safety risk is minimised by the partial removal of the exposures. Note that in the case of PL2107/PL2108 there are only exposures present at the pipeline ends and no exposures on the pipeline length compared to the other pipelines in this group that have exposures along the pipeline length, hence the onshore materials handling safety risk for PL2107/ PL2108 is significantly less than for the other pipelines.

Full removal, Option 6, is the least attractive for all safety criteria except for the long-term safety element as full removal eliminates the residual risk posed by pipeline exposures.

Overall, the most attractive options from a safety perspective is the option that intervenes by removing the exposures (remediating the exposure with rock placement: 2a), hence reducing the long-term residual risk, whilst also requiring minimal offshore and onshore support to execute.

#### 6.6.3.2 Environmental Criteria Discussion

The workshops considered the leave in-situ option 1a to have the least environmental impact although the alternative options were evaluated to have a similar cumulative environmental impact with little obvious preference between them.

Option 1a leave in-situ (minimum intervention) was most attractive overall due to this option having the least operational activity:

- Low vessel usage reducing the negative environmental impact of noise and discharges to sea.
- Limited pipeline remediation and hence a lower seabed disturbance with no requirement for pipeline unburial by Mass Flow Excavation and minor rock consumption.

The long-term marine impact from the degradation of remaining in-situ pipeline infrastructure is the evaluation sub-criteria where Option 1a does not score strongest. In Option 1a, the remaining pipelines are left to degrade and release degradation products into the water column over time. The full removal Option 6 scores best for this criterion due to full pipeline removal.

Partial removal of the exposures (Option 4) and leave in-situ, minor intervention (Option 2a) score weakest in terms of habitat loss as they require the application of rock introducing hard substrate into the existing sandbank. Although both Option 2a and Option 4 require the introduction of rock, the environmental results for Option 4 are higher than Option 2a because Option 2a will require more rock (full length of exposure) than Option 4 (pipeline ends only). For the Saturn ND to LOGGS pipeline, there is no difference between Option 4 and Option 2a because this pipeline does not involve exposures requiring remediation. However, for the other pipelines within the group, there are exposures along the pipeline(s) that would be removed in Option 4 and 2a.

Overall, the combined short-term and long-term environmental impact of the options associated with the decommissioning of these pipelines, favours leave in-situ, minimum intervention (Option 1a) predominantly due to this option having the lowest short-term operational marine impact and minor long-term habitat loss from minimal rock at the cut pipeline ends only. Partial removal Option 4 requires additional rock to stabilise cut ends, reducing its attractiveness compared to Option 1a whereas Option 2a and Option 6 score least attractively. Option 2a requires additional 3560 tonnes of rock to be introduced into the protected sandbank and Option 6 detrimentally impacts the



environment from short-term operations due to extensive marine disturbance and significantly higher operational vessel activity to undertake the removal of approximately 80km of pipeline.

## 6.6.3.3 Technical Criteria Discussion

The Leave in-situ options (1a and 2a) and partial removal (option 4) scored the most feasible both in terms of concept maturity and technical risk as a result of the routine nature of these operations.

The full removal option has comparatively greater risk as the operations would be conducted over a longer duration and requires de-burial which may present difficulties that lengthen the removal duration further.

## 6.6.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.

Option 1a, 2a and 4 have the least impact on commercial fishing as this option requires the least disruption and disturbance to the fishing industry. Conversely, the full removal option requires extended offshore operations and hence greater disruption to the fishing activities.

Leaving the pipeline in-situ was shown to have a more positive impact on the societal criteria compared to the removal options, driven by the higher quantity of material that would be required to be recycled if full removal took place. The greater the quantity of material that is removed, the greater the amount of material that will be bought to shore. Although recycling is a positive societal impact, it is outweighed by the requirement to use landfill because of the polymer contents within the piggybacked methanol pipelines that reduces its applicability for recycling. Since the leave in-situ options 1a, 2a and 4 (partial removal) of the 342m of exposure requires less recycling (and therefore minor use of landfill and no traffic disruption onshore) these options were more favourable than full removal (Options 6).

Overall Option 1a, 2a and 4 are equally attractive from both a societal (recycling) and commercial fishing (disruption) perspective. The removal option 6 is the least attractive because it contributes to large-scale landfill use and is likely to lead to disruptions in current fishing activity during execution.

#### 6.6.3.5 Economic Criteria Discussion

The economic criteria compare the short-term execution cost of undertaking the decommissioning options and the long-term legacy cost of undertaking post decommissioning monitoring surveys, contribution to the Fisheries Legacy Trust Fund to support pipeline snagging hazard awareness amongst fishermen and potential remedial works for leave in-situ options. Overall, the leave in-situ options (1a and 2a) and the partial removal option 4 are more favourable economically than the removal options driven by the short-term costs. The short-term full removal cost for Option 6 is £212million compared to £2.8million for leave in -situ Option 1a.

#### 6.6.4 Recommendation

The partial removal (Option 4) and leave in-situ options (Options 1a and 2a) all score relatively closely and were significantly preferred over the full removal option. These close scores reflect the similar nature of the partial and leave in-situ options in terms of scope. The most attractive option by a narrow margin is Option 1a, where the line ends are removed with the remainder left in-situ. This was the most attractive option from an environmental perspective due to the limited scope and lack of rock cover compared to some of the other options. It was also equally preferred for Options 2a



and Option 4 from a technical and societal perspective as they are all similar to execute and have similar fishing and other societal impacts. Option 1a was not the most attractive from a safety perspective due to the residual risk of leaving the lines with exposures, but was close enough to still be the overall preferred option. The emerging preference for Option 1a was maintained when the Economic criterion was included.

The full removal option 6 was considered significantly less attractive than the leave in-situ or partial removal options. This is mainly due to the increased offshore work scopes required for full removal increasing the safety risk, the environmental impact and the disruption to the fishing industry. In addition, the extra material being returned by removing the full pipeline had additional impact in terms of onshore personnel safety exposure and use of landfill from the polymer (associated with the methanol pipelines) returned. There was also a significant impact from the de-burial of the line to allow removal. The positive attributes of these full removal options such as no residual safety risk and no legacy environmental impact were insufficient to offset the impacts.

Overall, given the similar total score for the leave in-situ options (Option 1a and Option 2a) and partial removal (Option 4), these options are considered equally preferred. As such, the emerging recommendation from the CA is that any of these options may be executed as the decommissioning solution. Common to each of these options is the disconnection and removal of the pipeline ends. Spot rock placement would be installed at the cut pipeline ends to mitigate any potential snag hazard.

The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipelines, would be marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning pipelines (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 6.7 CA Outcome – Group 7 – Trenched & Buried Umbilical

# 6.7.1 Group Characteristics

Group 7 consists of a single 4" umbilical (PLU4178 (UM2)). The umbilical was laid within a trench and buried and has a single area of exposure of 11 m in length midline. The umbilical was installed in 1995 and there are no crossings associated with this line.

The pipeline is shown in context in Figure 6-13 and its key characteristics are shown in Table 6-7.

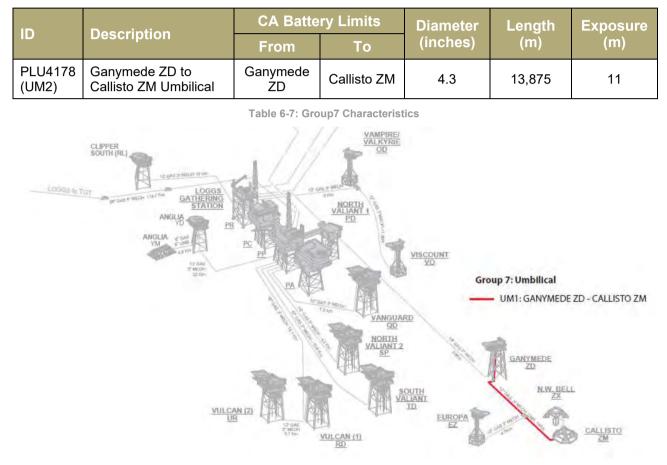


Figure 6-13: LOGGS Area (LDP2 – 5) Group 7

# 6.7.2 Decommissioning Options for Evaluation

Ten options were presented at CA screening stage with six of those screened out. The four decommissioning options retained for CA evaluation were:

- Option 1a: Leave in-situ (Minimum Intervention) Removal of pipeline ends and rock placement over cut ends only
- Option 2a: Leave in-situ (Minor Intervention) Removal of pipeline ends and rock placement on all ends and exposures
- Option 4: Partial Removal Cut and lift exposures and rock placed on all cut ends
- Option 5a: Full Removal Reverse reel

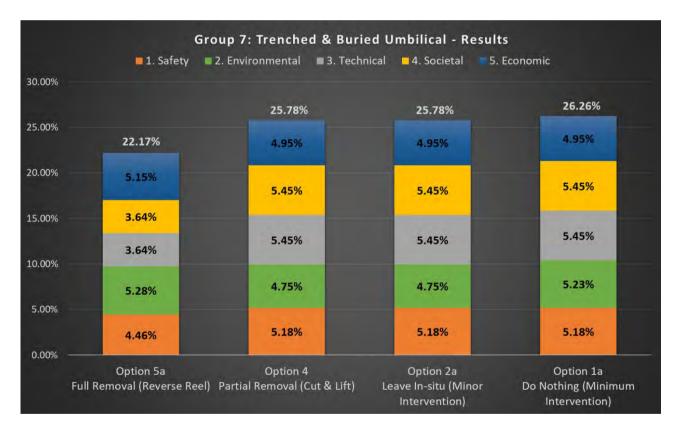


#### 6.7.3 Evaluation

During the evaluation phase of the CA, the remaining decommissioning options associated with Group 7 – Trenched & Buried Umbilical were assessed using the evaluation methodology introduced in section 2.5 and further detailed in Appendix A. The visual output representing the outcome of the evaluation for Group 7 is shown in Figure 6-14.

Overall, Option 1a leave in-situ (minimum intervention) scores the highest by a narrow margin. The evaluation process identified the leave-in situ options, (Option 1a and Option 2a) and the partial removal option (Option 4) to be equally preferred for all criteria apart from the environmental criterion associated with habitat loss which scores less favourably for Option 2a and 4 due to the need to place rock to stabilise the 11m exposure mid pipeline for option 2a and to place over the cut ends for option 4. Full removal by reverse reel scored the least favourably for all criteria apart from the environmental criteria due to the positive long-term benefits associated with the removal of the umbilical that removes umbilical degradation that includes polymers and no requirement for rock placement.

Full removal was also not the preferred option due to the technical challenges that surround the unburial of this 14km umbilical in combination with an unknown structural integrity.



#### Figure 6-14: Group 7 Evaluation Results

A discussion of the relative preference of each of the decommissioning options against each of the assessment criteria is provided in the following sub-sections.

# 6.7.3.1 Safety Criteria Discussion

Leave in-situ (Options 1a and 2a) and Partial removal (Option 4) are equally attractive from the safety perspective. This is because there is a minor 11m exposure recorded on the pipeline that would require minimal operational scope to remove by cut and lift operations (Option 4) or by rock



placement (Option 2a). Therefore, any scopes of work associated with Options 2a and 4 are ranked similarly to Option 1a that only entails the disconnection of pipeline ends. All these options have low short-term operational safety risks both onshore and offshore. In addition, the marine vessel support is not substantial therefore the risk to other users of the sea does not increase from these activities.

Full removal by reverse reel, Option 5a, is the least attractive for all safety criteria except for the long-term safety element as full removal eliminates the residual risk posed by pipeline exposures.

Overall, the most attractive options from a safety perspective are the in-situ or partial removal options as the pipeline is generally buried apart from limited exposure. The much larger operational scope associated with full removal Option 5a has the greatest operational hazards and therefore is the least attractive.

## 6.7.3.2 Environmental Criteria Discussion

The workshops considered the full removal by reverse reel Option 5a to have the least environmental impact and the alternative options (1a, 2a and 4) were evaluated to have a similar cumulative environmental impact with little obvious preference between them.

Option 5a full removal by reverse reel was the most attractive overall due to this option having the least long-term impacts:

- No requirement for additional rock placement and therefore no loss of habitat
- Elimination of the legacy impact from degradation products or polymers as a result of the full removal of the umbilical

From a short-term environmental perspective, Option 1a scored highest as there was less vessel activity and therefore less noise generated, whereas full removal Option 5a requires extensive vessel operations. In addition, there was the least marine disturbance, whereas reverse reeling operations associated with Option 5a requires extensive Mass Flow Excavation that disturbs the seabed in order to unbury the 14km pipeline length during removal operations.

Partial removal of the exposures (Option 4) and leave in-situ, minor intervention (Option 2a) score weakest in terms of habitat loss as they require the application of rock introducing hard substrate into the existing sandbank.

Overall, the combined short-term and long-term environmental impact of the options associated with the decommissioning of these pipelines, favours full removal (Option 5a) predominantly due to this option having the most favourable long-term marine impacts.

#### 6.7.3.3 Technical Criteria Discussion

The Leave in situ options (1a and 2a) and partial removal (option 4) scored the most feasible both in terms of concept maturity and technical risk as a result of the routine nature of these operations.

The full removal by reverse reel option has comparatively greater risk as the operations would be conducted over a longer duration and requires de-burial which may present difficulties that lengthen the removal duration further.

#### 6.7.3.4 Societal Criteria Discussion

The societal criteria compared the economic impact of the options on commercial fishing operations, as well as the impact the activities have on the recycling of material, landfill use and traffic disruption caused by the volume of scrap material returned to shore for handling.



Option 1a, 2a and 4 have the least impact on commercial fishing as this option requires the least disruption and disturbance to the fishing industry. Conversely, the full removal option requires extended offshore operations and hence greater disruption to the fishing activities.

Leaving the pipeline in situ was shown to have a more positive impact on the societal criteria compared to the removal options, driven by the higher quantity of material that would be required to be recycled if full removal took place. The greater the quantity of material that is removed, the greater the amount of material that will be bought to shore. Although recycling is a positive societal impact, it is outweighed by the requirement to use landfill because of the polymer coating and high pressure tubes of the umbilical that reduces its applicability for recycling. Since the leave in situ options 1a, 2a and partial removal of the 11m of exposure requires less recycling (and therefore minor use of landfill and no traffic disruption onshore) these options were more favourable than full removal of the 14km umbilical (Option 5a).

Overall Option 1a, 2a and 4 are equally attractive from both a societal (recycling) and commercial fishing (disruption) perspective. The removal Option 5a is the least attractive because it contributes to large-scale landfill use and is likely to lead to disruptions in current fishing activity during execution.

# 6.7.3.5 Economic Criteria Discussion

The economic criteria compare the short-term execution cost of undertaking the decommissioning options and the long-term legacy cost of undertaking post decommissioning monitoring surveys, contribution to the Fisheries Legacy Trust Fund to support pipeline snagging hazard awareness amongst fishermen and potential remedial works for leave-in situ options. Overall, the leave in situ options (1a and 2a) and the partial removal option 4 are more favourable economically than the removal options driven by the short-term costs. The short-term full removal cost for Option 6 is  $\pounds$ 6million compared to £1.7million for leave in -situ Option 1a.

# 6.7.4 Recommendation

The partial removal (Option 4) and leave in-situ options (Options 1a and 2a) all score relatively closely and were preferred over the full removal option. These close scores reflect the similar nature of the partial and leave in-situ options in terms of scope, as the pipeline is recorded to be sufficiently buried with a minor 11m exposure to which remediation is necessary in Options 2a and 4.

Option 1a, where the line ends are removed with the remainder left in-situ, is marginally more attractive overall. The driver for this result, is the minor short-term work scope required to implement this option. Where Option 1a does not score favourably is the environmental criteria, where rock is required to be applied on the pipeline ends and the umbilical (together with its polymer contents) are left to degrade in the marine environment. The emerging preference for Option 1a was maintained when the Economic criterion was included.

The full removal by reverse reel Option 5a was considered less attractive than the leave in-situ or partial removal options. This is mainly due to the greater offshore work scopes required for full removal increasing the safety risk, the technical challenges associated with umbilical de-burial and the short-term disruption to the fishing industry during operations. In addition, the extra material being returned by removing the full pipeline had additional impact in terms of onshore personnel safety exposure and use of landfill from the polymer returned. The positive attributes of these full removal options such as no residual safety risk and no legacy environmental impact were insufficient to offset the impacts.

Overall, given the similar total score for the leave in-situ options (Option 1a and Option 2a) and partial removal (Option 4), these options are considered equally preferred. As such, the emerging recommendation from the CA is that any of these options may be executed as the decommissioning



solution. Common to each of these options is the disconnection and removal of the umbilical ends. Spot rock placement would be installed at the cut umbilical ends to mitigate any potential snag hazard.

The single 11 m exposure will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposure will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining umbilical, would be marked on sea charts and notifications issued to fishermen / other users of the sea and left to degrade over time. The post decommissioning umbilical (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.



# 7 Summary of Final Recommendations

The LOGGS Area infrastructure was consolidated into a total of ten groups for Comparative Assessment purposes with the decommissioning approach for three of the groups being selected without performing the full CA process. These are:

- Group 5 Subsea Structures: The subsea structures, as detailed in Table 3-2, were confirmed at the CA Scoping and Screening stage to be full removal in accordance with OPRED Guidelines ref. [4].
- Group 6 Rigid Spools / Flexible Jumpers: The spools and jumpers were confirmed at the CA Scoping and Screening stage to be excluded from the remaining CA process as rigid spools and flexible jumpers would be treated as part of the corresponding pipeline to which they are connected and dealt with within the applicable pipeline groups.
- Group 8 Mattresses and Grout Bags: The mattresses and grout bags were confirmed at the CA Scoping and Screening stage to be excluded from the remaining CA process. Group 8 are the protection and stabilisation mattresses and grout bags used within the fields. Where mattresses and grout bags require to be moved to gain access to infrastructure that is to be removed, they will be fully removed and disposed of onshore in accordance with guidelines ref. [4]. Mattresses and grout bags that are providing stabilisation of pipelines or sections of pipelines that will be left in-situ, shall be left in-situ with minimal disturbance.

The remaining seven groups were subjected to the full CA process as detailed in Section 4 to 6. The emerging recommendations for the decommissioning option selected for each of these groups are as follows:

- Group 1 Trunkline: This group consists of the single, 36", 118 km trunk line from LOGGS PP to TGT. The evaluation workshops considered four options; full removal by cut and lift (Option 6), partial removal by cut and lift (Option 4), leave in-situ minor intervention (Option 2a) and leave in-situ minimum intervention (Option 1a). The emerging recommendation from the CA is to leave the Trunkline in-situ with minimum intervention. This would entail disconnection and removal of the pipeline at the LOGGS end and at the tee locations. Spot rock placement would be installed at the cut pipeline ends only. The remaining pipeline, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.
- Group 2 Mattress Covered Short Umbilical & Associated Pipeline: This group consists of the two short pipelines (80 m) and one short umbilical (80 m) running between NW Bell and Callisto. The evaluation workshops considered two options, full removal by cut and lift (Option 6) and leave in-situ with minimum intervention (Option 1a). The assessment showed little to choose between these options and as such, the emerging recommendation from the CA is that either the full removal or the leave in-situ could be progressed. Should the leave in-situ option be progressed, the remaining pipelines and umbilical, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipelines and umbilical (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.
- Group 3a Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤ 16": This group consists of the three gas lines (two 10" and one 12") with their piggybacked MeOH lines in the Saturn and Europa areas. Three options were evaluated for these lines, full removal by



cut and lift (Option 6), full removal by reverse reel (Option 5a) and leave in-situ with minimum intervention (Option 1a). The emerging recommendation from the CA is to leave the trenched pipelines in-situ with minimum intervention. This entails removal of the ends of the pipelines and placing spot rock cover at the cut ends only. The remaining pipelines, left in their current state will have no remaining exposures and would be marked on navigational charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

- Group 3b Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16": This group consists of the single, 4", 118 km MeOH pipeline from TGT to LOGGS PP. The evaluation workshops considered five options; full removal by cut and lift (Option 6), full removal by reverse reel (Option 5a), partial removal by cut and lift (Option 4), leave in-situ minor intervention (Option 2a) and leave in-situ minimum intervention (Option 1a). The emerging recommendation from the CA is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This would entail disconnection and removal of the pipeline at the LOGGS end and at the tee locations with spot rock placement installed at the cut pipeline ends in all cases. The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipeline, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of The post decommissioning pipeline (and associated stabilisation features) the sea. monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.
- Group 3c Trenched Interfield Concrete Coated Piggyback Pipelines  $\leq$  16": This group • consists of the four gas lines (three 10" and one 12") with their piggybacked MeOH lines in the Vanguard, North Valiant SP and Ganymede ZD to Callisto ZM. Four options were evaluated for these lines, full removal by cut and lift (Option 6), partial removal of the spanning and exposed sections (Option 4), leave in-situ minor intervention (Option 2a) and leave insitu with minimum intervention (Option 1a). The emerging recommendation from the CA is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This would entail disconnection and removal of the pipeline ends with spot rock placement installed at the cut pipeline ends in all cases. The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipelines, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.
- Group 4 Trenched Interfield Concrete Coated Piggyback Pipelines > 16": This group consists of the three gas lines (two 18" and one 14") with their piggybacked MeOH lines in the Vulcan, Ganymede and Saturn areas. Four options were evaluated for these lines, full removal by cut and lift (Option 6), partial removal of the spanning and exposed sections (Option 4), leave in-situ minor intervention (Option 2a) and leave in-situ with minimum intervention (Option 1a). The emerging recommendation from the CA is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This would entail disconnection and removal of the pipeline ends with spot rock placement installed at the cut pipeline ends in all cases. The exposures will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposures will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining pipelines, left in their current state,



would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning pipeline (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time.

Group 7 – Trenched and Buried Umbilical: This group consists of a single umbilical running between Ganymede and Callisto. The evaluation workshops considered four options, full removal by reverse reel (Option 5a), partial removal by cut and lift (Option 4), leave in-situ minor intervention (Option 2a) and leave in-situ with minimum intervention (Option 1a). The emerging recommendation from the CA is that any of the partial removal (Option 4) or leave in-situ (Option 2a and Option 1a) options may be executed as the decommissioning option. This would entail disconnection and removal of the umbilical ends with spot rock placement installed at the cut umbilical ends in all cases. The single 11 m exposure will be risk assessed to determine whether remediation is necessary, with the outcome of this assessment influencing whether the exposure will be removed (Option 4), rock covered (Option 2a) or left in-situ (Option 1a). The remaining umbilical, left in its current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. The post decommissioning umbilical (and associated stabilisation features) monitoring programme will be agreed with OPRED and will be in accordance with OPRED guidance in operation at that time

Group	Infrastructure Type	Decommissioning Recommendation
1	Trunk Line	Option 1a – Leave In-situ (Minimum Intervention)
2	Mattress Covered Short Umbilical & Associated Pipeline	Either Option 6 – Full removal or Option 1a – Leave In-situ (Minimum Intervention may be progressed
3a	Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤ 16"	Option 1a – Leave In-situ (Minimum Intervention)
3b	Trenched Interfield Non-concrete Coated Non-piggyback MeOH Pipeline ≤ 16"	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a Option 1a – Leave In-situ (Minimum Intervention may be progressed
Зс	Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16"	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a Option 1a – Leave In-situ (Minimum Intervention may be progressed
4	Trenched Interfield Concrete Coated Piggyback Pipelines > 16"	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a Option 1a – Leave In-situ (Minimum Intervention may be progressed
5	Subsea Structures	Full Removal
6	Rigid Spools / Flexible Jumpers	Treated as part of the relevant pipelines group
7	Trenched and Buried Umbilical	Either Option 4 – Partial Removal, Option 2a – Leave In-situ (Minor Intervention) or Option 1a Option 1a – Leave In-situ (Minimum Intervention may be progressed
8	Mattresses and Grout Bags	Leave In-situ where providing pipeline stabilisation

The above emerging recommendations are summarised in Table 7-1.

Table 7-1: Final LOGGS Area (LDP2 – 5) Recommendations



# 8 References

1.	LOGGS Area Decommissioning Method Statement	Xodus Group, LOGGS Area Decommissioning Method Statement, A400274-S00-REPT-002, Rev. A01, Dated 18/10/2017.
2.	Risk Analysis of Decommissioning Activities	Joint Industry Project Report "Risk Analysis of Decommissioning Activities" (Safetec 2005) [ <u>http://www.hse.gov.uk/research/misc/safetec.pdf]</u>
3.	Analytical Hierarchy Process	The Analytical Hierarchy Process by T.L. Saaty, McGraw Hill, 1980.
4.	Guidance Notes Decommissioning of Offshore Oil & Gas Installations and Pipelines	OPRED (2018) Offshore Oil and Gas Decommissioning Guidance Notes. https://assets.publishing.service.gov.uk/government/uploads/system/uploa ds/attachment_data/file/760560/Decom_Guidance_Notes_November_201 8.pdf
5.	Decommissioning Risk	Safetec – Risk Analysis of Decommissioning Activities, Doc. No. ST-20447-RA-1, Rev. 03, Dated 03/03/2005
6.	CA Guidelines	OGUK, Guidelines for Comparative Assessment in Decommissioning Programmes, J60073A-A-RT-00001, October 2015
7.	Fisheries Impact Assessment	Brown & May Marine Limited, Commercial Fisheries Baseline Characterisation: LOGGS South, LOGGS North and CMS Areas, August 2017
8.	2017 UK Greenhouse Gas Emissions	2017 UK Greenhouse Gas Emissions, Final Figures. Statistical release: National Statistic, online at <u>https://assets.publishing.service.gov.uk/government/uploads/system/uploa</u> <u>ds/attachment_data/file/776085/2017_Final_emissions_statistics</u> _report.pdf
9.	LOGGS Pipeline Burial and Stabilisation Material Report	BMT Cordah Limited, Lincolnshire Offshore Gas Gathering System (LDP2, LDP3, LDP4, LDP5) Pipeline Burial and Stabilisation Material Report, BMT_SNS-L-XX-P-HS-02-00001, Rev C1, January 2017
10.	Navigational Risk Assessment	Anatec (2017) Navigational Risk Assessment – LOGGS Area Decommissioning. Anatec report no. No. A309-CoP-NRA-1. Revision C1 (Final), November 2017



# APPENDIX A EVALUATION METHODOLOGY

# Appendix A.1 Introduction

Chrysaor has selected a Multi Criteria Decision Analysis (MCDA) methodology for the evaluation phase of the CA. This methodology uses a pairwise comparison system based on the methodologies of the Analytical Hierarchy Process (AHP) by T.L. Saaty, described in various publications, such as the Analytical Hierarchy Process ref. [3]. 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 (listed in Appendix A.2).
- Define Options completed as part of CA Screening.
- Pre-populate worksheets for internal CA workshop(s) based on all the studies undertaken the worksheets were pre-populated in advance of the internal CA workshops.
- Perform internal CA workshop.
- Discuss attributes of each option against each differentiating criterion the discussion was recorded 'live' during the workshop in order that informed opinion and experience was factored into the decision-making process.
- Perform scoring (see Appendix A.3).
- Perform sensitivity analyses to test the decision outcomes.
- Export worksheets as a formal record of the workshop attendees' combined opinion on the current preferred options, the 'Emerging Recommendations'.
- Evaluate whether the CA needs to 'recycle' study work (Preparation Phase) to obtain any further information to help inform decision making.
- Discuss Emerging Recommendations with stakeholders.
- Recycle process as required prior to decision on the selected options that will be presented in the Decommissioning Programme and assessed in the Environmental Appraisal.

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



# **Appendix A.2** Differentiating Criteria & Approach to Assessment

A key step in setting up the CA was agreeing and defining the appropriate criteria that differentiates between each of the tabled options. As a starting point, the criteria considered for this CA were taken from the Guidelines for Decommissioning of Offshore Oil and Gas Installations and Pipelines ref. [4], which are as follows (in no particular order):

- Safety
- Environmental
- Technical
- Societal
- Economic

These differentiating criteria were found to be appropriate for the decommissioning options tabled and were taken forward as the main differentiating criteria for the CA. Additional sub-criteria and definitions were added for clarity and are shown in Table 8-1 alongside the approach used for assessment under each criteria or sub-criteria.



Differentiating Criteria	Sub-Criteria	Description	Approach to Assessment
1 - Safety	1.1 Personnel Offshore	This sub-criterion considers elements that impact risk to offshore personnel and includes, project team, project vessel crew, diving teams, supply boat crew, and survey vessel crew. It should be noted that crew changes are performed via port calls. Any requirement for handling HazMat / NORM shall also be addressed here.	
	1.2 Personnel Onshore	This sub-criterion considers elements that impact risk to onshore personnel. Factors such as any requirement for dismantling, disposal operations, material transfer and onshore handling may impact onshore personnel. Any requirement for handling HazMat / NORM shall also be addressed here.	Summed PLL numbers allow a quantified direct comparison between options. See section 5.2 for information on study work undertaken.
	1.3 Other Users	This sub-criterion covers the impact associated with the risk to other users. Considers elements such as collision impact whilst performing activities. Users such as fishing vessels, commercial transport vessels, recreational vessels and military vessels are considered.	Assessment made based on summed PLL numbers and narrative around other factors such as high consequence events or residual risk where there was a differentiator.
	1.4 High Consequence Events	This sub-criterion relates to any inherent potential for high consequence events i.e. major accident hazard type events. It applies to all onshore and offshore personnel involved in the project. Considerations such as dropped object concerns, support vessel risks, are considered.	diferentiator.
	1.5 Residual Risk	This sub-criterion addresses residual safety risk to other sea users i.e. fishermen, military vessel crews, commercial vessel crews and passengers, other sea users, that is provided by the option. Issues such as residual snag risk, collision risk, etc. may be considered.	



Differentiating Criteria	Sub-Criteria	Description	Approach to Assessment
	2.1 Operational Marine Impact	This sub-criterion covers elements such as noise generated by vessels, cutting operations, any explosives etc. This sub-criterion also covers elements such as discharges to environment from vessels and / or activities performed. Consideration is also given to major environmental incident type events that may occur during the operations here.	Assessment based on discussion of underwater noise generated by decommissioning activities in the short term. Also considers planned and unplanned discharges on a qualitative basis.
	2.2 Legacy Marine Impact	This sub-criterion covers all legacy environmental impacts from any material left in-situ. Elements such as the discharge of any contents over time (leaching) and the impact from plastics or other potential harmful materials left behind are considered. Consideration is also given here to major environmental incident type events that may occur after the decommissioning activities are complete.	Qualitative assessment of the impact associated with any infrastructure left in-situ.
		Note: Impact of any remediation measures that may be required in the future is not included due to the uncertain nature of future remediation. Where future remediation is required, options for the best approach for that remediation will be explored at that time.	
2. Environmental	2.3 Fuel Use & Atmospheric Emissions	This sub-criterion relates to the amount of atmospheric emissions associated with a particular option. It also covers fuel use which is tightly correlated to atmospheric emissions.	Quantified estimate of the fuel use and atmospheric emission generated during a decommissioning option. The output $CO_2$ figures allow a direct, quantitative comparison between options.
	2.4 Other Consumptions	This sub-criterion relates to the amount of resource consumption associated with the option. It covers elements such as environmental burden from processing returned materials, use of quarried rock or other new material and any environmental burden associated with the production of replacement materials for material left in-situ.	Assessment based on quantifying the volume of fuel and new material used.
	2.5 Disturbance	This sub-criterion relates to both direct and indirect seabed disturbance. Consideration is given to the type and area of disturbance encountered and the impact this may have in the short-term.	Assessment based on quantifying the area of disturbance by type of disturbance (dredging, trenching, backfilling), in combination with an understanding of the baseline environment in the area as shown by the outputs from the environmental surveys.
	2.6 Loss of Habitat	This sub-criterion relates to the long-term loss of, or material change to, the seabed habitat that occurs from performing the decommissioning option. Consideration is given to the area and nature of any permanent habitat change.	Assessment based on quantifying the area of loss of habitat by type activity (rock placement), in combination with an understanding of the baseline environment in the area as shown by the outputs from the environmental surveys.



Differentiating Criteria	Sub-Criteria	Description	Approach to Assessment
3 – Technical	3.1 Technical Feasibility	This sub-criterion relates to the various technical risks associated with the decommissioning options, 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 two key areas. Concept Maturity, where the technical novelty of the decommissioning option is addressed and Technical Risks, where the factors that may result in an inability to deliver the decommissioning option as defined are described.	Assessment based on engineering studies (see section 5.5) and captures: Concept Maturity Technical Risk
	4.1 Fishing	This sub-criterion addresses the economic impact of the option on commercial fishing operations. It includes consideration of impacts from both the decommissioning activities and residual impacts post decommissioning such as reinstatement of access to area.	Commercial Fisheries Baseline Study provides a base level of understanding for the importance of the area for fisheries. This is combined with narrative (rather than quantification) regarding the influence of each decommissioning option on the availability of the area of seabed for fisheries.
4 – Societal	4.2 Other Users	This sub-criterion addresses any socio-economic impacts on other users both onshore where the impact may be from dismantling, transporting, treating, recycling and land filling activities relating to the option and offshore. 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 process which has a negative impact on communities, increased traffic disruption due to extra-large transport loads, etc.	Assessment of impacts on other users is a qualitative narrative considering both positive and negative impacts on waste disposal, recycling, business interruption and general community impacts. Potential employment benefits have been considered but at the scale of any individual option and in context with the wider full removal the potential employment benefits are not deemed to be a differentiator.
	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.	See engineering studies, section 5.5.
5 – Economic	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. It also addresses any contributions required to the Fishing Legacy Fund (FLTC).	See engineering studies, section 5.5. Timeframe assumed for the purposes of the CA is 10 years.

Table 8-1: Sub-criteria Definition



# Appendix A.3 Differentiator Weighting

The 5 main differentiating criteria all carry a 20% weighting, that is, all criteria are neutral to each other. Figure 8-1 shows the pairwise comparison matrix. Chrysaor decided that equal weightings for the main criteria offers the most transparency and a balanced view from all perspectives.

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

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

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.

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, the team 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 cover from a safety perspective? Are these Neutral to each other? Is it 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.



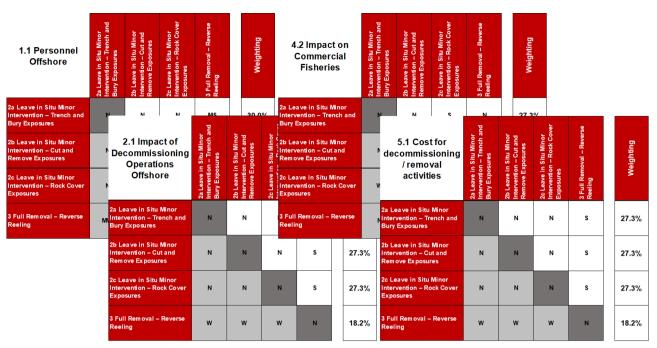


Figure 8-2: Example Option Pair-Wise Comparison

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, an opportunity was provided to test 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 B to Appendix H.





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 GROUP 1 – DETAILED EVALUATION RESULTS

# **Appendix B.1** Group 1 Attributes Table

# Group 1: Trunkline

- 118 km 36" concrete trunkline from LOGGS PP platform to Theddlethorp Gas Terminal (PL0454), 13 crossings, 2 in-line tees and 28 km of exposure

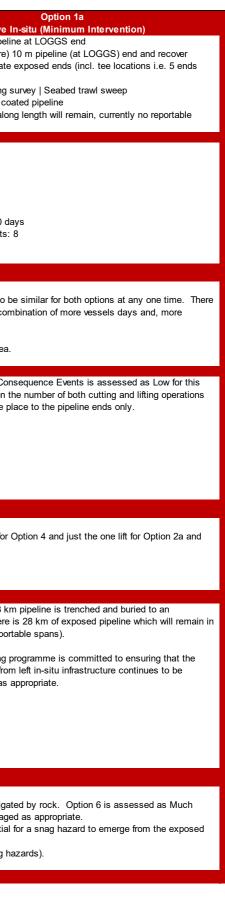
		Onti	on 6		Option 4	Option 2a	Option 1a
			al (Cut & Lift)		Partial Removal (Cut & Lift)	Leave In-situ (Minor Intervention)	Leave In-situ (Minimum Intervention)
	- Unbury entire pipeline with Mass Flow Excavator (MFE)			- Dredge to uncover pip		- Dredge to uncover pipeline at LOGGS end	- Dredge to uncover pipeline at LOGGS end
		ond wire) pipeline into	( )	<b>v</b> 11	e) 10 m of pipeline at LOGGS end and recover	- Cut (with diamond wire) 10 m of pipeline at LOGGS end and recover	
	· ·	tions and recover		· ·	e) all exposed sections into 20 m lengths	- Place rock to remediate exposed ends (incl. tee locations i.e. 5 end	
			ing survey   Seabed trawl sweep	- Bundle cut sections a	, , ,	total)	total)
		1	5 71 1	- Place rock to remedia	ate exposed cut ends (incl. tee locations)	- Place rock across all exposed sections	- Post decommissioning survey   Seabed trawl sweep
				- Post decommissionir	g survey   Seabed trawl sweep	- Post decommissioning survey   Seabed trawl sweep	- 118 km 36" concrete coated pipeline
				- 28 km of exposures a	long length will be removed	- 28 km of exposures along length will be rock dumped	- 28 km of exposures along length will remain, currently no reportable
							spans
	Vessel Type: Pe	B / Days / Hours / Pl		Vessel Type: PoB / Da	we / Houre / PLL	Vessel Type: PoB / Days / Hours / PLL	Vessel Type: PoB / Days / Hours / PLL
e		9.7 / 1.359.244 / 1.02		DSV: 110 / 253.4 / 334		DSV: 110 / 4.8 / 6.389 / 4.79E-04	DSV: 110 / 5.1 / 6.666 / 5.00E-04
оч	,	9.7 / 1,359,244 / 1.02 9.7 / 444.843 / 4.31E		DSV: 110 / 253.4 / 354 Divers: 18 / 253.4 / 109		Divers: 18 / 4.8 / 2.091 / 2.03E-03	Divers: 18 / 5.1 / 2.182 / 2.12E-03
Offsh	Trawler: 5 / 8.0 /	,,	-01	Trawler: 5 / 8.0 / 480 /		Trawler: 5 / 8.0 / 480 / 3.60E-05	Trawler: 5 / 8.0 / 480 / 3.60E-05
		480 / 3.00 <u>2</u> -05 14 / 18.0 / 9,478 / 7.1	1E 04	Survey Vessel: 44 / 18		Survey Vessel: 44 / 18.0 / 9.478 / 7.11E-04	Survey Vessel: 44 / 18.0 / 9,478 / 7.11E-04
nnel		.9 / 1,095,257 / 8.21E		CSV: 76 / 273.9 / 249.		Rockdump Vessel: 20 / 110.2 / 26,455 / 1.98E-03	
Sol	000.7071,200.	.97 1,035,257 7 0.212	-02	,	/ 54.4 / 13.046 / 9.78E-04	Nockdump Vessel. 207 110.27 20,4007 1.30E-00	Total offshore hours: 18.805 hrs
Per	Total offebora ba	urs: 2,909,302 hrs		Nockdullip vessel. 20	7 54.4 / 15,040 / 5.702-04	Total offshore hours: 44,892 hrs	Total offshore PLL: 3.36E-03
÷.	Total offshore PL	, ,		Total offshore hours: 7	16 838 bre	Total offshore PLL: 5.24E-03	
÷				Total offshore PLL: 1.5	- /		
	W	MW	MW	MW MW N			
Summary	for Option 6 due Option 4 is asse Option 2a is asse	e is more than 100 tir to the much longer w ssed as being Much essed as being Neuti	nes higher for Option 6 due to the mu ork scope durations compared to min Weaker than both Option 2a and 1a a	ch longer work scope du imal intervention required as the risk exposure is 30 mall difference in the risk	rations required to remediate the pipeline compared of or Option 2a and 1a. The sand 45 times higher respectively for Option exposure between the two options due to the sr		al for Option 6. Option 6 is assessed as being Much Weaker than Option 2a as Much Weaker than Option 1a as the risk exposure is more than 100 times higher ess a preference.
			ine equally preferred norm a risk to				
ē		Days / Hours / PLL		Resource Type: Days		Resource Type: Days / Hours / PLL	Resource Type: Days / Hours / PLL
un on o	Onshore Operation	ons (Cleaning & Disp	osal): 4,858.0 / 310,912 / 3.82E-02	Onshore Operations (C	Cleaning & Disposal): 1,180.0 / 75,520 / 9.29E-03	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06
1.2 Personnel Onshore	Total onshore hours: 310,912 hrs Total onshore PLL: 3.82E-02		Total onshore hours: 75,520 hrs Total onshore PLL: 9.29E-03		Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06	Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06	
	W	VMW	VMW	VMW	VMW	N	
Summary	Option 6 is asse Much Weaker th Option 4 is asse	ssed as being Weak an both Option 2a an ssed as being Very N	d Option 1a due to the much higher ri	isk exposure (almost 500 I Option 1a due to the mi	00 times higher) for onshore personnel due to har uch higher risk exposure (over 1000 times higher	ndling 118 km of pipeline versus the short 10m pipeline end section from th of or onshore personnel due to handling 28 km of pipeline versus the short 1	

NOTE: Pipeline Numbers in Appendix with a "0" after the "PL" are equivalent to those in the main body of the document with the same numbering but that do not contain the "0" in front of the "PL". The Main body of the text utilises the correct reference for the pipeline numbers.



				tion 6			Option 4			Option 2a	
	Full Removal (Cut & Lift) - Unbury entire pipeline with Mass Flow Excavator (MFE) - Cut (with diamond wire) pipeline into 20 m lengths - Bundle cut sections and recover - Backfill trench   Post decommissioning survey   Seabed trawl sweep					Unbury entire pipeline with Mass Flow Excavator (MFE)       - Dredge to uncover pipeline at LOGGS end         Cut (with diamond wire) pipeline into 20 m lengths       - Cut (with diamond wire) 10 m of pipeline at LOGGS end and recover         Bundle cut sections and recover       - Cut (with diamond wire) all exposed sections into 20 m lengths				(Minor Intervention) DGGS end     ipipeline at LOGGS end and recover ed ends (incl. tee locations i.e. 5 ends sections Seabed trawl sweep h will be rock dumped	Leave - Dredge to uncover pipe - Cut (with diamond wire - Place rock to remediat total) - Post decommissioning - 118 km 36" concrete c - 28 km of exposures alo spans
1. Safety	1.3 Other Users	Vessel Days: DSV: 1,029.7 Divers: 1,029.7 Trawler: 8.0 Survey Vessel: 18. CSV: 1,200.9 Total vessel days: : Total Number of Tra	2,256.6 days	MW		Vessel Days: DSV: 253.4 Divers: 253.4 Trawler: 8.0 Survey Vessel: 18.0 CSV: 273.9 Rockdump Vessel: 54.4 Total vessel days: 607.7 Total Number of Transits: W			Vessel Days: DSV: 4.8 Divers: 4.8 Trawler: 8.0 Survey Vessel: 18.0 Rockdump Vessel: 110.2 Total vessel days: 141.0 days Total Number of Transits: 32		Vessel Days: DSV: 5.1 Divers: 5.1 Trawler: 8.0 Survey Vessel: 18.0 Total vessel days: 31.0 ( Total Number of Transits
s	ummary	The assessment of Option 6 is assess are however, a high significantly, the hi Option 4 is assess Option 2a and Opti	f the Other Users s ed as being Weak her number of vess gher number of tra ed as being Weak on 1a are assesse	sub-criterion is as it er that Option 4. A el transits to / from nsits to / from the er than both Optio ed as being Neutra	Whilst there are man the work site (376 work site (376 versu n 2a and Option 1a I to each other as, w	ny more vessel days to rer versus 100) which provide is 32 or 8). due to the higher number o	move the full pipeline lengt a small increase in the po of vessel days and the hig in the number of vessel d	otential safety impact on other number of transits to	a longer operational duration and s other users. Option 6 is assessed / from the work site (100 versus 32	o the impact on safety of other users fror being Much Weaker than both Option 2a cor 8). n a material difference on the safety impa	a and Option 1a due to a co
1. Safety	1.4 High Consequence Events	The potential for Hi option. This is base that would need to It should be noted to group and it has be hydrocarbon live. Number of Lifts: 1,4	ed on the number take place to fully that there are num en assumed that	of both cutting and remove the pipelin ber of pipeline cros	lifting operations le. ssings within this		nsequence Events is ass ised on the number of both ed to take place to remov	n cutting and lifting		ce Events is assessed as Low for this ber of both cutting and lifting operations the pipeline ends only.	The potential for High Co option. This is based on that would need to take Number of Lifts: 1
s	ummary	Option 6 is assess Option 1a. Option 4 is also as Option 2a is asses	ed as being Weak sessed as being \ sed as being Neut	er than all other op Neaker than Option tral to Option 1a as	n 2a and Option 1a, the potential for Hig	nigh number of lifting opera	f lifting operations for onbo	arding the bundled, cut se		I for a dropped object hazard, compared one lift, resulting in greater potential for a	
1. Safety	1.5 Residual Risk	As the pipeline wou legacy risk associa			<ul> <li>d, there would be no</li> <li>The majority of the 118 km pipeline is trenched and buried to an appropriate depth. There is 28 km of exposed pipeline which will be removed with the potential snag hazard associated the cut ends mitigated by spot rock placement designed to be overtrawlable. A post-decommissioning trawl sweep will be conducted.</li> <li>As such, the potential snag hazard post-decommissioning activities is adequately mitigated and lower than for the pipeline in its current state of exposure.</li> <li>The survey &amp; monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed &amp; mitigated as appropriate.</li> </ul>				depth. There is 28 km of expose mitigate the potential snag hazar The areas of rock placement will post-decommissioning trawl swee As such, the potential snag haza adequately mitigated and lower the exposure. The survey & monitoring program	d pipeline which will be rock durined to d associated with these exposed areas. be designed to be overtrawlable and a ep will be conducted. Ind post-decommissioning activities is nan for the pipeline in its current state of me is committed to ensuring that the esitu infrastructure continues to be	te The majority of the 118 k appropriate depth. There its current state (no repo The survey & monitoring potential snag hazard fro managed & mitigated as
		S	S	MS		N	S		S		
S		Stronger than Option Option 4 is assess pipeline in Option 1 Option 2a is asses	ed as being Stron on 1a as there is r ed as being Neutr a (albeit this optic sed as being Stro	ger than both Option no residual risk ass al to Option 2a as on includes an appr nger than Option 1	on 4 and Option 2a d ociated with the full the residual risk is s opriate monitoring p	removal option versus pote imilar due to the potential rogramme to identify and r ng potential for a snag haz	ential for a snag hazard in snag hazard from pipeline manage emerging hazards	Option 1a. Note: existin e exposure being mitigate s).	g potential for snag hazard in Optio d in both cases. Option 4 is asse	ption 4 and Option 2a, albeit these poter on 1a will be monitored to ensure that any ssed as being Stronger than Option 1a dr appropriate monitoring programme to ider	y emerging risks are manague to the remaining potentia



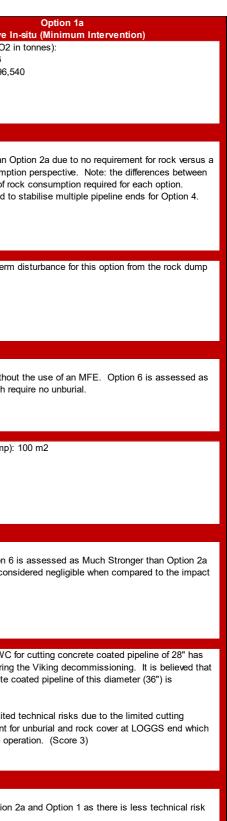


			Opt	ion 6			Option 4		Opti	on 2a	Option 1a
	Full Removal (Cut & Lift)				Partial Removal (Cut & I	_ift)		nor Intervention)	Leave In-situ (Minimum Intervention)		
		Vessel Noise (days						Vessel Noise (days on-site):		Vessel Noise (days on-site):	
		Survey Vessel - 10	days   CSV - 606	days   DSV - 989	) days   Trawler - 5			Survey Vessel - 10 days   DSV - 1 da	y   Rock Dump Vessel - 74 days	Survey Vessel - 10 days   DSV - 1 day   Trawler - 5 days	
		days				Vessel - 48 days   Trawl	ler - 5 days		Trawler - 5 days		
	ಕ	Tooling Noise:	007 1 104		40.1	Tooling Noise:			Tooling Noise:	0.111 0.17.1	Tooling Noise:
	Impact	Diamond Wire Cutti	ing - 987 days   M	FE for Unburial -	49 days		Diamond Wire Cutting - 24	0 days   Rock Dumping -	Dredging - 0.25 days   Diamond Wire	Cutting - 0.17 days	Dredging - 0.25 days   Diamond Wire Cutting - 0.17 days
8	<u>=</u>					45 days					
Environmental	Marine	Operational Dischar	r(196.)			Operation Discharges:			Operation Discharges:		Operation Discharges:
Ĕ	/ar	Negligible potential	0	leases through c	utting operations	1 0	ydrocarbon releases throu	igh cutting operations	Negligible potential for hydrocarbon re	leases through cutting operations	Negligible potential for hydrocarbon releases through cutting operations
ron					Planned discharges		s been cleaned successful	· · ·	because the pipeline has been cleaned	<b>o o</b> .	because the pipeline has been cleaned successfully. Planned discharges
Ň	oné	would therefore be v		,	Ŭ		n acceptable limits and in	, 0	would therefore be within acceptable	, ,	would therefore be within acceptable limits and included in operational
	ati	permits. Level of cu	•						permits. Negligible level of cutting sw		permits. Negligible level of cutting swarf would be present in this option.
°i	-	, compared to the oth	•	5 ,	5	full removal.					
	10								Vessel Discharges:		Vessel Discharges:
		Vessel Discharges:				Vessel Discharges:			This includes Ballast, Grey and Black	Water, this is driven by duration of	This includes Ballast, Grey and Black Water, this is driven by duration of
		This includes Ballas	st, Grey and Black	k Water, this is d	riven by duration of	This includes Ballast, G	rey and Black Water, this	is driven by duration of	vessel operations and therefore will be	e less for this option than Option 6	vessel operations and therefore will be less for this option than Option 6
		vessel operations a	nd therefore will be	e significant for th	is option. All	vessel operations and th	nerefore will be less for this	s option than Option 6 but	and Option 4 and similar to Option 1a	. All planned discharges will be in	and Option 4 and similar to Option 2a. All planned discharges will be in
		planned discharges	will be in accorda	ance with MARPC	DL.		d Option 1a. All planned	discharges will be in	accordance with MARPOL.		accordance with MARPOL.
						accordance with MARP	OL.				
		W	W	W		W	W		N		
		The assessment of	the Operational M		-criterion is as follows						
							environmental marine imp	acts from the increased n	oise, operational discharges (swarf) an	d vessel discharges is low for Option 6	b, cumulatively, they are greater than the other options due to greater
		pipeline cutting and	•			,				6 1	, ,, , , , , , , , , , , , , , , , , , ,
Su	nmary	Option 4 is assesse	ed as being Weak	er than Option 2a	a and Option 1a as, w	hilst the actual environme	ental marine impacts from	the increased noise, operative	ational discharges (swarf) and vessel d	ischarges is low for Option 4 compare	d to the other options, cumulatively, they are significant enough to express
		a small preference f	for the other option	ns.							
		Option 2a is assess	sed as being Neut	ral to Option 1a a	as the differences in te	erms of environmental ma	arine impacts were insuffic	ient to express a preference	e.		
		Overall, Option 2a	and Option 1a	are equally pref	erred from an Oper	ational Marine Impact	perspective.				
		There will be no lega	oov morino impoo	to from this full re	movel option	The majority of the 119	km ninalina ia tranahad ar	ad buried to an appropriate	The majority of the 119 km pipeline is	transhed and buried to an appropriate	The majority of the 118 km pipeline is trenched and buried to an
	ಕ	There will be no lega	acy manne impac		inoval option.	depth. There is 28 km of exposed pipeline which will be removed with the			depth. There is 28 km of exposed pip		appropriate depth. There is 28 km of exposed pipeline which will be left as-
-	ba					cut ends rock dumped.			depth. There is 20 km of exposed pit	cine whom will be took dumped.	is
nta	Ē								The legacy marine impacts relate to t	he left in-situ materials, i.e. the	
me	ju					The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried 36" diameter steel pipeline, which is			remaining trenched and buried 36" dia		The legacy marine impacts relate to the left in-situ materials, i.e. the
lo I	Marine Impact								concrete coated with a coal tar layer	between the steel and the concrete.	remaining trenched and buried 36" diameter steel pipeline, which is
Environmental	5					concrete coated with a coal tar layer between the steel and the concrete.					concrete coated with a coal tar layer between the steel and the concrete.
2. E	Legacy					Given the material being left in-situ and the pipeline having been cleaned the legacy marine impact is considered low.			Given the material being left in-situ and the pipeline having been cleaned the legacy marine impact is considered low.		
2	Ľ										Given the material being left in-situ and the pipeline having been cleaned
	2.2										the legacy marine impact is considered low.
		MS	MS	MS		S	S		N		
		The assessment of			orion is as follows:	3	5		N		
			0,			Ontion 1a due to the nin	eline being removed from	the marine environment in	Option 6 (zero potential for degradation	products) versus the potential for de	gradation products to be released into the marine environment from the
			•	<b>.</b> .			•			. ,	products to be released into the marine environment from the remaining
Su		material with the oth		- 1	5	5				1 5 1	5
		Option 2a is assess	sed as being Neut	ral to Option 1a a	s the potential legacy	/ marine impacts are the	same due to the amount	of remaining material being	the same.		
						left either buried, rock du					
		Overall, Option 6	is most preferred	d from a Legacy	Marine Impact per	spective.					
		Vogol Emission - (	(in toppos):			Vocal Emissions /:- +-	in the second se		Vocal Emissions (in terrac);		Vasad Emissions (in tannas):
a		Vessel Emissions (	(in torines):			Vessel Emissions (in to Fuel: 14,371	nnes).		Vessel Emissions (in tonnes): Fuel: 2,936		Vessel Emissions (in tonnes): Fuel: 1,075
en	ls ri	CO20: 177 400				CO2e: 47.104					CO2e: 3,522
Ē	io he	NOx: 3 216 47				CO2e: 47,104 NOx: 853.62			,		NOx: 63.83
2 4	osp iiss	SO2: 216 60				SO2: 57.48			NOx: 174.40 SO2: 11.74		SO2: 4.30
2. Environmental 2.3 Fuel Use &	ŧμ	Fuel: 54,149 CO2e: 177,490 NOx: 3,216.47 SO2: 216.60 Vessel Energy Use									
2 E	٩	Vessel Energy Use	: 2,328,422 GJ			Vessel Energy Use: 617	7,941 GJ		Vessel Energy Use: 126,249 GJ		Vessel Energy Use: 46,210 GJ
		BANA/		84147		14/	14/				
		MW	MW	MW		W	W		N		
					sions sub-criterion is				And a stad to see the set of the second	for this protion on the little of the	a de sa de la companya de la company
<b></b>											r the other options where there is significantly lower vessel usage. nall preference for Option 2a and Option 1a.
Sui			•				•		n considered in context, these differen s are considered insufficient when cons		
			•			Ise & Atmospheric Emis					



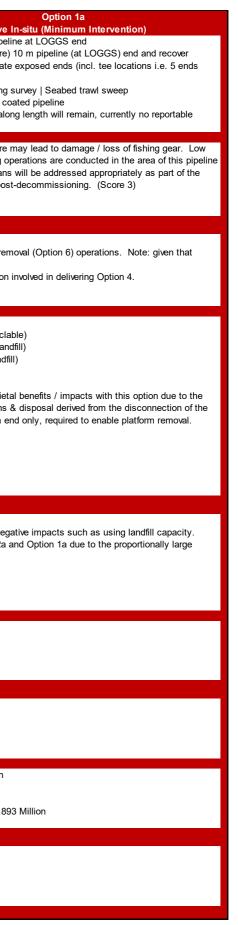
	Option 6 Full Removal (Cut & Lift)				Option 4 Partial Removal (Cut & Liff)				Leave		
2. Environmental 2.4 Other Consumptions				Partial Removal (Cut & Lift) Material Emissions (CO2 in tonnes): Recovered Material: 35,760 Remaining Material: 148,851 Total: 184,611 Rock: 26,550 tonnes			Leave In-situ (Minor Intervention) Material Emissions (CO2 in tonnes): Recovered Material: 26 Remaining Material: 196,540 Total: 196,565 Rock: 287,435 tonnes		Material Emissions (CO Recovered Material: 26 Remaining Material: 196 Total: 196,565 Rock: 125 tonnes		
	S	MS	N		S	W		MW			
Summar	Option 6 is asse significant amou the options in to Option 4 is asse Option 2a is ass	nt required to be pla nnage of CO2 assoc ssed as being Stron essed as being Muc	nger than Option 4 liced over 28 km of ciated with process nger than Option 2 ch Weaker than Op	as there is no require exposure in Option 2 sing returned materia a as there is a much otion 1a as there is n	2a. Option 6 is assessed a l and / or to produce replac higher amount of rock req	as being Neutral to Optio cement material left in-si uired for Option 2a. Opt or Option 2a to address 2	on 1a as whilst there is a s itu were considered insignif ion 4 is assessed as being	mall amount of rock required in C ficant in terms of this assessmen Weaker than Option 1a (where r	ple pipeline ends. Option 6 is assessed as Option 1a, this was insufficient to express a t. As such, the preference judgements we ock is placed at the LOGGS end only) as t at LOGGS end only for Option 1a.	preference from a consum re driven by the quantity of	
2. Environmental 2.5 Disturbance	Short Term Disturbance (MFE): 448,205 m2 Full pipeline to be unburied using MFE.				There is some short-term disturbance resulting from removing the 28 km of exposures along this line (approx. 23% of the line length).			There is limited short-term distu only.	rbance for this option from the rock dump	There is limited short-ter only.	
	W	MW	MW	n impact) sub-criterio	W	W		N			
Summar	y Option 4 is asse Option 2a is ass <b>Overall, Option</b>	Option 6 is assessed as being Weaker than Option 4 due to the large area of seabed disturbance from the unburial of the 118 km pipeline using an MFE when compared to smaller area of disturbance associated with removing the 28 km of exposures with being Much Weaker than Option 2a and Option 1a due to the large area of seabed disturbance from the unburial of the 118 km pipeline using a Mass Flow Excavator when compared to the small area of low impact disturbance with the other options which Option 4 is assessed as being Weaker than Option 2a and Option 1a due to the disturbance caused from removing the 28 km of exposures versus limited disturbance in the other options which require no unburial.         Option 2a is assessed as being Neutral to Option 1a as the seabed disturbance berspective.         Overall, Option 2a and Option 1a are equally preferred from a Seabed disturbance perspective.         Habitat Loss (Rockdump): N/A       Habitat Loss (Rockdump): 53,020 m2									
<ol> <li>Environmental</li> <li>2.6 Loss of Habitat</li> </ol>											
	S	MS	N		MS	W		MW			
Summar	Option 6 is asse as there is a larg from the other re Option 4 is asse Option 2a is ass Note: Habitat los <b>Overall, Option</b>	ssed as being Stron le area of habitat los mediation options (C ssed as being Stron essed as being Muc is is from the replace <b>6 and Option 1a a</b>	nger than Option 4 as associated with Option 4 and Option oger than Option 2 ch Weaker than Op ement of the sand are equally prefer	Option 2a from the 2 n 2a). a as the area of habit otion 4 as the area of bank features with ha rred from a Loss of	on multiple pipeline ends 1 28 km of rock. Option 6 is tat loss in Option 2a is mu f habitat loss in Option 2a ard substrate (rock). <b>F Habitat perspective.</b>	assessed as being Neu ch greater than Option 4 is much greater than Op	Itral to Option 1a as whilst I. Option 4 is assessed as otion 1a.	there is a small amount of rock re being Weaker than Option 1a as	at loss whereas there is no long-term habits equired in Option 1a at the LOGGS end wh s area of habitat loss in Option 1a is much	ich, in terms of scale, is co smaller than Option 4.	
nical Feasibility	<b>Concept Maturity:</b> DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. It is believed that DWC cutting of concrete coated pipeline of this diameter (36") is achievable. (Score 3)				<b>Concept Maturity:</b> DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. It is believed that DWC cutting of concrete coated pipeline of this diameter (36") is achievable. (Score 3)			<b>Concept Maturity:</b> DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. It is believed that DWC cutting of concrete coated pipeline of this diameter (36") is achievable. (Score 3)		Concept Maturity: DWC been demonstrated durin DWC cutting of concrete achievable. (Score 3)	
3. Tech 3.1 Technical	<b>Technical Risks:</b> Risk to successfully achieving full removal by unburial and cut and lift of the pipeline due to the long durations involved and the potential for unforeseen unburial issues, particularly in the near-shore tidal zone. (Score 2)				<b>Technical Risks:</b> Limited technical risks from cutting and removal of pipeline sections as the areas being cut and removed are already exposed therefore no unburial risk. There may be some risk associated with multiple DWC cutting operations. (Score 3)			<b>Technical Risks:</b> Limited technical risks due to the limited cutting required, no requirement for unburial and necessity for rock cover which is considered a routine operation. (Score 3)		Technical Risks: Limit required, no requirement is considered a routine of	
	W	MW	MW		W	W		N			
Summar	Option 6 is asse associated Option Option 4 is asse Option 2a is ass	on 2a and Option 1a ssed as being Weal essed as being Neu	ker than Option 4 c as there is a singl ker than Option 2a ttral to Option 1a as	due to potential chall le cut and no deburia and Option 1a as th s the concept maturi	al.	ssociated Option 2a and	d Option 1a as there is a si		rations. Option 6 is assessed as being Mu	ch Weaker than both Optic	





				ion 6 al (Cut & Lift)			Option 4 Partial Removal (Cut & L	ift)	Opti Leave In-situ (M	Leave	
		<ul> <li>Unbury entire pipeline with Mass Flow Excavator (MFE)</li> <li>Cut (with diamond wire) pipeline into 20 m lengths</li> <li>Bundle cut sections and recover</li> <li>Backfill trench   Post decommissioning survey   Seabed trawl sweep</li> </ul> Whilst this option provides a clear seabed, the operational impact of removing the pipeline disturbs (displacement and restricted access) current fishing operations significantly. Low intensity / value fishing operations are conducted in the area of this pipeline which would be curbed due to the interference of transiting vessels on fishing operations. (Score 2)				<ul> <li>Dredge to uncover pip</li> <li>Cut (with diamond wir</li> <li>Cut (with diamond wir</li> <li>Bundle cut sections a</li> <li>Place rock to remedia</li> <li>Post decommissionin</li> </ul>	eline at LOGGS end e) 10 m of pipeline at LOG e) all exposed sections into	GS end and recover o 20 m lengths tee locations) eep	<ul> <li>Dredge to uncover pipeline at LOGC</li> <li>Cut (with diamond wire) 10 m of pip</li> <li>Place rock to remediate exposed entotal)</li> <li>Place rock across all exposed sect</li> <li>Post decommissioning survey   See</li> <li>28 km of exposures along length with</li> </ul>	Dredge to uncover pipe Cut (with diamond wire Place rock to remedia total) Post decommissioning 118 km 36" concrete of 28 km of exposures al spans	
4. Societal	4.1 Fishing					operations are conduct decommissioning activi	in localised areas. Low in ed in the area of this pipeli ity of significantly shorter d ce with fishing operations.	ne however, the localised urations is expected to	Short term disturbance in localised areas. Low intensity / value fishing operations are conducted in the area of this pipeline however, the rock placement will be overtrawlable and will be undertaken over a short duration therefore is expected to have minimal interference with fishing operations. (Score 3)		Left in-situ infrastructure intensity / value fishing o and any reportable spar liability management po
		MW	MW	MW		N	W		W		
S	Summary The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 6 is assessed as being Much Weaker than Option 4, Option 2a and Option 1a due to the additional disruption caused to fishing operations, particularly to near-shore fishing operations where static creel pots may require to be removed durin fishing operations are already conducted in this area, presence of the pipeline is not considered a limitation to fishing activity. Option 4 is assessed as being Neutral to Option 2a as the disruption associated with exposure removal and / or rock dump is largely similar, as is remaining infrastructure. Option 4 is assessed as being Weaker than Option 1a as there is more disruption involved in delivering Option 2a. Overall, Option 1a is the most preferred from a Societal impact on Fishing perspective.										
al	Ammenities	Materials Returned: Steel: 69,844 tonnes (recyclable) Concrete: 73,440 tonnes (landfill) Coal Tar: 2,446 tonnes (landfill) Mattress/Grout Bag: 14 tonnes (landfill)				Materials Returned: Steel: 16,957 tonnes (recyclable) Concrete: 17,830 tonnes (landfill) Coal Tar: 594 tonnes (landfill)			Materials Returned: Steel: 12 tonnes (recyclable) Concrete: 13 tonnes (landfill) Coal Tar: 1 tonnes (landfill)		Materials Returned: Steel: 12 tonnes (recycl Concrete: 13 tonnes (land Coal Tar: 1 tonnes (land
4. Societal	2 Communities / Ammenities	Whilst there are some societal benefits from the returning of significant tonnage of recyclable steel, this is more than offset by the significant tonnage of contaminated and difficult to segregate concrete, which will take up landfill capacity. (Score 2) Note: given the quantity of concrete destined for landfill, there may be an			Whilst there are some societal benefits from the returning of significant tonnage of recyclable steel, this is more than offset by the significant tonnage of contaminated and difficult to segregate concrete, which will take up landfill capacity. (Score 2) Note: given the quantity of concrete destined for landfill, there may be an			There are minimal societal benefits / impacts with this option due to the minimal onshore returns & disposal derived from the disconnection of the pipeline at the platform end only, required to enable platform removal. (Score 3)		There are minimal socie minimal onshore returns pipeline at the platform of (Score 3)	
	4.2	opportunity to look at alternative uses / disposal routes, although no credence for this has been given in this assessment.				opportunity to look at alternative uses / disposal routes, although no credence for this has been given in this assessment.					
		N	W	W		W	W		Ν		
	The assessment of the Societal impact on Other Users sub-criterion is as follows: Note: Assessment of the societal impact of options is dominated by any negative impacts from material returned as the positive impacts, such as recyclable material or any job creation / retention offered by an option is considered less significant than in Option 6 is assessed as being Neutral to Option 4 due to both options having proportionally large quantities of contaminated and difficult to segregate concrete that are likely to end up in landfill. Option 6 is assessed as being Weaker than both Option 2 quantity of concrete likely to end up in landfill versus very limited quantities. Option 4 is assessed as being Weaker than both Option 1a due to the proportionally large quantity of concrete likely to end up in landfill versus very limited quantities. Option 2a is assessed as being Neutral to Option 1a as they both have negligible utilisation of landfill. <b>Overall, Option 1a are equally preferred from a Societal impact on Other Users perspective.</b>										
5. Economic	5.1 Short- term Costs	£356.355 Million				£90.081 Million			£15.275 Million		£2.501 Million
		VMW	VMW	VMW		MW	MW		W		•
s		The assessment of the Short-term Costs sub-criterion is as follows: Option 6 is assessed as being Very Much Weaker than all other options as the costs are much higher in all cases. Option 4 is assessed as being Very Much Weaker than Option 2a and Option 1a as the costs are 6 times higher than Option 2a and 45 times higher than Option 1a. Option 2a is assessed as being Much Weaker than Option 1a as the costs are around 6 times higher. Option 2a is assessed as being Much Weaker than Option 1a as the costs are around 6 times higher. Overall, Option 1a is most preferred from a Short-term Cost perspective.									
onomic	5.2 Long- term Costs	Surveys: N/A FLTC: N/A				Surveys: £0.467 Million FLTC: N/A			Surveys: £0.538 Million FLTC: N/A		Surveys: £0.538 Million FLTC: £0.355 Million
5. Ec	5.2 term	Total Legacy Cost: £0 Million				Total Legacy Cost: £0.467 Million			Total Legacy Cost: £0.538 Million		Total Legacy Cost: £0.8
		S	S	S		N	N		Ν		
s		The assessment of the Long-term Costs sub-criterion is as follows: Option 6 is assessed as being Stronger than all other options as there are no legacy / long-term costs associated with this option versus similar long-term costs for all other options. Y Option 4 is assessed as being Neutral to Option 2a as the long-term costs are similar. Option 4 is assessed as being Stronger than Option 1a are sufficiently higher to express a small preference for Option 4. Option 2a is assessed as being Stronger than Option 1a as the long-term costs with Option 1a are sufficiently higher to express a small preference for Option 4. Option 2a is assessed as being Stronger than Option 1a as the long-term costs with Option 1a are sufficiently higher to express a small preference for Option 2a. Overall, Option 6 is most preferred from a Long-term Cost perspective.									ence for Option 4.





1.1 Personnel Offshore	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	MW	мw	11.3%
Option 4 Partial Removal (Cut & Lift)	S	N	MW	MW	13.8%
Option 2a Leave In-situ (Minor Intervention)	MS	MS	N	N	37.5%
Option 1a Leave In-situ (Minimum Intervention)	MS	MS	N	N	37.5%

Appendix B.2	Group 1 Pairwise Comparison Matrices
--------------	--------------------------------------

1.2 Personnel Onshore	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	vмw	vмw	4.5%
Option 4 Partial Removal (Cut & Lift)	S	N	vмw	vмw	5.5%
Option 2a Leave In-situ (Minor Intervention)	VMS	VMS	N	N	45.0%
Option 1a Leave In-situ (Minimum Intervention)	VMS	VMS	N	N	45.0%

1.3 Other Users	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
	Full R	Partial I	Lea	Leave	
Option 6 Full Removal (Cut & Lift)	N	w	MW	MW	12.0%
Option 4 Partial Removal (Cut & Lift)	S	N	w	w	20.8%
Option 2a Leave In-situ (Minor Intervention)	MS	S	N	N	33.6%
Option 1a Leave In-situ (Minimum Intervention)	MS	S	N	N	33.6%

1.4 High Consequence Events	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.0%
Option 4 Partial Removal (Cut & Lift)	S	N	w	w	22.1%
Option 2a Leave In-situ (Minor Intervention)	S	S	N	N	29.9%
Option 1a Leave In-situ (Minimum Intervention)	S	S	N	N	29.9%

1.5 Residual Risk	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	MS	38.1%
Option 4 Partial Removal (Cut & Lift)	w	N	N	S	23.6%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	S	23.6%
Option 1a Leave In-situ (Minimum Intervention)	MW	w	w	N	14.7%

2.1 Operational Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
	Full	Partia	Le	Leav	
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.0%
Option 4 Partial Removal (Cut & Lift)	S	N	w	w	22.1%
Option 2a Leave In-situ (Minor Intervention)	S	s	N	N	29.9%
Option 1a Leave In-situ (Minimum Intervention)	S	s	N	N	29.9%



2.2 Legacy Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting	
Option 6 Full Removal (Cut & Lift)	N	MS	MS	MS	49.7%	
Option 4 Partial Removal (Cut & Lift)	MW	N	s	s	20.3%	
Option 2a Leave In-situ (Minor Intervention)	MW	w	N	N	15.0%	
Option 1a Leave In-situ (Minimum Intervention)	MW	w	N	N	15.0%	

2.3 Fuel Use & Atmospheric Emissions	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	мw	MW	9.9%
Option 4 Partial Removal (Cut & Lift)	MS	N	w	w	24.3%
Option 2a Leave In-situ (Minor Intervention)	MS	S	N	N	32.9%
Option 1a Leave In-situ (Minimum Intervention)	MS	S	N	N	32.9%

2.4 Other Consumptions	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	MS	N	33.6%
Option 4 Partial Removal (Cut & Lift)	w	N	S	w	20.8%
Option 2a Leave In-situ (Minor Intervention)	MW	w	N	MW	12.0%
Option 1a Leave In-situ (Minimum Intervention)	N	S	MS	N	33.6%

2.5 Disturbance	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	MW	MW	12.0%
Option 4 Partial Removal (Cut & Lift)	S	N	w	w	20.8%
Option 2a Leave In-situ (Minor Intervention)	MS	S	N	N	33.6%
Option 1a Leave In-situ (Minimum Intervention)	MS	S	N	N	33.6%

2.6 Loss of Habitat	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	MS	N	32.9%
Option 4 Partial Removal (Cut & Lift)	w	N	MS	×	24.3%
Option 2a Leave In-situ (Minor Intervention)	MW	MW	N	мw	9.9%
Option 1a Leave In-situ (Minimum Intervention)	N	S	MS	N	32.9%

3.1 Technical Feasibility	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	MW	MW	12.0%
Option 4 Partial Removal (Cut & Lift)	S	N	w	w	20.8%
Option 2a Leave In-situ (Minor Intervention)	MS	S	N	N	33.6%
Option 1a Leave In-situ (Minimum Intervention)	MS	S	N	N	33.6%



4.1 Fishing		Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)		N	мw	мw	MW	9.9%
	ion 4 val (Cut & Lift)	MS	N	N	w	26.9%
Leave In-	on 2a situ (Minor rention)	MS	N	N	w	26.9%
Leave In-si	on 1a tu (Minimum ention)	MS	S	S	N	36.4%

4.2 Communities / Ammenities	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	w	w	20.0%
Option 4 Partial Removal (Cut & Lift)	N	N	w	w	20.0%
Option 2a Leave In-situ (Minor Intervention)	S	S	N	N	30.0%
Option 1a Leave In-situ (Minimum Intervention)	S	S	N	N	30.0%

5.1 Short-term Costs	Option 6 Full Removal (Cut & Lift)
Option 6 Full Removal (Cut & Lift)	N
Option 4 Partial Removal (Cut & Lift)	VMS
Option 2a Leave In-situ (Minor Intervention)	VMS
Option 1a Leave In-situ (Minimum Intervention)	VMS

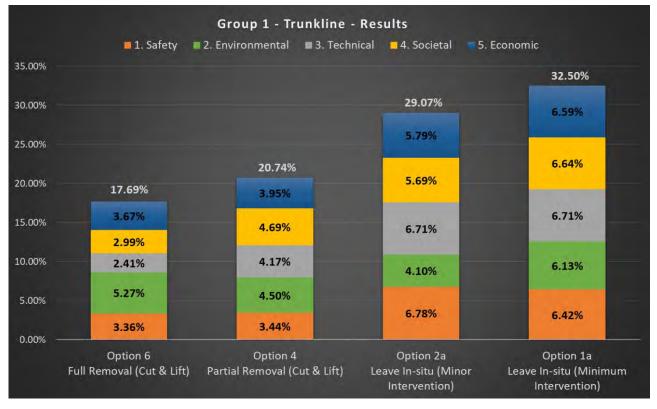
5.2 Long-term Costs	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Leave In-situ (Minimum Intervention)	W	N	N	N	22.2%



Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Leave In-situ (Minimum Intervention)		Weighting
VMW	VMW	VMW		3.3%
N	MW	MW		17.3%
MS	N	w		35.7%
MS	S	N		43.7%



# Appendix B.3 Group 1 Results Chart





# Appendix B.4 Group 1 Detailed Evaluation Discussion

#### Appendix B.4.1 Safety – Personnel Offshore

The assessment of the options during the workshop indicated that the leave in-situ options (Option 1a and Option 2a) to be the most attractive against the Personnel Offshore sub-criterion. This was due to these options having the shortest offshore scope duration of the remaining decommissioning options as these options involve removing the pipeline ends at the LOGGS end and at the tee locations in both cases. Option 2a also allows for rock placement over areas of exposure. Whilst this increases the offshore scope from additional use of a Rockdump Vessel, this increase over Option 1a was insufficient to increase the risk exposure to offshore personnel sufficiently to express a preference between the two options.

Option 4 – Partial Removal was assessed as significantly less attractive than the leave in-situ options from a safety risk to offshore personnel perspective. This is due to increased safety risk from the greater offshore work scope associated with removing the areas of exposure (28 km) in Option 4 in addition to the pipeline end sections. Option 4 also requires an increase in operational support from divers over the leave in-situ options, further increasing the safety risk.

Option 6 - Full Removal was assessed as less attractive than Option 4 from a safety risk to offshore personnel perspective. This is due to increased safety risk from the greater offshore work scope associated with removing the entire pipeline (118 km) in Option 6 and the further increase in operational support from divers over Option 4.

# Appendix B.4.2 Safety – Personnel Onshore

The safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. The leave in-situ options return the (equal) least material of the decommissioning options from the pipeline end sections, making these options assessed as the most attractive from a safety risk to onshore personnel perspective.

Option 4 returns significantly more material for onshore handling, transportation and processing, than the leave in-situ options due to returning the 28 km of exposed pipeline. Option 6 returns significantly more material than Option 4 as it returns the full 118 km pipeline length to shore. Both Option 4 and Option 6 are assessed as being significantly less attractive than the leave in-situ options, with a preference for Option 4 over Option 6.

# Appendix B.4.3 Safety – Other Users

The impact of performing the decommissioning options on other users of the sea from a safety perspective is related to the duration of operations, the number of vessels involved, and significantly, the number of transits to and from port to the decommissioning site.

The assessment of the decommissioning options against this criterion has indicated that the leave in-situ options (Option 1a and Option 2a) to be the most attractive against the Safety – Other Users sub-criterion. This is due to these options having fewer vessels, fewer days of vessel operations and less vessel transits than the other options.

Option 4 is assessed as being more attractive than Option 6 as Option 4 has fewer vessels, fewer days of vessel operations and less vessel transits than Option 6.



## Appendix B.4.4 Safety – High Consequence Events

The assessment during the workshop indicated that the leave in-situ options would have the least exposure to potential for High Consequence Events and would therefore, be the most attractive against this criterion. This is due to the limited cut and lift operations to recover the pipeline end sections at the LOGGS end and the tee locations.

Option 4 would be exposed to a greater potential for a High Consequence Event from a potential dropped object due to the additional lifting operations associated with the recovery of the 28 km of exposed pipeline.

Option 6 would be exposed to a greater potential for a dropped object as there is more lifting associated with the recovery of the entire 118 km pipeline in sections.

#### Appendix B.4.5 Safety – Residual Risk

The residual risk relates to the potential for any safety impact from the decommissioning options. Option 6 is assessed as the most attractive option from a residual safety risk perspective as it is a full removal option and therefore removes all residual risk.

Option 4 and Option 2a were assessed as being equally attractive from a residual risk perspective as the removal of the exposures in Option 4 or the rock placement over the exposures in Option 2a were considered to provide similar mitigation of any potential residual risk.

Option 1a was assessed as the least attractive option against this criterion due to the existing pipeline exposures remaining in this option.

It should be noted that, as part of any partial removal or leave in-situ solution being selected, any potential hazards along the pipeline would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

#### Appendix B.4.6 Safety – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from a safety perspective is Option 2a, followed closely by Option 1a. These options were assessed as being equally preferred against all sub-criteria except the residual risk, where Option 2a was preferred.

Option 4 and Option 6 were assessed as significantly less attractive than the leave in-situ options in all areas except residual risk, with Option 6 being less attractive than Option 4. The residual risk criterion redresses this balance somewhat, where Option 6 is more attractive than Option 4 as it removes residual risk. This brings Option 4 and Option 6 closer together again.

#### Appendix B.4.7 Environment – Operational Marine Impact

The environmental impact on the marine environment from performing the decommissioning options was considered low across all options. However, there were sufficient, cumulative differences, to indicate preferences across the decommissioning options.

The assessment performed during the workshop indicated that the leave in-situ options are the most attractive from an operational marine impact perspective. This is due to these options having the least impact in terms of marine noise as they have the lowest number of vessel days and the lowest amount of subsea cutting operations.



All options have similar impacts in terms of discharges that occur from the pipeline whilst performing the decommissioning option as the pipeline is to have been cleaned successfully for all options. Options 4 and 6 do have increased quantities of cutting swarf over the leave in-situ options, which may have a small additional environmental impact.

The discharges from vessels relates to the number of vessels and the number of vessel days. Option 4 is considered less attractive than the leave in-situ options due to the additional vessel days required. Option 6 is worse again, due to the additional number of vessel days associated with the full removal option.

#### Appendix B.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 6, full removal of the pipeline, is the most attractive decommissioning option from a legacy marine environmental impact perspective. This is due to the full pipeline being removed and thus eliminating any legacy impact from degradation products.

Option 4 was assessed as being more attractive than the leave in-situ options as 28 km of pipeline material is removed from the marine environment which reduces the potential legacy environmental impact over the leave in-situ options where all material is left in-situ. No distinction was made between the impact of exposed pipeline versus buried or rock covered pipeline.

#### Appendix B.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that the leave in-situ options are the most attractive against the fuel use and atmospheric emissions criterion. This is due to these options having the least offshore work scope duration and hence vessel use and durations.

Option 4 has increased impact due to the additional offshore work scope associated with removing the 28 km of exposed pipeline. Option 6 has increased impact again, from the additional offshore work scope associated with removing the entire pipeline.

#### Appendix B.4.10 Environment – Other Consumptions

The environmental impact of the decommissioning options in terms of 'other consumptions' relates to the use of materials required to deliver that option such as the use of rock for rock placement. It also considers the environmental impact of replacing material that has been left in-situ and the impact from recycling any material returned.

All options were assessed as having a similar environmental impact when considering the material returned versus material left in-situ perspective. The assessment therefore focussed on the quantity of rock required for each option.

Option 6, the full removal option and Option 1a were assessed as being the most attractive as they require no rock and 125 tonnes of rock respectively.

Option 4 was less attractive than these options as it required more than 25,000 tonnes of rock, used to mitigate the snag hazard associated with the cut ends left after the exposures were removed in this option.

Option 2a was the least attractive of the options due to the extensive use of rock placement, which results in requiring almost 300,000 tonnes of rock.



## Appendix B.4.11 Environment – Seabed Disturbance

The short-term, environmental impact on the seabed, of performing the decommissioning options, is addressed in this criterion.

The leave in-situ options are assessed as the most attractive decommissioning options here as the seabed impact is limited to the area relating to the sections of pipeline removal at the LOGGS end and the tee locations.

Option 4 is less attractive than the leave in-situ options as the seabed is impacted over a much greater area as it is disturbed in all the areas where the 28 km of pipeline exposures are being removed.

Option 6 is the least attractive option as the seabed is impacted over by far the largest area due to the de-burial along the entire pipeline length using a Mass Flow Excavator (MFE) prior to the pipeline being cut into section and removed.

#### Appendix B.4.12 Environment – Loss of Habitat

The long-term, environmental impact on the seabed, of performing the decommissioning options, is considered in this criterion, with a focus on any material change to or loss of existing habitat.

Option 6, the full removal option and Option 1a were assessed as being the most attractive options against this criterion as neither option results in a loss of, or material change to the marine habitat as it currently stands.

Option 4 is assessed as less attractive as it involves the introduction of rock to mitigate the snag hazard associated with the cut ends of the pipeline left after the exposures are removed. The introduction of this rock is a material change to more than  $50,000 \text{ m}^2$  of habitat where the existing sandbank is replaced with a hard substrate.

Option 2a is assessed as the least attractive option as almost 300,000 m<sup>2</sup> of existing sandbank is replaced with a hard substrate.

#### Appendix B.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from an environmental perspective is Option 1a, followed by Option 6, then Option 4 and finally Option 2a.

The leave in-situ Option 1a was assessed as being the most attractive or equal most attractive option against five of the six environment sub-criteria. This relates to the limited work scope associated with the leave in-situ option and the lack of rock required in this option.

Option 6, was also assessed as attractive as no rock is required for this option making it attractive in the Other Consumptions and Loss of Habit criteria. It was also the most attractive in the Legacy Marine Impact criterion. The longer duration work scopes and the associated environmental impact from these, and the short-term impact on the seabed for the de-burial with an MFE offset these positives.

Option 4 was assessed as average across all criteria making is less attractive than other options overall. Option 2a was attractive in some areas, however, the extensive use of rock was enough to make this the least attractive overall.



## Appendix B.4.14 Technical – Technical Feasibility

The Technical Feasibility criterion considers two key areas, Concept Maturity – where the novelty and track record of the proposed solution is considered, and Technical Risks, where inherent technical risks associated with the option are assessed.

The key area for consideration in terms of concept maturity was in the subsea cutting of this large diameter, concrete coated pipeline. It was noted during the assessment that cutting of 28" diameter concrete coated pipeline has been proven during the Viking decommissioning programme and as such, it is believed that the cutting of this 36" concrete pipeline is achievable.

The operations associated with the leave in-situ options where there is a minimal number of subsea cuts and recovery of short sections of pipeline, along with routine rock placement, were considered to present the lowest technical risk of the decommissioning options, making Option 1a and Option 2a the most attractive from a Technical perspective.

Option 4 was considered to have a higher potential for technical risk than the leave in-situ options due to the subsea Diamond Wire Cutting (DWC) operations numbering around 1,500 with this option versus only a few with the leave in-situ options.

Option 6 was considered to have higher potential for technical risk than Option 4 due to almost 6,000 subsea DWC operations and the additional technical risk posed by the requirement to achieve deburial prior to performing these subsea cuts.

Overall, Option 1a and Option 2a are the most attractive from a Technical perspective, followed by Option 4 and then Option 6.

#### Appendix B.4.15 Societal – Fishing Industry

The impact of the decommissioning options upon the fishing industry is addressed in this criterion. Consideration is given to the operational and legacy impacts.

Prior to discussing the assessment, some context is provided from the Fishing Baseline Characterisation ref. [7]. The fishing activity in the area of this pipeline is considered low, ranging from 5 to 20 days per annum fishing effort and relates mainly to beam trawling fishing operations from the Netherlands. UK beam trawling is less represented and generally target brown shrimp closer to shore. Potting activity by fleets under 15 m in length and scallop dredging have been observed, although the majority of sightings have not been in the immediate vicinity of the pipeline.

Given the above, Option 1a is assessed as being the most attractive option due to it presenting the least disruption and disturbance to the fishing industry due to it having the smallest offshore work scope i.e. removing the pipeline end at LOGGS (within existing 500m zone) and at the tee locations only.

Option 2a and Option 4 are assessed as being less attractive than Option 1a but similar to each other. Whilst Option 2a results in disruption from performing rock placement and Option 4 results in disruption from removing the exposures, the impact on fishing operations is consider similar.

Option 6 is assessed as the least attractive option due to the extensive disruption to the fishing industry from the removal of the entire 118 km of the pipeline. It was noted that this option is also likely to have the most significant impact on near-shore fishing operations where static creel pots may need to be removed to allow the full removal of the pipeline.

It was noted that, given that fishing operations are already conducted in the area along and around this pipeline, and any infrastructure remaining on the seabed will be subject to an appropriate post-



decommissioning monitoring regime, the residual presence of the pipeline was not considered a limitation to fishing activity.

# Appendix B.4.16 Societal – Communities / Amenities

The impact of the decommissioning options on communities and amenities are considered in this criterion.

The leave in-situ options are assessed as being the most attractive due to them returning limited quantities of material for processing onshore. Whilst this limits the amount of useful material, such as steel, being returned for recycling, it also results in the least amount of material being returned that will be directed to landfill, such as the concrete coating of the pipeline.

Option 4 was assessed as being less attractive than the leave in-situ options due to the amount of concrete that would be returned with the pipeline exposures that would be directed to, and take up limited capacity in, onshore landfill. Option 6 was considered the least attractive option as this returns the most concrete, destined for landfill, of all the options.

#### Appendix B.4.17 Societal – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from a Societal perspective is Option 1a, followed by Option 2a, then Option 4 and finally Option 6.

The leave in-situ Option 1a was assessed as being the most attractive option against both the Fishing Industry and Communities / Amenities criteria.

Option 2a, was considered marginally less attractive due to the higher impact on the fishing industry from the greater offshore work scope. Option 4 was less attractive again due to the greater impact on the fishing industry and the increased quantity of concrete being directed to landfill. Finally, Option 6 was the least attractive option overall, due to having the highest impact on the fishing industry and the greatest quantity of concrete being directed to landfill.

#### Appendix B.4.18 Economic – Short-term Costs

The impact of the decommissioning options in terms of short-term costs to perform the option is considered in this criterion.

Option 1a was assessed as the most attractive option from a short-term costs perspective. This is due to it being the lowest cost option at approx. £2.5 million.

Option 2a was the next lowest cost at around £15 million, with Option 4 at £90 million and finally, Option 6 at over £350 million.

#### Appendix B.4.19 Economic – Long-term Costs

The impact of the decommissioning options in terms of long-term costs i.e. any on-going survey and monitoring costs and Fishing Legacy Trust-fund Company (FLTC) payments, are considered in this criterion.

Option 6 is considered the most attractive option against this criterion. This is due to there being no long-term costs associated with this full removal option.



All other options are considered equally less attractive as the long-term costs associated with them is largely similar.

#### Appendix B.4.20 Economic – Overall

Overall, the assessment is dominated by the short-term costs as the differentials are much greater than for the long-term costs.

Option 1a is the most attractive option from an Economic perspective, followed by Option 2a, then Option 4 and finally Option 6.



# APPENDIX C GROUP 2 – DETAILED EVALUATION RESULTS

Appendix C.1 Group 2 Attributes Table

# Group 2: Mattress Covered Short-umbilical & Associated Pipeline

- 80 m 8" gas production pipeline from NW Bell to Callisto with 8.1 m of exposure (PL1690)
 - 80 m 3" methanol pipeline from NW Bell to Callisto with 8.1 m of exposure (PL1691)
 - 80 m umbilical from NW Bell to Callisto with no exposure (UM3)

		Option 6	Option 1a
		Full Removal (Cut & Lift)	Do Nothing (Minor Intervention)
		- Recover concrete mattresses & grout bags	- Dredge to uncover umbilical & pipeline ends
		<ul> <li>Unbury entire umbilical and pipeline with MFE</li> </ul>	- Cut 10m umbilical and pipeline ends with hydraulic shears
		- Cut umbilical and pipeline into 20m lengths with hydraulic shears	- Recover (6 x 10m) end sections
		- Bundle cut sections and recover	- Place rock to remediate cut ends
		- Post decommissioning survey   Seabed trawl sweep	- Post decommissioning survey   Seabed trawl sweep
		Vessel Type: PoB / Days / Hours / PLL	Vessel Type: PoB / Days / Hours / PLL
	-	DSV: 110 / 10.6 / 13,952 / 1.05E-03	DSV: 110 / 7.4 / 9,808 / 7.36E-04
>	e ne	Divers: 24 / 10.6 / 6,088 / 5.91E-03	Divers: 24 / 7.4 / 4,280 / 4.15E-03
afet	lo l	Trawler: 5 / 4.0 / 240 / 1.80E-05	Trawler: 5 / 4.0 / 240 / 1.80E-05
Ö.	1.1 Personnel Offshore	Survey Vessel: 44 / 8.1 / 4,282 / 3.21E-04	Survey Vessel: 44 / 8.1 / 4,282 / 3.21E-04
	1.1	Total offshore hours: 24,563 hrs	Total offshore hours: 18,609 hrs
		Total offshore PLL: 7.29E-03	Total offshore PLL: 5.23E-03
		N	
		The assessment of the Personnel Offshore sub-criterion is as follows:	
		Option 6 is assessed as being Neutral to Option 1a as the risk profiles are	largely similar due to the effort required to disconnect the short, 80 m line
Sun	nmary	lengths, at both ends to allow the associated subsea structures to be reco	
		remove these short lines fully (Option 6) is considered negligible in terms o	f additional personnl risk exposure.
		Overall, both options are equally preferred from a risk to Offshore P	ersonnel perspective.
	_	Resource Type: Days / Hours / PLL	Resource Type: Days / Hours / PLL
ety	Inel	Onshore Operations (Cleaning & Disposal): 14.0 / 896 / 1.10E-04	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06
Safe 1.2	Personnel Onshore		
÷	on Per	Total onshore hours: 896 hrs	Total onshore hours: 64 hrs
	_	Total onshore PLL: 1.10E-04	Total onshore PLL: 7.87E-06
		W	
		The assessment of the Personnel Onshore sub-criterion is as follows:	and the time of the
Sun	nmary	Option 6 is assessed as being Weaker than Option 1a as the risk profile is shore for processing with the full removal option.	a alound 14 times higher due to the increased material being returned to
		Overall, Option 1a is most preferred from a risk to Onshore Personne	el perspective.
	s	Vessel Days: DSV: 10.6	Vessel Days: DSV: 7.4
	ser	DSV. 10.6 Divers: 10.6	Divers: 7.4
ety	Ű,	Trawler: 4.0	Trawler: 4.0
Saf	Other Users	Survey Vessel: 8.1	Survey Vessel: 8.1
÷.	ō		
	1.3	Total vessel days: 22.7 days	Total vessel days: 19.5 days
		Total Number of Transits:- 10	Total Number of Transits:- 8
		N	
		The assessment of the Other Users sub-criterion is as follows:	
Sun	nmary	Both options are assessed as being Neutral to each other as, the number	
		Overall, both options are equally preferred from a risk to Other User	s perspective.
	ø	The potential for High Consequence Events is assessed as Low for this	The potential for High Consequence Events is assessed as Low for this
<u>≥</u> ≓	Consequence Events	option. This is based on the number of both cutting and lifting operations	option. This is based on the number of both cutting and lifting operations
Safety 4 High	, ent	that would need to take place to the pipelines and umbilical.	that would need to take place to the pipeline ends only.
1.8	ы Ш		Number of Lifts: 2
	ပိ	Number of Lifts: 7	
		N	
		The assessment of the High Consequence Events sub-criterion is as follow	
	nmary	Option 6 is assessed as being Neutral to Option 1a as the potential for Hig	h Consequence Events is considered similar as the number of lifts are
Sun		Inclusion al las heathe authors a	
Sun		minimal in both options.	
Sun		minimal in both options. Overall, both options are equally preferred from a Residual Risk per	spective.



		Ortica	Ortion to
		Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)
		- Recover concrete mattresses & grout bags	- Dredge to uncover umbilical & pipeline ends
		- Unbury entire umbilical and pipeline with MFE	- Cut 10m umbilical and pipeline ends with hydraulic shears
		- Cut umbilical and pipeline into 20m lengths with hydraulic shears	- Recover (6 x 10m) end sections
		- Bundle cut sections and recover	- Place rock to remediate cut ends
		- Post decommissioning survey   Seabed trawl sweep	- Post decommissioning survey   Seabed trawl sweep
	×	As the umbilical and pipeline would be fully removed from the seabed,	With the exposed ends removed, the remaining umbilical and pipelines are
	Ris	there would be no legacy risk associated with this full removal option.	buried.
ety	Residual Risk		
. Safety	sidu		The survey & monitoring programme is committed to ensuring that the
÷	Re		potential snag hazard from left in-situ infrastructure continues to be
	1.5		managed & mitigated in the future as appropriate.
		S	
		The assessment of the Residual Risk sub-criterion is as follows:	
5	Summary	Option 6 is assessed as being Stronger than Option 1a as the full removal of	pption removes the potential for snag hazard completely.
		Overall, Option 6 is the most preferred from a Residual Risk perspect	ive.
		Vessel Noise (days on-site):	Vessel Noise (days on-site):
		Survey Vessel - 0.1 days   CSV - 0.35 days   DSV - 4 days   Trawler - 1 day	Survey Vessel - 0.1 days   DSV - 3 days   Trawler - 1 day
		uay	
	act	Tooling Noise:	Tooling Noise:
_	ŭ	MFE for Unburial - 0.1 days   Dredging - 3 days   Hydraulic Shears - 0.63	Dredging - 1.5 days   Hydraulic Shears - 0.25 days
nta	e	days	
me	lari		
ror	al N	Operational Discharges: Negligible potential for hydrocarbon releases through cutting operations	Operational Discharges: Negligible potential for hydrocarbon releases through minimal cutting
Environmental	<u> </u>	due to umbilical and pipeline cleaning being carried out to a regulatory	operations due to umbilical and pipeline cleaning being carried out to a
2. E	erat	acceptable level. Planned discharges will be included in operational	regulatory acceptable level. Planned discharges will be included in
	ð	permits. No cutting swarf as cutting performed by hydraulic shears.	operational permits. No cutting swarf as cutting performed by hydraulic
	5		shears.
		Vessel Discharges:	Vessel Discharges:
		This includes Ballast, Grey and Black Water, this is driven by duration of	This includes Ballast, Grey and Black Water, this is driven by duration of
		vessel operations and therefore will be similar for both options.	vessel operations and therefore will be similar for both options.
		Ν	
		The assessment of the Operational Marine Impact sub-criterion is as follows	
5	Summary	Option 6 is assessed as being Neutral to Option 1a as the marine impacts to both options.	from low vessel and equipment usage along short line lengths are minimal in
		Overall, both options are equally preferred from an Operational Mari	ne Impact perspective.
	·		
		There will be no legacy marine impacts from this full removal option.	The remaining umbilical and pipelines are buried to an appropriate depth.
	act		Any area of exposure of these lines will be removed with the ends.
ם	Marine Impact		The legacy marine impacts relate to the left in-situ materials, i.e. the
nen	e l		remaining trenched and buried 8" and 3" diameter steel pipelines and the
vironmental	lari		umbilical.
vir			Given the buried status of the pipelines and the umbilical that are cleaned
Ē.	Legacy		to a regulatory acceptable level, the legacy marine impact is considered
2.	2 Le		low but greater than the full removal option.
	5		
		S	
		The assessment of the Legacy Marine Impact sub-criterion is as follows:	
	Summany	Whilst the legacy environmental impact is expected to be low for these opti-	ption removes all material whilst there is material left in-situ with Option 1a.
	Junnary	preference for the full removal option.	
		Overall, Option 6 is the most preferred from a Legacy Marine Impact	perspective.
		Vessel Emissions (in tonnes):	Vessel Emissions (in tonnes):
Ital		Fuel: 368	Fuel: 480
mer	Jse ieri ons	CO2e: 1,206	CO2e: 1,573
l no	2.3 Fuel Use & Atmospheric Emissions	NOx: 21.86	NOx: 28.51
nvi	Emi Fu	SO2: 1.47	SO2: 1.92
2. Environmenta	<b>A</b> 2.3	Vessel Energy Use: 15,822 GJ	Vessel Energy Use: 20,638 GJ
CN.			
		N	
		The assessment of the Fuel Use & Atmospheric Emissions sub-criterion is	as follows:
_			
ş	Summary	Both options are assessed as being Neutral to each other as the fuel used	and emissions generated are similar for these options.
\$	Summary		and emissions generated are similar for these options.



		Option 6	Option 1a
		Full Removal (Cut & Lift)	Do Nothing (Minor Intervention)
		- Recover concrete mattresses & grout bags	- Dredge to uncover umbilical & pipeline ends
		- Unbury entire umbilical and pipeline with MFE	- Cut 10m umbilical and pipeline ends with hydraulic shears
		<ul> <li>Cut umbilical and pipeline into 20m lengths with hydraulic shears</li> <li>Bundle cut sections and recover</li> </ul>	- Recover (6 x 10m) end sections - Place rock to remediate cut ends
		- Post decommissioning survey   Seabed trawl sweep	- Post decommissioning survey   Seabed trawl sweep
		·	·
ta Ia	su	Material Emissions (CO2 in tonnes):	Material Emissions (CO2 in tonnes):
ien	otio	Recovered Material: 424	Recovered Material: 4
Z. onm	2.4 Other nsumptic	Remaining Material: N/A	Remaining Material: 361
2. Environmental	2.4 Other Consumptions	Total: 424	Total: 365
Ш	ပိ	Rock: N/A	Rock: 150 tonnes
		N	
		The assessment of the Other Consumptions sub-criterion is as follows:	
S	ummary	Both options are assessed as being Neutral to each other as, whilst there a	re differences between the quantities consumed between the options, the
		differential was considered insufficient to express a preference. Overall, both options are equally preferred from an Other Consumpti-	ons nerspective
fal	8		There is limited short-term disturbance for this option from the small area of
ner	an	removal of these short lines.	rock dump only.
Environmental	5 Disturbance		
wir	Dist		
2. EI	2.5		
2			
		W	
		The assessment of the Seabed Disturbance (short-term impact) sub-criterio Option 6 is assessed as being Weaker than Option 1a as there is a small a	
S	ummary	compared to the small area of low impact disturbance from rock placement	
		Overall, Option 1a is the most preferred from a Seabed Disturbance p	perspective.
_		Habitat Loss (Rockdump): N/A	Habitat Loss (Rockdump): 120 m2
ente	7		
шu	ss ( tat		
iro	2.6 Loss of Habitat		
2. Environmental	2.6 H		
<b>5</b>			
		S	
		The assessment of the Loss of Habitat (legacy / long-term impact) sub-crite	
9	ummarv	Option 6 is assessed as being Stronger than Option 1a as the rock dump in of habitat loss whereas there is no habitat loss in Option 6.	Option 1a changes the current seabed habitat and thus results in an area
3	unnary	Note: Habitat loss is from the replacement of the sandbank features with ha	rd substrate (rock).
		Overall, Option 6 is most preferred from a Loss of Habitat perspective	
		Concept Maturity: All operations to deliver this option are considered	Concept Maturity: All operations to deliver this option are considered
a	.1 Technical Feasibility	routine. (Score 3)	routine. (Score 3)
Technical	ini bili		
Tec	Tec	Technical Risks: There is potential for mattresses to be degraded and	Technical Risks: Limited technical risks due to the limited cutting required
ર્ભ	З.1 Д	additional risk associated with the unburial operations. (Score 2)	and short duration of work scopes. (Score 3)
		W	
		The assessment of the Technical Risk sub-criterion is as follows:	
		Option 6 is assessed as being Weaker than Option 1a due to the potential	challenges associated with unburial of the lines and the recovery of the
3	ummary	mattresses.	
		Overall, Option 1a is most preferred from a Technical Risk perspectiv	e.
		The operational impact of removing the umbilical and pipelines may disturb	Small volume of rock covering installed over cut ends, profiled to be
ital	ing	(displacement and restricted access) current fishing operations. The	overtrawlable. Left in-situ infrastructure may lead to damage / loss of gear
ocie	lish	impact is low due to the very short lengths of umbilical and pipelines. (Score 3)	however, the lines are buried along their full length. (Score 3)
4. Societal	4.1 Fishing		
ব	4		
		N	
		The assessment of the Societal impact on Fishing sub-criterion is as follows	
		Option 6 is assessed as being Neutral to Option 1a as the impact of both th	
S	ummary	decommissioning operations being conducted within the existing 500m excl	ssion zone.
		Overall, both options are equally preferred from a Societal impact or	n Fishing perspective.



# Appendix C.2 Group 2 Pairwise Comparison Matrices

1.1 Personnel Offshore	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	1.2 Personnel Onshore	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	50.0%	Option 6 Full Removal (Cut & Lift)	N	×	40.0%
Option 1a Do Nothing (Minor Intervention)	N	N	50.0%	Option 1a Do Nothing (Minor Intervention)	S	N	60.0%
1.3 Other Users	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	1.4 High Consequence Events	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	50.0%	Option 6 Full Removal (Cut & Lift)	N	N	50.0%
Option 1a Do Nothing (Minor Intervention)	N	N	50.0%	Option 1a Do Nothing (Minor Intervention)	N	N	50.0%
1.5 Residual Risk	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	2.1 Operational Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	60.0%	Option 6 Full Removal (Cut & Lift)	N	N	50.0%
Option 1a Do Nothing (Minor Intervention)	w	N	40.0%	Option 1a Do Nothing (Minor Intervention)	N	N	50.0%



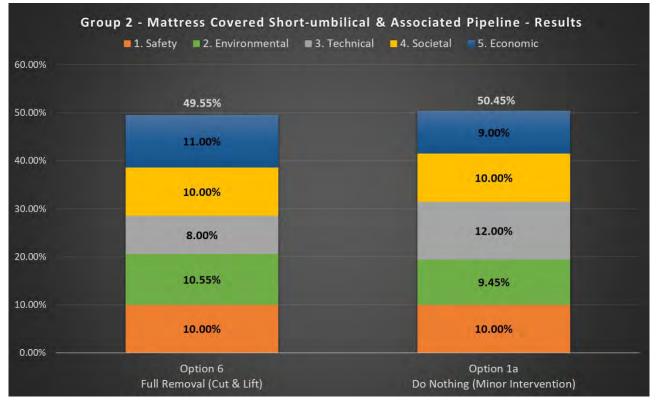
2.2 Legacy Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	2.3 Fuel Use & Atmospheric Emissions	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	S	60.0%	Option 6 Full Removal (Cut & Lift)	N	N	50.0%
Option 1a Do Nothing (Minor Intervention)	w	N	40.0%	Option 1a Do Nothing (Minor Intervention)	N	N	50.0%
2.4 Other Consumptions	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	2.5 Disturbance	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	50.0%	Option 6 Full Removal (Cut & Lift)	N	w	40.0%
Option 1a Do Nothing (Minor Intervention)	N	N	50.0%	Option 1a Do Nothing (Minor Intervention)	S	N	60.0%
2.6 Loss of Habitat	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	3.1 Technical Feasibility	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	S	60.0%	Option 6 Full Removal (Cut & Lift)	N	w	40.0%
Option 1a Do Nothing (Minor Intervention)	w	N	40.0%	Option 1a Do Nothing (Minor Intervention)	S	N	60.0%



4.1 Fishing	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	4.2 Communities / Ammenities	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	50.0%	Option 6 Full Removal (Cut & Lift)	N	N	50.0%
Option 1a Do Nothing (Minor Intervention)	N	N	50.0%	Option 1a Do Nothing (Minor Intervention)	N	N	50.0%
5.1 Short-term Costs	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting	5.2 Long-term Costs	Option 6 Full Removal (Cut & Lift)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	50.0%	Option 6 Full Removal (Cut & Lift)	N	s	60.0%
Option 1a Do Nothing (Minor Intervention)	N	N	50.0%	Option 1a Do Nothing (Minor Intervention)	w	N	40.0%



# Appendix C.3 Group 2 Results Chart





# Appendix C.4 Group 2 Detailed Evaluation Discussion

## Appendix C.4.1 Safety – Personnel Offshore

The assessment of the options during the workshop indicated that the full removal and the leave insitu options (Option 6 and Option 1a) were equally attractive against the Personnel Offshore subcriterion. The full removal of these three, short (80 m) lines was shown to require a similar offshore duration to the removal and recovery of the six, short (10 m) line ends. As such, the options have similar risk exposures and no preference was indicated.

# Appendix C.4.2 Safety – Personnel Onshore

The safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. Option 1a is the most attractive from a safety risk to onshore personnel perspective. This is due to there being 60 m of material returned for onshore handling, transportation and processing, versus 240 m of material for the full removal option. The differential in risk profile was considered sufficient to express a preference.

# Appendix C.4.3 Safety – Other Users

The impact of performing the decommissioning options on other users of the sea from a safety perspective is related to the duration of operations, the number of vessels involved, and significantly, the number of transits to and from port to the decommissioning site.

The assessment of the decommissioning options against this criterion has indicated that both options have a similar, low impact on the safety of other users due to the low duration of operation and limited number of transits associated with the small offshore scope. Both options were assessed as equally attractive from a Safety – Other Users perspective.

#### Appendix C.4.4 Safety – High Consequence Events

The potential for High Consequence Events in both the full removal option and the leave in-situ option centred around the potential for a dropped object during the recovery of the cut sections of line from the seabed, through the water column to the vessel for return to shore. Whilst there are a few more lifts for Option 6 than Option 1a as there is more line being recovered, this differential was insufficient to express a preference. As such, both options are equally attractive from a High Consequence Events perspective.

#### Appendix C.4.5 Safety – Residual Risk

The residual risk relates to the potential for any legacy safety impact from the decommissioning options. Option 6 is assessed as the most attractive option from a residual safety risk perspective as it is a full removal option and therefore removes all residual risk. It should be noted however, that Option 1a leaves the lines in a fully buried state, and, as part of any partial removal or leave in-situ solution being selected, any potential hazards along the pipeline would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations. In addition, any infrastructure remaining on the seabed presents a low potential for future interaction ref. [7].



#### Appendix C.4.6 Safety – Overall

The options are assessed as being comparable from a safety to offshore personnel and safety to other users perspective. Option 1a is preferred from a safety to onshore personnel perspective and Option 6 is preferred from a residual risk perspective. Overall, there is little to separate these options from a safety perspective and as such, both are assessed as equally preferred.

#### Appendix C.4.7 Environment – Operational Marine Impact

The environmental impact on the marine environment from performing the decommissioning options was considered low across all options, with the impact considered similar enough to be unable to express a preference of one option over the other.

#### Appendix C.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 6, full removal of the lines, is the most attractive decommissioning option from a legacy marine environmental impact perspective. This is due to the full length of the lines being removed and thus eliminating any legacy impact from left in-situ materials such as degradation products or polymers.

#### Appendix C.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that, given the similar operational durations and numbers of vessels, there was little to choose between the options and both were equally attractive from a fuel use and atmospheric emissions perspective.

#### Appendix C.4.10 Environment – Other Consumptions

The assessment indicated that, given the minimal differences in quantity of material returned between the two options, and the requirement for only a small quantity of rock cover in Option 1a, both options have a similar environmental impact from an Other Consumption perspective. As such, both options were equally preferred.

#### Appendix C.4.11 Environment – Seabed Disturbance

The short-term environmental impact on the seabed from the de-burial of the lines using MFE under the full removal option was assessed as being greater than the leave in-situ option. As such, Option 1a, leave in-situ was assessed as being the most attractive option from a short-term seabed disturbance perspective.

#### Appendix C.4.12 Environment – Loss of Habitat

The long-term, environmental impact on the seabed, of performing the decommissioning options, is considered in this criterion, with a focus on any material change to or loss of existing habitat.

Option 6, the full removal option is assessed as being more attractive than Option 1a, the leave insitu option as, whilst the area of rock cover is small at 120 m<sup>2</sup>, the introduction of this rock is a material change to the habitat where the existing sandbank is replaced with a hard substrate.

#### Appendix C.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, there is a small preference for Option 6 over Option 1a. The options were considered similar against the Operational Marine



Impact, Fuel Use & Atmospheric Emissions and Other Consumptions criteria. Option 6 was preferred against the Legacy Marine Impact and Loss of Habitat criteria with the preference for Option 1a being insufficient to overturn this preference.

## Appendix C.4.14 Technical – Technical Feasibility

The assessment indicated that Option 1a is the most attractive option from a Technical Feasibility perspective. Whilst both options employ largely routine operations, the preference was due to the potential difficulties associated with removing the mattresses due to degradation and the challenges associated with the de-burial of the lines in Option 6, the full removal option.

# Appendix C.4.15 Societal – Fishing Industry

Both options were equally preferred against the Societal – Fishing criterion. This is due to the limited disruption to fishing operations as both options have short operational durations. Additionally, any infrastructure left in-situ in Option 1a is adequately buried and is unlikely to impact commercial fishing operations. It is noted from the Fishing Baseline Characterisation ref. [7] that moderate to high fishing activity is recorded in the vicinity of the Jupiter area and is predominantly attributable to Dutch Beam Trawling.

# Appendix C.4.16 Societal – Communities / Amenities

The impact of the decommissioning options on communities and amenities are assessed as similar as the quantities of material being returned are minimal in both cases with only small amounts of material being directed to landfill.

#### Appendix C.4.17 Societal – Overall

Given both options are equally preferred against both Societal sub-criteria, both options are equally preferred from an overall Societal perspective.

#### Appendix C.4.18 Economic – Short-term Costs

The assessment showed that both options were equally preferred from a short-term costs perspective as the cost of performing the decommissioning options are similar at £2.8 million for Option 6 and £2.2 million for Option 1a. This small difference in cost was considered insufficient to express a preference.

#### Appendix C.4.19 Economic – Long-term Costs

The full removal option has a zero legacy or long-term cost, whereas the leave in-situ option has a small legacy cost element from the on-going survey and monitoring costs and the FLTC payments. This was considered sufficient to express a preference for Option 6.

#### Appendix C.4.20 Economic – Overall

Overall, given the similar short-term costs for the two options, the economic assessment is driven by the requirement for on-going, long-term costs in Option 1a. This was considered sufficient for Option 6 to be the most attractive option from an Economic perspective.

# APPENDIX D GROUP 3A - DETAILED EVALUATION RESULTS

# Appendix D.1 Group 3a Attributes Table

# Group 3a: Trenched Interfield Non-concrete Coated Piggyback Pipelines ≤ 16"

- 3.9 km 10" gas production pipeline with piggyback methanol pipeline from Tethys to ND-PR Tee with 17.9 m of exposure at pipeline ends (PL2234 & PL2235)
 - 13.6 km 10" gas production pipeline with piggyback methanol pipeline from Mimas to Saturn with 7.1 m of exposure at pipeline ends (PL2236 & PL2237)
 - 4.5 km 12" gas production pipeline with piggyback methanol pipeline from Europa to ZM to ZD Tee with 4.2 m of exposure at pipeline ends (PL1694 & PL1695)

		Full Re	Option 6 moval (Cut & Lift)		on 5a (Reverse Reel)	Option Do Nothing (Minor	
		<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Cut pipe into 20m sections   Bit</li> </ul>		<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Install recovery rigging for reverse ree</li> <li>Reverse reel onto reel vessel</li> <li>Backfill trench   Post decommission</li> </ul>	el and remove concrete mattresses	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10m section with hydraulic shears</li> <li>Remove pipeline ends (6 x 10m)</li> <li>Place rock to remediate snag risk at ex</li> <li>Post decommissioning survey   Seabed</li> <li>Note: all areas of exposure at pipeline of</li> </ul>	
1. Safety	1.1 Personnel Offshore	Vessel Type: PoB / Days / Hours / PLL         DSV: 110 / 55.9 / 73,814 / 5.54E-03         Divers: 18 / 55.9 / 24,157 / 2.34E-02         Trawler: 5 / 8.0 / 480 / 3.60E-05         Survey Vessel: 44 / 9.9 / 5,238 / 3.93E-04         CSV: 76 / 138.2 / 126,057 / 9.45E-03         Total offshore hours: 229,746 hrs         Total offshore PLL: 3.89E-02		DSV: 110 / 8.5 / 11,246 / 8.43E-04 Divers: 18 / 8.5 / 3,681 / 3.57E-03 Trawler: 5 / 8.0 / 480 / 3.60E-05 Survey Vessel: 44 / 9.9 / 5,238 / 3.93 CSV: 76 / 25.8 / 23,539 / 1.77E-03	Divers: 18 / 8.5 / 3,681 / 3.57E-03 Trawler: 5 / 8.0 / 480 / 3.60E-05 Survey Vessel: 44 / 9.9 / 5,238 / 3.93E-04 CSV: 76 / 25.8 / 23,539 / 1.77E-03 Reel Vessel: 76 / 22.7 / 20,666 / 1.55E-03 Total offshore hours: 64,849 hrs Total offshore PLL: 8.16E-03		
	Summary	Option 6 is assessed as being V as being Much Weaker than Op Option 5 is assessed as being V	tion 1a as the risk exposure for offshore	personnel is almost 9 times higher for Op sure for offshore personnel is double for O	otion 6 due to the larger scope, greate	for longer offshore duration and greater use er use of divers and no requirement for a CS ling CSV and Reel Vessel for usage Option	
1. Safety	1.2 Personnel Onshore	Onshore Operations (Cleaning & Disposal): 133.6 / 8,553 / 1.05E-03OnshoreTotal onshore hours: 8,553 hrsTotal		Resource Type: Days / Hours / PLL Onshore Operations (Cleaning & Disp Total onshore hours: 8,553 hrs Total onshore PLL: 1.05E-03	oosal): 133.6 / 8,553 / 1.05E-03	Resource Type: Days / Hours / PLL Onshore Operations (Cleaning & Dispos Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06	
	Summon	Option 6 is assessed as being N			material being returned to shore for p	rocessing. Option 6 is assessed as being	
	Summary	Option 5 is assessed as being N	returned to shore versus only 20 m in C Much Weaker than Option 1a due to the eferred from a risk to Onshore Perso	return of the full pipeline lengths being ret	turned to shore versus only 20 m in C	Option 1a.	



on 1a nor Intervention)

rs (at each end)

t exposed ends bed trawl sweep ne ends will be removed with ends

E-04

use of divers. Option 6 is assessed CSV in Option 1a. ion 5.

osal): 1.0 / 64 / 7.87E-06

ng Much Weaker than Option 1a due

			Option 6	#)		on 5a (Reverse Reel)	Option	
		<ul> <li>Unbury pipeline(s) with</li> <li>Mattress removal and n</li> <li>Cut pipe into 20m section</li> </ul>		is and recover	- Unbury pipeline(s) with MFE - Mattress removal and recovery - Install recovery rigging for reverse red - Reverse reel onto reel vessel - Backfill trench   Post decommission		Do Nothing (Mino - Dredge to uncover pipeline ends - Cut 10m section with hydraulic shears - Remove pipeline ends (6 x 10m) - Place rock to remediate snag risk at e - Post decommissioning survey   Seabe - Note: all areas of exposure at pipeline	
1. Safety	3 Other Users	Vessel Days: DSV: 55.9 Divers: 55.9 Trawler: 8.0 Survey Vessel: 9.9 CSV: 138.2 Total vessel days: 212.1 Total Number of Transits	-		Vessel Days: DSV: 8.5 Divers: 8.5 Trawler: 8.0 Survey Vessel: 9.9 CSV: 25.8 Reel Vessel: 22.7 Total vessel days: 74.9 days Total Number of Transits:- 16		Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 9.9 Total vessel days: 25.6 days Total Number of Transits:- 8	
Sum	mary	N       N       N         The assessment of the Other Users sub-criterion is as follows:       All options are assessed as being Neutral to each other as, whilst there are more vessel days with Option 6, these are spread over a longer operational duration. Additionally, whilst there are differential impact on the safety of other users between the options.         Overall, all options are equally preferred from a risk to Other Users perspective.						
1. Safety 1.4 High	sequei Events	The potential for High Consequence Events is assessed as Medium for this option. This is based on the number of both cutting and lifting operations that would need to take place to fully remove the pipeline. Number of Lifts: 275			The potential for High Consequence E option. This relates to the on-deck cu reel capacity), lifting (for pipeline reco reverse reeling). Number of Lifts: 3	The potential for High Consequence Eve option. This is based on the number of b that would need to take place to the pipe Number of Lifts: 3		
Sum	mary	Option 6 is assessed as considered similar for the Both Option 6 and Option	being Neutral to Option ese options. n 5 are assessed as bei		f potential High Consequence Events an tion 1a as there is potential for High Co		. lifting for Option 6 and deck handling for ential in Option 1a due to limited lifting op	
1. Safety		As the pipelines would be fully removed from the seabed, there would be no legacy risk associated with this full removal option.		As the pipelines would be fully remove legacy risk associated with this full re	With the exposed ends removed, the removed in their current state with no report The survey & monitoring programme is a potential snag hazard from left in-situ informanaged & mitigated as appropriate.			
		N	S		S			
Sum	mary	in-situ for Option 1a whe	being Neutral to Option re there is small potentia	5 as there is no residual i	ese pipelines however, do not exhibit hi		re assessed as being Stronger than Optic e considered stable in burial.	



ars (at each end)

- t exposed ends
- bed trawl sweep
- ne ends will be removed with ends

differences in the number of vessel

vents is assessed as Low for this of both cutting and lifting operations pipeline ends only.

for Option 5, the potential is

operations.

remaining pipelines are trenched and portable spans.

s committed to ensuring that the infrastructure continues to be

otion 1a as, the pipelines will remain

			Option 6 Full Removal (Cut & Li	ft)		on 5a (Reverse Reel)	Option Do Nothing (Mino
		<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Cut pipe into 20m sections   Bundle cut sections and recover</li> <li>Backfill trench   Post decommissioning survey   Seabed trawl sweep</li> </ul>			<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Install recovery rigging for reverse red</li> <li>Reverse reel onto reel vessel</li> <li>Backfill trench   Post decommission</li> </ul>	el and remove concrete mattresses	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10m section with hydraulic shears</li> <li>Remove pipeline ends (6 x 10m)</li> <li>Place rock to remediate snag risk at e</li> <li>Post decommissioning survey   Seabe</li> <li>Note: all areas of exposure at pipeline</li> </ul>
		Survey Vessel - 2 days   CSV - 127 days   DSV - 52 days   Trawler - 5		Vessel Noise (days on-site): Survey Vessel - 2 days   CSV - 19 da 19 days   Trawler - 5 days	ys   DSV - 4.5 days   Reel Vessel -	Vessel Noise (days on-site): Survey Vessel - 2 days   DSV - 3.67 da	
	npact	Tooling Noise: MFE for Unburial - 9.16 o	days   Hydraulic Shears -	- 46 days	Tooling Noise: MFE for Unburial - 9.16 days   Hydrau	ulic Shears - 1 day	Tooling Noise: Dredging - 1.5 days   Hydraulic Shears
2. Environmental		Negligible potential for hydrocarbon releases through cutting operations because the pipelines have been cleaned successfully. Planned discharges would therefore be within acceptable limits and included in operational permits. The level of cutting swarf would be significantly higher			Operation Discharges: Negligible potential for hydrocarbon re because the pipelines have been clea discharges would therefore be within a operational permits. No cutting swarf option.	ned successfully. Planned acceptable limits and included in	Operation Discharges: Negligible potential for hydrocarbon rele because the pipelines have been cleane discharges would therefore be within ac operational permits. Minimal cutting sw
	2.1 0	of the 3 options being evaluated.		Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations. This option has less vessel usage than full removal (cut and lift) option and will therefore have a lower associated vessel discharges than full removal (cut & lift) option.		Vessel Discharges: This includes Ballast, Grey and Black V vessel operations and having the least v lowest associated vessel discharges of	
		W	W		W		
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 6 is assessed as being Weaker than both Option 5 and Option 1a as, w			as, whilst the actual environmental mari for the other options. Il environmental marine impacts from th	-	
		There will be no legacy r	marine impacts from this	full removal option.	There will be no legacy marine impact	ts from this full removal option.	The remaining pipelines are trenched ar
	2. Environmental Legacy Marine Impact						The legacy marine impacts relate to the remaining trenched and buried 10" and production), and the piggybacked 3" ste have a polymer coating.
	2.2 Legacy						Given the material being left in-situ and a regulatory acceptable level, the legacy albeit it with the limited potential (due to the water column slowly over time.
		Ν	S		S		
	Summary	Option 6 is assessed as the legacy environmenta	being Neutral to Option I impact associated with	Option 1a is expected to			ull removal options is assessed as being



ars (at each end)

t exposed ends bed trawl sweep ne ends will be removed with ends

days | Trawler - 5 days

rs - 1 day

eleases through cutting operations ned successfully. Planned acceptable limits and included in swarf associated with this option.

Water, this is driven by duration of t vessel usage this option has the of the 3 options being evaluated.

sel discharges is minimal for Option

y, they are significant enough to

and buried to an appropriate depth.

he left in-situ materials, i.e. the d 12" diameter steel pipelines (gas steel pipelines (methanol), all of which

ad the pipeline having been cleaned to acy marine impact is considered low, to burial status) for polymer to enter

ng Stronger than Option 1a as, whilst

			Option 6		O	otion 5a	Optio
		<ul> <li>Unbury pipeline(s) with</li> <li>Mattress removal and re</li> <li>Cut pipe into 20m secti</li> </ul>		s and recover	<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Install recovery rigging for reverse</li> <li>Reverse reel onto reel vessel</li> </ul>	al (Reverse Reel) reel and remove concrete mattresses oning survey   Seabed trawl sweep	Do Nothing (Min - Dredge to uncover pipeline ends - Cut 10m section with hydraulic shear - Remove pipeline ends (6 x 10m) - Place rock to remediate snag risk at - Post decommissioning survey   Seat - Note: all areas of exposure at pipelin
2. Environmental	2.3 Fuel Use & Atmospheric Emissions	Vessel Emissions (in tor Fuel: 5,145 CO2e: 16,864 NOx: 305.61 SO2: 20.58 Vessel Energy Use: 221			Vessel Emissions (in tonnes): Fuel: 1,945 CO2e: 6,376 NOx: 115.55 SO2: 7.78 Vessel Energy Use: 83,644 GJ		Vessel Emissions (in tonnes): Fuel: 608 CO2e: 1,992 NOx: 36.10 SO2: 2.43 Vessel Energy Use: 26,130 GJ
		Ν	W		N		
S	ummary	Option 6 is assessed as differences in fuel use an	being Neutral to Option 5 d emissions are just suffi being Neutral to Option 1	icient to express a small 1a as, whilst there are diff	rences in the fuel use and emissions preference for Option 1a. ferences in the fuel use and emission	s, these are insufficient to express a pre	
2. Environmental	2.4 Other Consumptions	Material Emissions (CO2 in tonnes): Recovered Material: 4,026 Remaining Material: N/A Total: 4,026		Material Emissions (CO2 in tonnes Recovered Material: 4,026 Remaining Material: N/A Total: 4,026	):	Material Emissions (CO2 in tonnes): Recovered Material: 9 Remaining Material: 6,560 Total: 6,569	
2. E	ပိ	Rock: N/A			Rock: N/A		Rock: 150 tonnes
S	ummary	N         N           The assessment of the Other Consumptions sub-criterion is as follows:           All options are assessed as being Neutral to each other as the consumptions           Overall, all options are equally preferred from an Other Consumptions			-	largely similar, and the amount of rock c	consumed in the leave in-situ option is m
2. Environmental	2.5 Disturbance	Short Term Disturbance	(MFE): 109,745 m2		Short Term Disturbance (MFE): 10	9,745 m2	There is limited short-term disturbance rock dump only.
		Ν	MW		MW		
S	ummary	Option 6 is assessed as to the large area of seable	being Neutral to Option 5 ed disturbance from the u ed as being Much Weake Option 1a.	inburial of the 22 km of pi r than Option 1a, again di	nce caused by the unburial of these pelines using a Mass Flow Excavato ue to the large area of seabed distur	pipelines is the same for both full remova or compared to the small area of low imp bance from the unburial of the 22 km of p	act disturbance with Option 1a.
		overan, option la ISM	ios preferreu from a Si	eabeu Disturbance per			



ars (at each end)

- t exposed ends
- bed trawl sweep
- ne ends will be removed with ends

g Weaker than Option 1a as the

ninor.

e for this option from the small area of

ng Much Weaker than Option 1a due compared to the small area of low

			Option 6 Full Removal (Cut & Lift	)		on 5a (Reverse Reel)	Option Do Nothing (Minc
		<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Cut pipe into 20m sections   Bundle cut sections and recover</li> <li>Backfill trench   Post decommissioning survey   Seabed trawl sweep</li> </ul>			<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recovery</li> <li>Install recovery rigging for reverse re</li> <li>Reverse reel onto reel vessel</li> <li>Backfill trench   Post decommission</li> </ul>	el and remove concrete mattresses	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10m section with hydraulic shears</li> <li>Remove pipeline ends (6 x 10m)</li> <li>Place rock to remediate snag risk at e</li> <li>Post decommissioning survey   Seabe</li> <li>Note: all areas of exposure at pipeline</li> </ul>
2. Environmental	2.6 Loss of Habitat	Habitat Loss (Rockdump): N/A			Habitat Loss (Rockdump): N/A	Habitat Loss (Rockdump): 120 m2	
		Ν	S		S		
S	ummary	Option 6 is assessed as habitat loss associated Note: Habitat loss is fror	•	as there is no habitat lo on 1a is small, this will c andbank features with h	ss associated with either of the full ren occur in a protected area and thus any ard substrate (rock).	• •	s are assessed as being Stronger than C to express a preference.
iical			ing using hydraulic shears r is considered routine. (S		<b>Concept Maturity:</b> Whilst reverse rea flexible flowlines, it is currently an unp pipelines. (Score 2)	eling is proven for umbilicals and proven technical solution for rigid steel	<b>Concept Maturity:</b> All operations to de routine. (Score 3)
3. Technical	· · -	and cut and lift of the pip	to successfully achieving fi beline due to the long dura unburial issues. (Score 2)		<b>Technical Risks:</b> There are risks to spiggybacked lines due to the potentia recovery and the challenges associat methanol import piggybacked lines or	I for integrity failure of the lines during ed with decoupling the gas export and	Technical Risks: Limited technical risk and short duration of work scopes. (Sco
		MS	W		MW		
S	ummary	Option 6 is assessed as is assessed as being W Option 5 is assessed as	eaker than Option 1a due	n Option 5 due to reverse to potential technical risl Option 1a due to unprov	ks for achieving unburial of the pipeline ven nature of the reverse reeling and the	s to perform the cutting operations in C	risks from pipeline integrity and decoupli Dption 6 versus simple and routine opera nple and routine operations in Option 1a.
Societal	b		es clear seabed, the opera sturbs (displacement and r s significantly.	-	Whilst this option provides clear seab the pipeline disturbs (displacement an operations.	· · · ·	Short operation, small area of disturbar rock at pipeline ends will be profiled to
4. Soo	5	Fishing operations are c (Score 2)	surrently conducted in the a	area of this pipeline.	Fishing operations are currently cond (Score 2)	ucted in the area of this pipeline.	Short term disturbance in localised area lead to damage / loss of gear because of burial along the full length. (Score 2)
		N	W		W		•
S	ummary	Option 6 is assessed as preference. Option 6 is in this area, the presenc Option 5 is assessed as	assessed as being Weake e of the pipeline is not cor	as, whilst the disruption er than Option 1a, due to nsidered a limitation to th n 1a, again due to the di	to fishing operations (disturbance and the disruption to fishing operations be fishing activity. sruption to fishing operations being hig	ing higher from the longer duration ope	er due to the longer durations, this it not rations associated with Option 6, given t associated with Option 5.



ars (at each end)

- t exposed ends
- bed trawl sweep
- ne ends will be removed with ends

Option 1a as, whilst the area of

deliver this option are considered

risks due to the limited cutting required Score 3)

pling of the piggyback lines. Option 6 erations. Ia.

bance, introduction of a small volume of to be over-trawlable. (Score 2)

areas. Infrastructure are unlikely to se the pipelines demonstrate a history 2)

not significant enough to express a n that fishing operations are conducted

			Option 6 Full Removal (Cut & Li	ft)	Full Re	Option 5a emoval (Reverse Reel)	Optic Do Nothing (Min
		<ul> <li>Unbury pipeline(s) with</li> <li>Mattress removal and re</li> <li>Cut pipe into 20m section</li> </ul>	MFE	s and recover	<ul> <li>Unbury pipeline(s) with MFE</li> <li>Mattress removal and recover</li> <li>Install recovery rigging for re</li> <li>Reverse reel onto reel vesse</li> </ul>	ery everse reel and remove concrete mattresses	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10m section with hydraulic shea</li> <li>Remove pipeline ends (6 x 10m)</li> <li>Place rock to remediate snag risk at</li> <li>Post decommissioning survey   Seat</li> <li>Note: all areas of exposure at pipelin</li> </ul>
4. Societal	4.2 Communities / Ammenities	Materials Returned: Steel: 3,063 tonnes (recy Polymer: 50 tonnes (land Mattress/Grout Bag: 899 Whilst there are some so this is offset by returning	dfill) tonnes (landfill) pocietal benefits from retu polymer and mattress /		is offset by returning polymer		
	V	take up landfill capacity.	(Score 2)		landfill capacity. (Score 2)		
S	ummary	The assessment of the Societal impact on Other Users sub-criterion is as follows: Option 6 is assessed as being Neutral to Option 5 as the societal impacts are largely similar for these options. Both full removal options are assessed as being Weaker than Option 1a due returned that will go to landfill. Overall, Option 1a is most preferred from a Societal impact on Other Users perspective.					
5. Economic	5.1 Short- term Costs	£28.645 Million			£9.883 Million		£2.451 Million
		MW	VMW		MW		
S	ummary	Option 5 is assessed as	being Much Weaker that being Much Weaker that	n Option 5 as the costs a	are around 4 times higher.	Option 6 is assessed as being Very Much We	aker as the costs are more than 10 tim
nomic	-ong- Costs	Surveys: N/A FLTC: N/A			Surveys: N/A FLTC: N/A		Surveys: £0.297 Million FLTC: £0.066 Million
5. Econ	5.2 Lo term C	Total Legacy Cost: £0 Million			Total Legacy Cost: £0 Million		Total Legacy Cost: £0.363 Million
		N	S		S		
S	ummary	long-term costs for surve	being Neutral to Option y and monitoring of the I	5 due to there being no lo	nd the contribution to the FLTC	either of these full removal options. Both the required for Option 1a.	full removal options are assessed as be



ars (at each end)

t exposed ends bed trawl sweep ne ends will be removed with ends

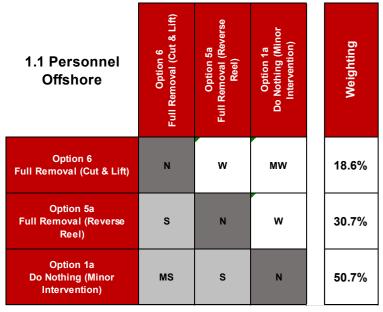
mpacts with this option due to the Score 3)

o the larger quantity of material being

nes higher.

eing Stronger than Option 1a due to





1.2 Personnel Onshore	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	MW	20.0%
Option 5a Full Removal (Reverse Reel)	N	N	MW	20.0%
Option 1a Do Nothing (Minor Intervention)	MS	MS	N	60.0%

1.3 Other Users	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	N	33.3%
Option 5a Full Removal (Reverse Reel)	N	N	N	33.3%
Option 1a Do Nothing (Minor Intervention)	N	N	N	33.3%

1.4 High Consequence Events	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	MW	20.0%
Option 5a Full Removal (Reverse Reel)	N	N	мw	20.0%
Option 1a Do Nothing (Minor Intervention)	MS	MS	N	60.0%

1.5 Residual Risk	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	s	38%
Option 5a Full Removal (Reverse Reel)	N	N	S	38%
Option 1a Do Nothing (Minor Intervention)	w	w	N	25%

2.1 Operational Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	24.8%
Option 5a Full Removal (Reverse Reel)	S	N	w	32.5%
Option 1a Do Nothing (Minor Intervention)	S	S	N	42.6%



2.2 Legacy Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	s	37.5%
Option 5a Full Removal (Reverse Reel)	N	N	s	37.5%
Option 1a Do Nothing (Minor Intervention)	W	w	N	25.0%

2.3 Fuel Use & Atmospheric Emissions	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	w	28.9%
Option 5a Full Removal (Reverse Reel)	N	N	N	33.1%
Option 1a Do Nothing (Minor Intervention)	S	N	N	37.9%

2.4 Other Consumptions	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	N	33.3%
Option 5a Full Removal (Reverse Reel)	N	N	N	33.3%
Option 1a Do Nothing (Minor Intervention)	N	N	N	33.3%

2.5 Disturbance	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	MW	20.0%
Option 5a Full Removal (Reverse Reel)	N	N	MW	20.0%
Option 1a Do Nothing (Minor Intervention)	MS	MS	N	60.0%

2.6 Loss of Habitat	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	s	38%
Option 5a Full Removal (Reverse Reel)	N	N	S	38%
Option 1a Do Nothing (Minor Intervention)	w	w	N	25%

3.1 Technical Feasibility	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MS	w	37.1%
Option 5a Full Removal (Reverse Reel)	MW	N	MW	14.2%
Option 1a Do Nothing (Minor Intervention)	S	MS	N	48.7%



4.1 Fishing	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	w	28.6%
Option 5a Full Removal (Reverse Reel)	N	N	w	28.6%
Option 1a Do Nothing (Minor Intervention)	S	S	N	42.9%

4.2 Communities / Ammenities	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting		5.1 Short-term Costs
Option 6 Full Removal (Cut & Lift)	N	N	w	28.6%		Option 6 Full Removal (Cut & Lift)
Option 5a Full Removal (Reverse Reel)	N	N	w	28.6%	,	Option 5a Full Removal (Reverse Reel)
Option 1a Do Nothing (Minor Intervention)	S	S	N	42.9%		Option 1a Do Nothing (Minor Intervention)

5.2 Long-term Costs	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	S	37.5%
Option 5a Full Removal (Reverse Reel)	N	N	S	37.5%
Option 1a Do Nothing (Minor Intervention)	w	w	N	25.0%



Option 5a Full Removal (Reverse Reel)	Option 1a Do Nothing (Minor Intervention)	Weighting
MW	vмw	7.7%
N	MW	23.1%
MS	N	69.2%

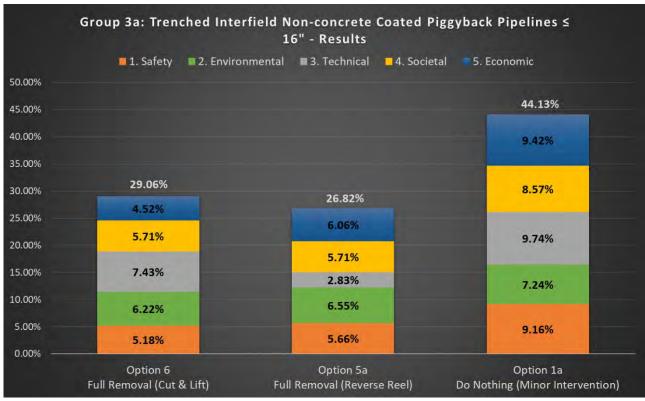
Option 6 Full Removal (Cut & Lift)

Ν

MS

VMS





# Appendix D.3 Group 3a Results Chart



# Appendix D.4 Group 3a Detailed Evaluation Discussion

#### Appendix D.4.1 Safety – Personnel Offshore

The assessment of the options indicated that the Option 1a, leave in-situ with minor intervention to be the most attractive against the Personnel Offshore sub-criterion. This was due to this option having the shortest offshore scope as it involves removing the pipeline ends only.

Option 5a, the full removal by reverse reeling option was assessed as less attractive than the leave in-situ option from a safety risk to offshore personnel perspective. This is due to increased safety risk from the greater offshore work scope associated with reverse reeling operations which requires additional vessels i.e. a Reverse Reel Vessel and a Construction Support Vessel (CSV).

Option 6, the full removal option by cut and lift was considered the least attractive option by some margin due to the much greater safety risk associated with the longer durations to cut the pipelines into short section and recover.

#### Appendix D.4.2 Safety – Personnel Onshore

As with previous assessments, the safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. Option 1a, leave in-situ returns the least material from  $6 \times 10$  m pipeline end sections, making this the most attractive from a safety risk to onshore personnel perspective.

Option 5a and Option 6 both return significantly more material for onshore handling, transportation and processing, than the leave in-situ option as the full 22 km of pipelines are retuned in both cases. As such, the full removal options were assessed as being significantly less attractive than the leave in-situ option.

#### Appendix D.4.3 Safety – Other Users

The impact of performing the decommissioning options on other users of the sea from a safety perspective is related to the duration of operations, the number of vessels involved, and significantly, the number of transits to and from port to the decommissioning site.

The assessment of the decommissioning options against this criterion has indicated that all options have a similar, low impact on the safety of other users. This is justified on the basis that, whilst there is a significantly higher number of vessel days associated with the full removal options, these vessel days are spread over longer durations and thus the safety impact is similar. Additionally, whilst there are more transits associated with the full removal options, the differences in number of transits were not deemed sufficient to express a preference. As such, all three were assessed as equally attractive from a Safety – Other Users perspective.

#### Appendix D.4.4 Safety – High Consequence Events

The assessment indicated that the leave in-situ option would have the least exposure to potential for High Consequence Events and would therefore, be the most attractive against this criterion. This is due to the limited cut and lift operations to recover the pipeline end sections.

Option 5a and Option 6 were assessed as being significantly less attractive than the leave in-situ option due to the potential for High Consequence Events associated with the back of deck handling during the reverse reeling operations in Option 5a and the additional lifting operations associated with the recovery of the 22 km of pipeline in Option 6.



## Appendix D.4.5 Safety – Residual Risk

The residual risk relates to the potential for any safety impact from the decommissioning options. As both Option 5a and Option 6 are full removal options, the residual risk is the lowest for these options and as such, they are equally preferred.

Option 1a was assessed as the least attractive option against this criterion due to the existing pipelines remaining in this option. There are no spans or exposures remaining with this option as they are removed with the pipeline ends. In addition, any partial removal or leave in-situ solution would have any potential hazards along the pipeline risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

# Appendix D.4.6 Safety – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from a safety perspective is Option 1a, with Option 5a and Option 6 being assessed as significantly less attractive.

Option 1a was the most attractive option against the Personnel Offshore, Personnel Onshore criteria due to the lowest risk exposure from the lowest offshore scope and lowest amount of material returned. It was also the most attractive against the High Consequence Events criterion due to limited lifting operations.

Option 1a was equally preferred against the safety impact to other users criterion and, whilst it was not as attractive from a residual risk perspective as the full removal options, the residual risk posed by the left in-situ pipelines was considered minimal as they are fully buried condition.

#### Appendix D.4.7 Environment – Operational Marine Impact

Option 1a, leave in-situ has the lowest impact in terms of marine noise as it has the lowest number of vessel days and the lowest amount of subsea cutting operations. It also has the lowest operational & vessel discharge impact for similar reasons.

Option 5a, Reverse Reel is less attractive than Option 1a as there is a greater impact in terms of marine noise from the increased number of vessels, their increased durations and the MFE de-burial operations. It is also likely to have higher vessel discharges from the increased number of vessels and longer durations.

Option 6, Cut & Lift is the least attractive option due to greater marine noise and vessel discharge impact than Option 5a from the longer durations of vessel operations. In addition, there is an additional environmental impact from the swarf generated by cutting these lines.

It is noted that, whilst there is a preference expressed for Option 1a over Option 5a and Option 6, the Operational Marine Impacts are considered low for all options.

#### Appendix D.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 6 and Option 5a, the full removal options were the equal most attractive options from a legacy marine environmental impact perspective. This is due to the full pipelines being removed and thus eliminating any legacy impact from degradation products or polymer.



Option 1a was the least attractive option due to the degradation products and polymer left in-situ with this option. No distinction was made between the impact of exposed pipeline versus buried or rock covered pipeline.

## Appendix D.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that Option 1a, the leave in-situ option is the most attractive against the fuel use and atmospheric emissions criterion. This is due to this option having the least offshore work scope duration and hence vessel use and durations.

Option 5a has additional fuel use and atmospheric emissions over Option 1a due to the additional offshore work scope associated with reverse reeling the pipelines. Option 6 has additional impact again from the additional offshore scopes to cut and lift the pipelines.

It is noted that, whilst there is a preference expressed for Option 1a over Option 5a and Option 6, the Fuel Use & Atmospheric Emissions impacts are considered low for all options.

#### Appendix D.4.10 Environment – Other Consumptions

All options were assessed as having a similar environmental impact when considering the material returned versus material left in-situ perspective. The options were also considered comparable from a rock consumption perspective. This is due to Option 5a and Option 6 requiring no rock cover and Option 1a only requiring 150 tonnes, insufficient to express a preference from a consumption perspective.

#### Appendix D.4.11 Environment – Seabed Disturbance

The leave in-situ option is assessed as the most attractive decommissioning options here as the seabed impact is limited to the area relating to the sections of pipeline removal at the pipeline ends.

Option 5a ad Option 6 are assessed as significantly less attractive due to the short-term seabed disturbance associated with the de-burial operations using an MFE prior to the pipelines being reverse reeled or cut into sections and recovered.

#### Appendix D.4.12 Environment – Loss of Habitat

Option 5a and Option 6, the full removal options were assessed as being the most attractive options against this criterion as neither option results in a loss of, or material change to the marine habitat as it currently stands.

Option 1a is assessed as the least attractive option as almost whilst there is only a small area (120  $m^2$ ) of habitat affected by the introduction of rock cover to remediate the cut ends of the pipelines, this does present a material change to the habitat where existing sandbank is replaced with a hard substrate.

#### Appendix D.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from an environmental perspective is Option 1a, followed by Option 5a and finally Option 6.

The leave in-situ Option 1a was assessed as being the most attractive or equal most attractive option against four of the six environment sub-criteria. This relates to the limited work scope associated with the leave in-situ and the limited short-term seabed disturbance associated with this option. It



was the least preferred option from a legacy and loss of habitat perspective due to the polymer coatings of these pipelines remaining in-situ, albeit fully trenched and buried, and the small area of altered habitat from the rock cover introduced at the cut pipeline ends.

Option 5a was less preferred due to the higher operational impact from the extended duration operations and the significant seabed disturbance from the de-burial using MFE operations.

Option 6 was less preferred than Option 5a due to the greater impact from the even longer duration associated with cutting the pipelines into sections for recovery.

#### Appendix D.4.14 Technical – Technical Feasibility

Option 1a was assessed as being the most attractive from a Technical Feasibility perspective due to the scope of removing the pipeline end sections and placing spot rock cover being considered routine subsea operations.

Option 6 was the next most attractive option with the technical risks associated with the longer durations to cut the pipelines into short sections and recover them, and successfully performing the de-burial operations to allow the subsea cutting to be performed being the main concerns.

Option 5a was the least attractive option by some margin due to concern surrounding the ability to reverse reel piggybacked lines and concerns around their integrity. The concept maturity was also assessed as being low as reverse reeling of rigid lines of this size is unproven.

Overall, Option 1a is the most attractive from a Technical perspective, followed by Option 6 and then Option 5a.

#### Appendix D.4.15 Societal – Fishing Industry

Prior to discussing the assessment, some context is provided from the Fishing Baseline Characterisation ref. [7]. The fishing activity around these pipelines ranges from very low in the northern extremity of the Mimas pipeline to higher fishing effort towards Tethys TN and Europa EZ. Activity is predominantly conducted by Dutch beam trawlers although potting has been observed around the MN and ND platforms.

Given the above, Option 1a is assessed as being the most attractive option due to it presenting the least disruption and disturbance to the fishing industry from it having the smallest offshore work scope i.e. removing the pipeline ends only.

Option 5a and Option 6 are equally less preferred due to the additional disruption to the fishing industry from the extended offshore operations to fully remove the pipelines. It was noted that, whilst the durations for the cut and lift full removal option (Option 6) are greater than for reverse reel (Option 5a), this was insufficient to express a preference for one option over the other.

#### Appendix D.4.16 Societal – Communities / Amenities

The leave in-situ option is assessed as being the most attractive due to it returning limited quantities of material for processing onshore. Whilst this limits the amount of useful material, such as steel, being returned for recycling, it also results in the least amount of material being returned that will be directed to landfill, such as the polymer coatings of the lines.



Option 5a and Option 6 were assessed as being less attractive than the leave in-situ option due to the amount of polymer (50 tonnes) that would be returned with the fully removed pipelines that would be directed to onshore landfill.

## Appendix D.4.17 Societal – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from a Societal perspective is Option 1a, followed by Option 5a and Option 6.

The leave in-situ Option 1a was assessed as being the most attractive option against both the Fishing Industry and Communities / Amenities criteria.

Option 5a and Option 6 were considered significantly less attractive due to the higher impact on the fishing industry from the greater offshore work scope and the impact from the returned polymer taking up limited onshore landfill capacity.

# Appendix D.4.18 Economic – Short-term Costs

Option 1a was assessed as the most attractive option from a short-term costs perspective. This is due to it being the lowest cost option at approx. £2.4 million.

Option 5a was the next lowest cost at around £10 million, with the least attractive option being Option 6 at £28.6 million.

#### Appendix D.4.19 Economic – Long-term Costs

Option 5a and Option 6 are considered as the equal most attractive options against this criterion. This is due to there being no long-term costs associated with these full removal options.

Option 1a is assessed as less attractive due the long-term costs for surveying, monitoring and FLTC payments. It is noted that these long-term costs are small in comparison to the operation costs.

#### Appendix D.4.20 Economic – Overall

Overall, the assessment is dominated by the short-term costs as the differentials are much greater than for the long-term costs.

Option 1a is the most attractive option from an Economic perspective, followed by Option 5a and finally Option 6.

#### APPENDIX E **GROUP 3B – DETAILED EVALUATION RESULTS**

# **Appendix E.1** Group 3b Attributes Table

### Group 3b: Trenched Interfield Non-concrete Coated Non-piggyback MEOH Pipeline ≤ 16"

- 118 km 4" non-concrete coated methanol pipeline from Theddlethorpe Gas Terminal to LOGGS PP platform with 338 m of exposure (PL0455)

		Full Remo	ption 6 val (Cut & Lift)		Full Remo	Option 5a oval (Reverse Reel)		Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Interver	ntion)	Option 1a Do Nothing (Minimum Intervention)
	- Unbury pipeline with MFE - Cut pipe into 20m sections with hydraulic shears - Bundle cut sections and recover - Backfill trench   Post decommissioning survey   Seabed trawl sweep			<ul> <li>Install recovery ri</li> <li>Reverse reel onto</li> </ul>	<ul> <li>Unbury pipeline with MFE</li> <li>Install recovery rigging for reverse reel</li> <li>Reverse reel onto reel vessel</li> <li>Backfill trench   Post decommissioning survey   Seabed trawl sweep</li> </ul>			eline at LOGGS end hydraulic shears (at LOGGS end) and recover ons into 20 m lengths with hydraulic shears te snag risk at exposed ends g survey   Seabed trawl sweep 8 m) will be removed by cut & lift	<ul> <li>Dredge to uncover pipeline at LOGGS end</li> <li>Out 10m section with hydraulic shears (at LOGG</li> <li>Place rock at exposed ends &amp; over exposed sect</li> <li>Post decommissioning survey   Seabed trawl swe</li> <li>areas of exposure (338 m) will be rock dumped</li> </ul>	ctions	Dredge to uncover pipeline at LOGGS end     Out 10m section with hydraulic shears (at LOGGS end) and recow     Place rock to remediate snag risk at exposed ends (inc. tee locati     Post decommissioning survey   Seabed trawl sweep     areas of exposure will remain
1.1 Personnel Offshore	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 260.5 / 343,820 / 2.58E-02 Divers: 18 / 260.5 / 112,523 / 1.09E-01 Trawler: 5 / 8.0 / 480 / 3.60E-05 Suney Vessel: 44 / 18.0 / 9,478 / 7.11E-04 CSV: 76 / 625.3 / 570,246 / 4.28E-02 Total offshore hours: 1,036,547 hrs Total offshore PLL: 1.78E-01			DSV: 110/4.5/5 Divers: 18/4.5/1 Trawler: 5/8.0/4 Survey Vessel: 44 CSV: 76/107.0/ Reel Vessel: 76/ Total offshore hou	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 4.5 / 5,940 / 4.46E-04 Divers: 18 / 4.5 / 1,944 / 1.89E-03 Trawler: 5 / 8.0 / 480 / 3.60E-05 Survey Vessel: 44 / 18.0 / 9,478 / 7.11E-04 CSV: 76 / 107.0 / 97,602 / 7.32E-03 Reel Vessel: 76 / 63.8 / 58,213 / 4.37E-03 Total offshore hours: 173,657 hrs Total offshore PLL: 1.48E-02			ys / Hours / PLL / 6.63E-04 / 2.81E-03 3.60E-05 0 / 9.478 / 7.11E-04 / 7.0 / 1,675 / 1.26E-04 J.371 hrs JE-03	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 4.7 / 6,164 / 4.62E-04 Divers: 18 / 4.7 / 2,017 / 1.96E-03 Trawier: 5 / 8.0 / 480 / 3.60E-05 Survey Vessel: 44 / 18.0 / 9,478 / 7.11E-04 Rockdump Vessel: 20 / 7.1 / 1,694 / 1.27E-04 Total offshore hours: 19,834 hrs Total offshore PLL: 3.29E-03		Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 4.8 / 6,283 / 4.71E-04 Divers: 18 / 4.8 / 2,056 / 1.99E-03 Trawler: 5 / 8.0 / 480 / 3.60E-05 Survey Vessel: 44 / 18.0 / 9,478 / 7.11E-04 Total offshore hours: 18,297 hrs Total offshore PLL: 3.21E-03
	W		MW MW Dffshore sub-criterion is as follow	W	W	W	N	N	N		
Option 5 is assessed as being Weaker than all other options as the risk     Option 4, Option 2a and Option 1a are assessed as being Neutral to ea     Overall, Option 4, Option 2a and Option 1a are equally preferred     Resource Type: Days / Hours / PLL     Onshore Operations (Cleaning & Disposal): 136.0 / 8,704 / 1.07E-03     Total onshore hours: 8,704 hrs				each other as the risk ex	xposures are la	rgely similar due to the work durations ar			oon pravonnent activity over the reduced length.		
Onshore	Resource Type Onshore Opera Total onshore	be: Days / Hours / PLL arations (Cleaning & Dis	_ · · · · · · · · · · · · · · · · · · ·	Resource Type: D Onshore Operatio Total onshore hou Total onshore PLL	urs: 8,704 hrs	PLL Disposal): 136.0 / 8,704 / 1.07E-03	Resource Type: Days / Onshore Operations (C Total onshore hours: 64 Total onshore PLL: 7.87	leaning & Disposal): 1.0 / 64 / 7.87E-06 4 hrs	Resource Type: Days / Hours / PLL Onshore Operations (Cleaning & Disposal): 1.0 / 6 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06	64 / 7.87E-06	Resource Type: Days / Hours / PLL Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06
Onshore	Resource Type Onshore Opera Total onshore I Total onshore I <b>N</b>	De: Days / Hours / PLL rations (Cleaning & Di hours: 8,704 hrs PLL: 1.07E-03	sposal): 136.0 / 8,704 / 1.07E-0	Onshore Operation Total onshore hou Total onshore PLL	urs: 8,704 hrs		Onshore Operations (C Total onshore hours: 64	leaning & Disposal): 1.0 / 64 / 7.87E-06 4 hrs	Onshore Operations (Cleaning & Disposal): 1.0 / 6 Total onshore hours: 64 hrs	64 / 7.87E-06	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 64 hrs
Onshore	Resource Type Onshore Opera Total onshore I Total onshore I N The assessme Option 6 is ass to 338 m of pig Option 5 is ass Option 4, Optio Overall, Optio Vessel Days:	be: Days / Hours / PLL rations (Cleaning & Di e hours: 8,704 hrs e PLL: 1.07E-03 MW N nent of the Personnel C sessessed as being Neu ipeline in Option 4 and assessed as being Muc tion 2a and Option 1a a ion 4, Option 2a and	sposal): 136.0 / 8,704 / 1.07E-03 MW MW Dnshore sub-criterion is as follow tral to Option 5 as the risk expos 10 m of pipeline in Option 2a ar th Weaker than Option 4, Option	Onshore Operation Total onshore hou Total onshore PLL MW s: ure is the same due to the d Option 1a. 2a and Option 1a as the risk ex ed from a risk to Onsho Vessel Days:	ns (Cleaning & urs: 8,704 hrs L: 1.07E-03 MW ne same quantit risk exposure for xposure associa	Disposal): 136.0 / 8,704 / 1.07E-03 MW y of material being returned to shore for p or onshore personnel is 135 times higher ated with handling 338 m or 10 m of pipel	Onshore Operations (C Total onshore hours: 64 Total onshore PLL: 7.87 N processing. Option 6 is as for Option 5 due to the full line in these options is con Vessel Days:	leaning & Disposal): 1.0 / 64 / 7.87E-06 I hrs 7E-06 N sessed as being Much Weaker than all other opti pipeline length of 118 km being recovered to sho	Onshore Operations (Cleaning & Disposal): 1.0 / 6 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06 N ions as the risk exposure for onshore personnel is 135 re compared to 338 m of pipeline in Option 4 and 10 m Vessel Days:	5 times higher for Option 6 n of pipeline in Option 2a a	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06 6 due to the full pipeline length of 118 km being recovered to shore co and Option 1a.
Other Users	Resource Type Onshore Opera Total onshore i Total onshore i N The assessme Option 6 is ass to 338 m of pip Option 5 is ass Option 4, Optio Overall, Optio	ee: Days / Hours / PLL rations (Cleaning & Di- e hours: 8,704 hrs e PLL: 1.07E-03 MW N eent of the Personnel C ssessed as being Neu ipeline in Option 4 and ssessed as being Muc tion 2a and Option 1a a ion 4, Option 2a and	sposal): 136.0 / 8,704 / 1.07E-03 MW MW Dishore sub-criterion is as follow tral to Option 5 as the risk expos 4 10 m of pipeline in Option 2a ar h Weaker than Option 4. Option are assessed as being Neutral to	Onshore Operation Total onshore hou Total onshore PLL MW s: ure is the same due to the d Option 1a. 2a and Option 1a as the risk ex each other as the risk ex ed from a risk to Onsho	Cleaning &     Ins (Cleaning &     Ins (C	Disposal): 136.0 / 8,704 / 1.07E-03 MW y of material being returned to shore for p or onshore personnel is 135 times higher ated with handling 338 m or 10 m of pipel	Onshore Operations (C Total onshore hours: 64 Total onshore PLL: 7.87 N processing. Option 6 is as for Option 5 due to the full line in these options is con	leaning & Disposal): 1.0 / 64 / 7.87E-06 I hrs 7E-06 Sessed as being Much Weaker than all other opti pipeline length of 118 km being recovered to sho sidered largely similar.	Onshore Operations (Cleaning & Disposal): 1.0 / 6 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06 N ions as the risk exposure for onshore personnel is 135 re compared to 338 m of pipeline in Option 4 and 10 m	5 times higher for Option 6 n of pipeline in Option 2a a	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06 6 due to the full pipeline length of 118 km being recovered to shore ca and Option 1a. Vessel Days: DSV: 4.8 Divers: 4.8 Trawler: 8.0 Survey Vessel: 18.0 Total vessel days: 30.7 days
1.3 Other Users Onshore	Resource Type Onshore Opera Total onshore I Total onshore I N The assessme Option 6 is ass Option 6 is ass Option 4, Optio Overall, Optio Versel Days: DSV: 260.5 Divers: 260.5 Divers: 260.5 Divers: 260.5 Survey Vessel CSV: 625.3 Total vessel da	ee: Days / Hours / PLL rations (Cleaning & Di- e hours: 8,704 hrs e PLL: 1.07E-03 MW N eent of the Personnel C ssessed as being Neu ipeline in Option 4 and ssessed as being Muc tion 2a and Option 1a a ion 4, Option 2a and	sposal): 136.0 / 8,704 / 1.07E-03 MW MW Dishore sub-criterion is as follow tral to Option 5 as the risk expos 4 10 m of pipeline in Option 2a ar h Weaker than Option 4. Option are assessed as being Neutral to	Onshore Operation Total onshore hou Total onshore PLL <b>MW</b> a: ure is the same due to the d Option 1a. 2a and Option 1a as the r each other as the risk ex- ed from a risk to Onsho Vessel Days: DSV: 4.5 Divers: 4.5 Trawler: 8.0 Survey Vessel: 18 CSV: 107.0	Cleaning &     urs: 8,704 hrs     L: 1.07E-03      MW     re same quantit     risk exposure for     xposure associa     re Personnel      8.0     3     : 201.3 days	Disposal): 136.0 / 8,704 / 1.07E-03 MW y of material being returned to shore for p or onshore personnel is 135 times higher ated with handling 338 m or 10 m of pipel	Onshore Operations (C Total onshore hours: 64 Total onshore PLL: 7.87 N processing. Option 6 is as for Option 5 due to the full line in these options is con Vessel Days: DSV: 6.7 Divers: 6.7 Trawler: 8.0 Survey Vessel: 18.0	leaning & Disposal): 1.0 / 64 / 7.87E-06 I hrs 7E-06 N sessed as being Much Weaker than all other opti pipeline length of 118 km being recovered to sho sidered largely similar.	Onshore Operations (Cleaning & Disposal): 1.0 / 6 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06 N ions as the risk exposure for onshore personnel is 135 re compared to 338 m of pipeline in Option 4 and 10 m Vessel Days: DSV: 4.7 Divers: 4.7 Trawler: 8.0 Survey Vessel: 18.0	5 times higher for Option 6 n of pipeline in Option 2a a	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06 6 due to the full pipeline length of 118 km being recovered to shore co and Option 1a. Vessel Days: DSV: 4.8 Divers: 4.8 Trawler: 8.0 Survey Vessel: 18.0

NOTE: Pipeline Numbers in Appendix with a "0" after the "PL" are equivalent to those in the main body of the document with the same numbering but that do not contain the "0" in front of the "PL". The Main body of the text utilises the correct reference for the pipeline number.



	Option 6				tion 5a			Option 4			on 2a	
	Full Removal (Cut & Lift) - Unbury pipeline with MFE - Cut pipe into 20m sections with hydraulic shears Rundle art acating and recent		- Unbury pipeline wi - Install recovery rig	ith MFE Iging for reverse re	I (Reverse Reel) eel		<ul> <li>Dredge to uncover pi</li> <li>Cut 10m section with</li> </ul>	Partial Removal (Cut & ipeline at LOGGS end h hydraulic shears (at LOC ipenetic 20 m (anothe ut)	GGS end) and recover	Leave In-situ (Mi - Dredge to uncover pipeline at LOGG - Cut 10m section with hydraulic sheat Diago creft of expressed and a site	S end ars (at LOGGS end) and recover	- Dredge to u - Cut 10m se - Place rock
	Bundle cut sections and recover     Backfill trench   Post decommissioning survey   Seabe	ed trawl sweep	- Reverse reel onto - Backfill trench   Po		oning survey   Seab	ed trawl sweep	<ul> <li>Place rock to remedi</li> <li>Post decommissioni</li> </ul>	tions into 20 m lengths wi iate snag risk at exposed ing survey   Seabed trawl i38 m) will be removed by	ends sweep	<ul> <li>Place rock at exposed ends &amp; over a - Post decommissioning survey   Seal - areas of exposure (338 m) will be room         <ul> <li>Areas of exposure (338 m)</li> <li>Areas of exposure (338 m)</li> </ul> </li> </ul>	bed trawl sweep	<ul> <li>Place rock</li> <li>Post decond</li> <li>areas of ex</li> </ul>
1. Safety 1.4 High Consequence Events	The potential for High Consequence Events is assessed this option. This is based on the number of both cutting operations that would need to take place to fully remove It should be noted that there are number of pipeline cros group and it has been assumed that all 3rd party pipelin hydrocarbon live.	and lifting e the pipeline. ssings within this	option. This relates to the on-deck cutting (for pipeline that is longer than reel capacity), lifting (for pipeline recovery for reeling) and integrity (whilst reverse reeling). s Number of Lifts: 2				option. This is based of	Consequence Events is a on the number of both cut ce place to remove the pip	ting and lifting operations	The potential for High Consequence E option. This is based on the number of that would need to take place to the p Number of Lifts: 1	f both cutting and lifting operations	The potentia option. This that would n Number of Li
	N W W W		W	W	W		N	N		N		
1. Safety 1.5 Residual Risk	onboarding the bundled, cut sections of pipeline which p Option 5 is assessed as being Weaker than Option 4, C Option 4, Option 2a and Option 1a are assessed as bei <b>Overall, Option 4, Option 2a and Option 1a are equ</b> As the pipeline would be fully removed from the seabed, legacy risk associated with this full removal option.	Option 2a and Option og Neutral to each ally preferred fro	on 1a as there is pote other as the potentia <b>m a High Conseque</b>	ential for a High C al for High Conseq ence Events per	Consequence Event quence Events is c rspective. ed from the seabed	t from the deck hand onsidered similar for	Ing during reverse reel of these options due to lin The majority of the 111 an appropriate depth. removed with the pote decommissioning traw As such, the potential adequately mitigated a exposure. The survey & monitorin	8 km methanol 4" pipeline There is 338 m of expos- ntial snag hazard associa vi sweep will be conducted I snag hazard post-decom and lower than for the pipe ng programme is committ from left in-situ infrastruct	potential from the limited lif each option. It is trenched and buried to ed pipeline which will be ted with the cut ends be overtrawlable. A post- d. missioning activities is aline in its current state of ed to ensuring that the	The majority of the 118 km methanol an appropriate depth. There is 338 m rock dumped to mitigate the potential exposed areas. The areas of rock pla overtrawlable and a post-decommission As such, the potential snag hazard pot adequately mitigated and lower than f exposure. The survey & monitoring programme i potential snag hazard from left in-situ managed & mitigated as appropriate.	4* pipeline is trenched and buried to of exposed pipeline which will be snag hazard associated with these icement will be designed to be oning trawl sweep will be conducted. ost-decommissioning activities is or the pipeline in its current state of s committed to ensuring that the	The majority an appropria in its current The survey & potential sna managed &
Summa	N         S         MS           The assessment of the Residual Risk sub-criterion is as Option 6 is assessed as being Neutral to Option 5 as the mitigated by rock placement. Option 6 is assessed as Option 5 is assessed as being Stronger than both Option associated with the full removal option versus potential 1 Option 4 is assessed as being Neutral to Option 2a as to to identify and manage emerging hazards). Option 2a is assessed as being Stronger than Option 1: Overall, Option 6 and Option 5 are equally preferred	s follows: here is no residual r Much Stronger tha on 4 and Option 2a for a snag hazard ir the residual risk is a due to the remair	n Option 1a as there due to there being no o Option 1a, which, w similar due to the pot ing potential for a sna	is no residual ris o residual risk ass hilst no higher th tential snag haza ag hazard to eme	k associated with sociated with the fi an it is currently, t and being mitigated	the full removal option ull removal option ver he potential snag ha by rock dump in bot	n versus potential for a snag sus potential for a snag zard is not further mitiga h cases. Option 4 is as	snag hazard in Option 1a hazard from pipeline exp ated in this option. It is h ssessed as being Stronge	Note: existing potential fo osure in Option 4 and Optio owever, monitored to ensure r than Option 1a due to the	r snag hazard in Option 1a will be moni n 2a, albeit these potential snag hazard e it does not increase. remaining potential for a snag hazard t	tored to ensure that any emerging risk ds are mitigated by rock. Option 6 is	ks are manage assessed as
_	Vessel Noise (days on-site):		Vessel Noise (days	s on-site):			Vessel Noise (days or			Vessel Noise (days on-site):		Vessel Noise
l Impact	Survey Vessel - 10 days   CSV - 614 days   DSV - 249 days Tooling Noise: MFE for Unburial - 49.33 days   Hydraulic Shears - 247		Survey Vessel - 10 60 days   Trawler - 5 Tooling Noise: MFE for Unburial - 4	5 days			Trawler - 5 days Tooling Noise:	ys   DSV - 2.7 days   Roo   Hydraulic Shears - 0.17		Survey Vessel - 10 days   DSV - 0.67 Trawler - 5 days Tooling Noise: Dredging - 0.25 days   Hydraulic Shea days		Survey Vess Tooling Nois Dredging - 0
2. Environmental 2.1 Operational Marine I	Operational Discharges: Negligible potential for hydrocarbon releases through cu because the pipeline has been cleaned successfully. F would therefore be within acceptable limits and included permits. No cutting swarf as cutting performed by hydra Vessel Discharges: This includes Ballast, Grey and Black Water, this is driv	Planned discharges d in operational aulic shears. ven by duration of	Operation Discharg Negligible potential because the pipelin would therefore be v permits. No cutting shears. Vessel Discharges:	for hydrocarbon r ne has been clean within acceptable g swarf as (limited	ned successfully. I limits and include d) cutting performed	Planned discharges d in operational d by hydraulic	Operation Discharges: Negligible potential for because the pipeline f would therefore be with permits. No cutting so shears.	r hydrocarbon releases th	sfully. Planned discharges included in operational	Operation Discharges: Negligible potential for hydrocarbon re because the pipeline has been cleane would therefore be within acceptable I permits. No cutting swarf as (limited) shears.	ed successfully. Planned discharges imits and included in operational	Operation D Negligible po because the would theref permits No shears .
		greater than for all other options. vessel operations and therefore will be less for this option than Option 6 vessel operations and therefore will				This includes Ballast, Grey and Black vessel operations and therefore will be and Option 5 but similar for all other o	e less for this option than Option 6	This include vessel opera and Option {				
	W MW MW MW The assessment of the Operational Marine Impact sub-		W	W	W		N	N		N		
Summa	Option 6 is assessed as being Weaker than Option 5 d	ue to the vessel dis Option 2a and Optio ch other as marine	charges associated on 1a due to a the greating the second se	eater vessel disch otions are largely	harges from the lon similar.				options due to a combination	on of the greater vessel discharges from	the much longer durations and the n	oise from the u



Option 1a Do Nothing (Minimum Inter uncover pipeline at LOGGS end ection with hydraulic shears (at LOGGS end) and recover t to remediate snag risk at exposed ends (inc. tee locations) mmissioning survey | Seabed trawl sweep posure will remain al for High Consequence Events is assessed as Low for this is based on the number of both cutting and lifting operations eed to take place to the pipeline ends only. .ifts: 1 other options as there is a high number of lifting operations for y of the 118 km methanol 4" pipeline is trenched and buried to ate depth. There is 338 m of exposed pipeline which will remain t state with no reportable spans. & monitoring programme is committed to ensuring that the ag hazard from left in-situ infrastructure continues to be mitigated as appropriate. Option 4 and Option 2a, albeit these potential snag hazards are led as appropriate. Much Stronger than Option 1a as there is no residual risk lbeit this option includes an appropriate monitoring programme se (days on-site): sel - 10 days | DSV - 0.75 day | Trawler - 5 days .25 days | Hydraulic Shears - 0.17 days Discharges: solential for hydrocarbon releases through cutting operations e pipeline has been cleaned successfully. Planned discharges fore be within acceptable limits and included in operational lo cutting swarf as (limited) cutting performed by hydraulic charges: Is Ballast, Grey and Black Water, this is driven by duration of ations and therefore will be less for this option than Option 6 5 but similar for all other options. unburial operations.

	Option 6 Full Removal (Cut & Lift)						Optic Full Removal				Option 4 Partial Removal (Cut &	Lift)		ion 2a linor Intervention)		
		- Bundle cut s		vith hydraulic s over	hears	rawl sweep	- Reverse reel onto	with MFE igging for reverse ree	el	d trawl sweep	<ul> <li>Dredge to uncover pij</li> <li>Cut 10m section with</li> <li>Cut all exposed sect</li> <li>Place rock to remedii</li> <li>Post decommissionii</li> </ul>	peline at LOGGS end h ydraulic shears (at LOG ions into 20 m lengths with ate snag risk at exposed ng survey   Seabed trawl s 38 m) will be removed by o	GS end) and recover h hydraulic shears ends weep	Dredge to uncover pipeline at LOG(     Cut 10m section with hydraulic she     Place rock at exposed ends & over     Post decommissioning survey   Se     areas of exposure (338 m) will be n	GS end ears (at LOGGS end) and recover exposed sections abed trawl sweep	<ul> <li>Dredge to u</li> <li>Cut 10m se</li> <li>Place rock t</li> <li>Post decom</li> <li>areas of exp</li> </ul>
2. Environmental	There will be no legacy marine impacts from this full removal option.					al option.	There will be no legacy marine impacts from this full removal option.				appropriate depth. The removed with the cut eff The legacy marine imp remaining trenched an coating. Given the buried status	8 km pipeline is trenched a ere is 338 m of exposed p ends rock dumped. Doacts relate to the left in-si d buried 4* diameter steel s of the material being left o a regulatory acceptable i	ipeline which will be tu materials, i.e. the pipeline with a polymer in-situ and the pipeline	The majority of the 118 km pipeline i appropriate depth. There is 338 m o dumped. The legacy marine impacts relate to remaining trenched and buried 4" dia coating. Given the buried status of the materi having been cleaned to a regulatory i	f exposed pipeline which will be rock the left in-situ materials, i.e. the meter steel pipeline with a polymer al being left in-situ and the pipeline	The majority of depth. There The legacy m remaining tree coating. Given the bur having been of impact is con
	N	N S S S					S	S	S		impact is considered l	ow but greater than the ful	I removal option.	impact is considered low but greater	than the full removal option.	
	2.3 ruei Use ه Atmospheric Emissions	Option 5 is as All other option <b>Overall, Optio</b> Vessel Emissi	sessed as being ns are assessed on 5 and Optic ions (in tonnes)	g Stronger than d as Neutral to <b>n 6 are equa</b>	Option 4, Opt each other as	tion 2a and Opti the quantities a	on 1a as this full re	al and thus the legac propective. (in tonnes):	es all material whils		s leave similar quantities to be similar for these op Vessel Emissions (in Fuel: 1,191 CO2e: 3,902 NOX: 70.72 SO2: 4.76 Vessel Energy Use: 5	tonnes):	itu.	Vessel Emissions (in tonnes): Fuel: 1,153 CO2e: 3,779 NOX: 68.49 SO2: 4.61 Vessel Energy Use: 49,580 GJ		Vessel Emiss Fuel: 1,070 CO2e: 3,506 NOx: 63.54 SO2: 4.28 Vessel Energ
		w	MW	MW	MW		W	W	w		N	N		N		
Su	mmary	Option 6 is as options where Option 5 is as All other option	sessed as Wea there is signific sessed as Wea ns are assessed	ker than Optio antly lower ves ker than Optio d as Neutral to	n 5 as the fuel sel usage. n 4, Option 2a each other as	and Option 1a a the fuel used a	missions generated as the fuel used and nd emissions gener	-	erated for this optio these options.		-			d emissions generated by the vessels of the full pipeline length compared to the		
2. Environmental	2.4 Other Consumptions	Material Emiss Recovered Ma Remaining Ma Total: 4,052		onnes):			Material Emission Recovered Materia Remaining Materia Total: 4,052				Material Emissions (C Recovered Material: 12 Remaining Material: 7, Total: 7,591	2		Material Emissions (CO2 in tonnes): Recovered Material: 1 Remaining Material: 7,600 Total: 7,601		Material Emis Recovered Ma Remaining Ma Total: 7,601
2. Envi	2.4 Const	Rock: N/A					Rock: N/A				Rock: 1,400 tonnes			Rock: 3,430 tonnes		Rock: 25 ton
		N	S	S	N		S	S	N		N	W		W		
Su	mmary	Option 6 is as: a small amour were driven by Option 5 is as: Option 4 is as: Option 2a is as	nt of rock require the quantity of sessed as being sessed as being ssessed as being	g Neutral to Op ed in Option 1a rock consump g Stronger than g Neutral to Op ng Weaker tha	otion 5 as the in , this was insu- tion for each op n Option 4 and otion 2a as whil n Option 1a as	mpact in terms ufficient to expre ption. Option 2a as th Ist there are diffe there is much is	ss a preference fror ere is no requireme erences between th more rock required	m a consumption pe ent for rock in Option le quantity of rock co	n 5 versus a requirer onsumed between t	ne differences betw ment for rock in O	veen the options in tonna ption 4 and Option 2a.	ige of CO2 associated with Option 5 is assessed as b	n processing returned mat	ck in Option 6 versus a requirement for erial and / or to produce replacement n as whilst there is a small amount of roc isessed as being Weaker than Option	naterial left in-situ were considered ins sk required in Option 1a, this was insu	significant in terr ufficient to expre
2. Environmental	Short Term Disturbance (MFE): 590,220 m2 Full pipeline to be unburied using MFE.							bance (MFE): 590,2 unburied using MFE				along this line and rock d		There is limited short-term disturban s exposed pipeline for this option.	ce from rock dumping the 338 m of	There is limite rock placed o
		N	MW	MW	MW		MW	MW	MW		N	N		N		
Su	N         M VV         M VV         M VV           The assessment of the Seabed Disturbance (short-term impact) sub- Option 6 is assessed as being Neutral to Option 5 as the disturbance disturbance with the other options.         Summary           Summary         Option 5 is also assessed as being Much Weaker than Option 4, Opti Option 4, Option 2a and Option 1a are all assessed as being Neutral Overall, Option 4, Option 2a and Option 1a are equally preferre					listurbance caus otion 4, Option 2 ng Neutral to ea	on is as follows: sed by the unburial a and Option 1a du ch other as the sea	of this line is the sa e to the large area o abed disturbance is o	me for both full rem of seabed disturband considered negligibl	ce from the unburi	ion 6 is assessed as bei al of the 118 km of pipeli	ing Much Weaker than all		-		sing a Mass Flo



Option 1a Do Nothing (Minimum Intervention)
Incover pipeline at LOGGS end ction with hydraulic shears (at LOGGS end) and recover to remediate snag risk at exposed ends (inc. tee locations) missioning survey   Seabed trawl sweep posure will remain
of the 118 km pipeline is trenched and buried to an appropriate a is 338 m of exposed pipeline which will be left as-is.
narine impacts relate to the left in-situ materials, i.e. the enched and buried 4" diameter steel pipeline with a polymer
ried status of the material being left in-situ and the pipeline cleaned to a regulatory acceptable level, the legacy marine nsidered low but greater than the full removal option.
-situ. Whilst the legacy environmental impact is expected to
sions (in tonnes):
gy Use: 45,998 GJ
peline for this option are much higher than for the other
ge to remediate minimal pipeline lengths.
ssions (CO2 in tonnes): laterial: 1 laterial: 7,600
nes
is assessed as being Neutral to Option 1a as whilst there is ms of this assessment. As such, the preference judgements
ess a preference from a consumption perspective. rock versus a very small amount of rock.
ed short-term disturbance for this option from the small area of on pipeline ends only.
ow Excavator when compared to the small area of low impact

	Option 6 Full Removal (Cut & Lift)						ion 5a		Option 4 Partial Removal (Cut & Lift)				tion 2a			
		- Unbury pipeli		Removal (Cut	& Lift)		- Unbury pipelin		(Reverse Reel)		- Dredge to uncover pip		Lift)	Leave In-situ (I - Dredge to uncover pipeline at LOG	Minor Intervention)	- Dredge to ur
			20m sections	with hvdraulic	shears			/ rigging for reverse re	el			hydraulic shears (at LOG	GS end) and recover	- Cut 10m section with hydraulic sh		- Cut 10m set
			ections and rec				- Reverse reel o					ons into 20 m lengths with		- Place rock at exposed ends & ove		- Place rock t
		- Backfill trenc	h   Post decom	nmissioning su	rvey   Seabed tr	rawl sweep	- Backfill trench	Post decommission	ning survey   Seab	ed trawl sweep		te snag risk at exposed e		- Post decommissioning survey   Se		- Post decom
												g survey   Seabed trawl sv 8 m) will be removed by c		- areas of exposure (338 m) will be	rock dumped	- areas of exp
-		Habitat Loss (	Rockdump): N/	A			Habitat Loss (R	ockdump): N/A			Habitat Loss (Rockdum	מו): 1,120 m2		Habitat Loss (Rockdump): 3,420 m2	2	Habitat Loss
2. Environmental	2.6 Loss of Habitat															
		N S S S					S	S	S		S	W		W		
							terion is as follow abitat associated		ull removal options.	Option 6 is assess	sed as being Stronger that	an all other options as the	rock placement in each	of these options changes the current s	eabed habitat and thus results in an a	rea of habitat los
		Option 5 is as	sessed as bei	ng Stronger tha	an all other option	ons as the rock	dump in each of	these options change	es the current seat	bed habitat and thus	results in an area of hab	itat loss whereas there is	no habitat loss in Option	5.		
s	ummary							a 2a is greater than O n 2a is much greater		s assessed as bein	g Weaker than Option 1a	a as area of habitat loss in	Option 1a is much smal	ler than Option 4.		
							ard substrate (ro		than Option Ta.							
							Habitat perspec									
					shears for pipel	ines of this		ity: Whilst reverse re	<b>U</b> 1			tting using hydraulic shea	rs for pipelines of this	Concept Maturity: All operations to	o deliver this option are considered	Concept Mat
ल	v al	diameter is co	nsidered routin	e. (Score 3)			pipelines. (Scor		proven technical s	olution for rigid steel	diameter is considered	routine. (Score 3)		routine. (Score 3)		routine. (Scor
Technical	3.1 Technical Feasibility			,	eving full remov	,						ed technical risks from cu	5		risks due to the limited cutting require	
Tec	Tec				g durations invo ticularly in the r						pipeline sections as the therefore no unburial ris	e areas being cut and rem	oved are already expose	and short duration of work scopes.	(Score 3)	and short dur
÷	3.1	zone. (Score		na ioouco, pui	lioularly in the i		challenges associated with having to load the recovered line onto multiple									
							reels due to len	gth. (Score 1)								
		MS	W	W	W		MW	MW	MW		N	N		N		
s	ummary	Option 6 is as to perform the Option 5 is as Option 4, Optio	sessed as bein cutting operations sessed as bein on 2a and Option	g Much Strong ons in Option 6 g Much Weake on 1a are asse	and the techni er than Option 4 ssed as being I	5 due to reversi ical risk associa 4, Option 2a an Neutral to each	ated with the dura d Option 1a due t other as the cond	tion of the operations	, versus simple an the reverse reeling	d routine operations of steel pipelines ar	for the other options. Ind the associated technic	rity and loading recovered al risks versus simple and	-		being Weaker than all other options d	ue to potential t
4. Societal	4.1 Fishing	removing the p current fishing	operations. Fi hich would be	s (displacemen shing operatior curbed due to i	e operational im t and restricted ns are conducte nterference of tr	access) ed in the area o	the pipeline dist f operations. Fis	urbs (displacement a hing operations are c curbed due to interfe	nd restricted acce onducted in the are	ss) current fishing ea of this pipeline		in localised areas. Left in e. Fishing operations are			areas. Left in-situ infrastructure may perations are conducted in the area of	Short term dis lead to snagg this pipeline.
		N	MW	MW	MW		MW	MW	MW		N	N		N		
		The assessme Option 6 is as	ent of the Socie sessed as bein	etal impact on F ig Neutral to Op	ishing sub-crite	mpact on the fis	ws: shing industry bot	h in performing the re	moval and post-rer		these full removal options				due to the additional disruption caused	d to fishing opera
S	ummary	Option 5 is as	sessed as bein	g Much Weak	er than Option 4	4, Option 2a an	d Option 1a due t	o the additional disru	ption caused to fisl	hing operations, part	ticularly to near-shore fish	ning operations (creel pote		the full pipeline length compared to th	e limited remediation required for Option	on 4, Option 2a
									338 m of exposure	removal, rock place	ment or just line end rem	oval is similar.				
		Overall, Optio	on la istne m	ost preterred	from a Societ	al impact on r	ishing perspect	ive.								
	~	Materials Retu	imed:				Materials Return	ned:			Materials Returned:			Materials Returned:		Materials Ret
	s	Steel: 4,024 to	( )	ole)				ines (recyclable)			Steel: 12 tonnes (recyc	,		Steel: 1 tonnes (recyclable)		Steel: 1 tonne
4. Societal	: Communit Ammenitie:	Polymer: 31 to	onnes (landfill)				Polymer: 31 tor	ines (landfill)			Polymer: 1 tonnes (land	dfill)				
Soc	mme	Whilst there a	re some societ	al benefits from	n returning recy	clable steel,	Whilst there are	some societal bene	fits from returning r	ecyclable steel, this	There are minimal soci	etal benefits / impacts wit	h this option due to the	There are minimal societal benefits	/ impacts with this option due to the	There are mir
4,	2 CC	this is offset by (Score 2)	y returning poly	mer which will	take up landfill	capacity.	is offset by retu	ming polymer which w	will take up landfill	capacity. (Score 2)	minimal onshore return	s & disposal. (Score 3)		minimal onshore returns & disposal	. (Score 3)	minimal onsh
	4.2	(30016 2)														
		N	W	W	W		W	W	W		N	N		N		
					Other Users sub options is dom			rom material returned	as the nocitive im	nacts such as room	clable material or any iot	creation / retention offer	d by an ontion is consid	ered less significant than negative impa	acts such as using landfill canacity	
												lue to the quantity of mate			aoto odon do uonny idriunni capacilly.	
S	ummary				o Option 4, Opti	on 2a and Opti	on 1a due to the I	arger quantity of mate	erial being returned	that will be directed	to landfill	-	-			
Summary Option 5 is assessed as being Weaker than Option 4, Option 2a and Option 1a due to the larger quantity of material being returned that will be directed to landfill. Option 4, Option 2a and Option 1a are quastered as being Neutral to each other as the positive and negative societal benefits are largely similar. Overall, Option 4, Option 2a and Option 1a are equally preferred from a Societal impact on Other Users perspective.																



Option 1a Do Nothing (Minimum Intervention)
uncover pipeline at LOGGS end ection with hydraulic shears (at LOGGS end) and recover to remediate snag risk at exposed ends (inc. tee locations) mmissioning survey   Seabed trawl sweep cposure will remain
s (Rockdump): 40 m2
oss whereas there is no habitat loss in Option 6.
aturity: All operations to deliver this option are considered
ore 3)
Risks: Limited technical risks due to the limited cutting required aration of work scopes. (Score 3)
technical risks for achieving unburial of the full pipeline length
listurbance in localised areas. Left in-situ infrastructure may
is unbance in localised areas. Left in slid infrastructure may ging in time. Fishing operations are conducted in the area of . (Score 2)
erations, particularly to near-shore fishing operations where a and Option 1a.
eturned:
nes (recyclable)
inimal societal benefits / impacts with this option due to the hore returns & disposal. (Score 3)

	Option 6 Full Removal (Cut & Lift)						ion 5a I (Reverse Reel)		F	Option 4 Partial Removal (Cut &	Lift)		on 2a inor Intervention)		
	- Unixernovar (cur & Lin) - Unbury pipeline with MFE - Cut pipe into 20m sections with hydraulic shears - Bundle cut sections and recover - Backfill trench   Post decommissioning survey   Seabed trawl sweep				awl sweep	- Reverse reel ont	igging for reverse re o reel vessel	eel ning survey   Seabe	d trawl sweep	<ul> <li>Cut all exposed section</li> <li>Place rock to remedian</li> <li>Post decommissioning</li> </ul>	eline at LOGGS end hydraulic shears (at LOG ins into 20 m lengths with te snag risk at exposed e g survey   Seabed trawl s 8 m) will be removed by c	n hydraulic shears ends weep	Dredge to uncover pipeline at LOGG Cut 10m section with hydraulic she Place rock at exposed ends & over Post decommissioning survey   See areas of exposure (338 m) will be ro	- Dredge to u - Cut 10m se - Place rock - Post decon - areas of ex	
5. Economic 5.1 Short-term Costs	£131.505 Milli	on				£28.351 Million				£2.849 Million			£2.441 Million		£2.328 Millio
	MW	VMW	VMW	VMW		MW	MW	MW		N	N		N		
Summa	Option 6 is as Option 5 is as Option 4, Opti	sessed as beir sessed as beir ion 2a, Option 2	ng Much Weake Ia are assessed	er than Option 5 er than Option 4 d as being Neut	as the costs , Option 2a an ral to each oth	are almost five times d Option 1a as the er as the costs are om a Short-term C	costs are around 10 around the same.		ng Very Much We	aker than the other options	as the costs are around	50 times higher.			
<u>e</u>	Surveys: N/A					Surveys: N/A				Surveys: £0.538 Million			Surveys: £0.538 Million		Surveys: £0.
5. Economic 5.2 Long-term Costs	FLTC: N/A Total Legacy Cost: £0 Million			FLTC: N/A Total Legacy Cost: £0 Million				FLTC: N/A Total Legacy Cost: £0.538 Million			FLTC: N/A Total Legacy Cost: £0.538 Million		FLTC: £0.355		
	N	S	S	S		S	S	S		N	N		N		
Summa	The assessment of the Long-term Costs sub-criterion is as follows: Option 6 is assessed as being Neutral to Option 5 as there are no legad Option 5 is assessed as being Stronger than Option 4 Option 3 and C				are no legacy on 2a and Opt er as the long-	ion 1a there are no term costs are large	legacy / long-term ely similar.					ere are no legacy / long-te	erm costs associated with this option ve	rsus similar long-term costs for all c	other options.



# Option 1a Do Nothing (Minimum Intervention) ge to uncover pipeline at LOGGS end Om section with hydraulic shears (at LOGGS end) and recover rock to remediate snag risk at exposed ends (inc. tee locations) decommissioning survey | Seabed trawl sweep of exposure will remain Villion Villion 3.538 Million 3.55 Million 2y Cost: £0.893 Million



1.1 Personnel Offshore	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	MW	MW	MW	9.1%
Option 5a Full Removal (Reverse Reel)	S	N	w	w	w	14.0%
Option 4 Partial Removal (Cut & Lift)	MS	S	N	N	N	25.6%
Option 2a Leave In-situ (Minor Intervention)	MS	S	N	N	N	25.6%
Option 1a Do Nothing (Minimum Intervention)	MS	s	N	N	N	25.6%

1.2 Personnel Onshore	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	мw	мw	MW	9.1%
Option 5a Full Removal (Reverse Reel)	N	N	мw	MW	мw	9.1%
Option 4 Partial Removal (Cut & Lift)	MS	MS	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	MS	MS	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	MS	MS	N	N	N	27.3%

1.3 Other Users	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	w	14.3%
Option 5a Full Removal (Reverse Reel)	S	N	N	N	N	21.4%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	N	21.4%
Option 2a Leave In-situ (Minor Intervention)	s	N	N	N	N	21.4%
Option 1a Do Nothing (Minimum Intervention)	s	N	N	N	N	21.4%

2.1 Operational Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	MW	MW	MW	8.9%
Option 5a Full Removal (Reverse Reel)	S	N	w	w	w	15.8%
Option 4 Partial Removal (Cut & Lift)	MS	S	N	N	N	25.1%
Option 2a Leave In-situ (Minor Intervention)	MS	S	N	N	N	25.1%
Option 1a Do Nothing (Minimum Intervention)	MS	S	N	N	N	25.1%

1.4 High Consequence Events	Option 6 Full Removal (Cut & Lift	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Li	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	w	w	w	15.4%
Option 5a Full Removal (Reverse Reel)	N	N	w	w	w	15.4%
Option 4 Partial Removal (Cut & Lift)	S	s	N	N	N	23.1%
Option 2a Leave In-situ (Minor Intervention)	s	s	N	N	N	23.1%
Option 1a Do Nothing (Minimum Intervention)	S	S	N	N	N	23.1%

Ĵ

1.5 Residual Risk	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	S	S	MS	27.5%
Option 5a Full Removal (Reverse Reel)	N	N	s	s	MS	27.5%
Option 4 Partial Removal (Cut & Lift)	w	w	N	N	s	17.3%
Option 2a Leave In-situ (Minor Intervention)	w	w	N	N	s	17.3%
Option 1a Do Nothing (Minimum Intervention)	MW	MW	w	w	N	10.3%

<u>
</u>

CHRYSAOR

2.2 Legacy Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	s	s	s	25.0%
Option 5a Full Removal (Reverse Reel)	N	N	s	S	s	25.0%
Option 4 Partial Removal (Cut & Lift)	w	w	N	N	N	16.7%
Option 2a Leave In-situ (Minor Intervention)	w	w	N	N	N	16.7%
Option 1a Do Nothing (Minimum Intervention)	W	w	N	N	N	16.7%

2.3 Fuel Use & Atmospheric Emissions	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	мw	мw	мw	8.9%
Option 5a Full Removal (Reverse Reel)	S	N	w	w	w	15.8%
Option 4 Partial Removal (Cut & Lift)	MS	S	N	N	N	25.1%
Option 2a Leave In-situ (Minor Intervention)	MS	s	N	N	N	25.1%
Option 1a Do Nothing (Minimum Intervention)	MS	S	N	N	N	25.1%

2.4 Other Consumptions	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	S	s	N	23.1%
Option 5a Full Removal (Reverse Reel)	N	N	S	s	N	23.1%
Option 4 Partial Removal (Cut & Lift)	w	w	N	N	w	15.4%
Option 2a Leave In-situ (Minor Intervention)	w	w	N	N	w	15.4%
Option 1a Do Nothing (Minimum Intervention)	N	N	s	S	N	23.1%

2.6 Loss of Habitat	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting	
Option 6 Full Removal (Cut & Lift)	N	N	s	S	s	24.9%	
Option 5a Full Removal (Reverse Reel)	N	N	s	S	s	24.9%	
Option 4 Partial Removal (Cut & Lift)	w	w	N	S	w	16.6%	
Option 2a Leave In-situ (Minor Intervention)	w	w	w	N	w	14.1%	
Option 1a Do Nothing (Minimum Intervention)	W	w	S	S	N	19.5%	

3.1 Technical Feasibility	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MS	w	w	w	17.9%
Option 5a Full Removal (Reverse Reel)	MW	N	мw	MW	MW	7.6%
Option 4 Partial Removal (Cut & Lift)	S	MS	N	N	N	24.8%
Option 2a Leave In-situ (Minor Intervention)	S	MS	N	N	N	24.8%
Option 1a Do Nothing (Minimum Intervention)	S	MS	N	N	N	24.8%

2.5 Disturbance	Option 6 Full Removal (Cut & L	Option 5a Full Removal (Rever Reel)	Option 4 Partial Removal (Cut &	Option 2a Leave In-situ (Mino Intervention)	Option 1a Do Nothing (Minimu Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	мw	мw	MW	9.1%
Option 5a Full Removal (Reverse Reel)	N	N	мw	мw	MW	9.1%
Option 4 Partial Removal (Cut & Lift)	MS	MS	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	MS	MS	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	MS	MS	N	N	N	27.3%

ift)

9 <del>(1</del>



4.1 Fishing	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	MW	MW	MW	9.1%
Option 5a Full Removal (Reverse Reel)	N	N	MW	MW	MW	9.1%
Option 4 Partial Removal (Cut & Lift)	MS	MS	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	MS	MS	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	MS	MS	N	N	N	27.3%

4.2 Communities / Ammenities	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	w	w	w	15.4%
Option 5a Full Removal (Reverse Reel)	N	N	w	w	w	15.4%
Option 4 Partial Removal (Cut & Lift)	S	s	N	N	N	23.1%
Option 2a Leave In-situ (Minor Intervention)	s	S	N	N	N	23.1%
Option 1a Do Nothing (Minimum Intervention)	s	S	N	N	N	23.1%

5.2 Long-term Costs	Option 6 Full Removal (Cut & Lift)	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	N	s	s	s	25.0%
Option 5a Full Removal (Reverse Reel)	N	N	s	s	s	25.0%
Option 4 Partial Removal (Cut & Lift)	w	w	N	N	N	16.7%
Option 2a Leave In-situ (Minor Intervention)	w	w	N	N	N	16.7%
Option 1a Do Nothing (Minimum Intervention)	W	W	N	N	N	16.7%



Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
vмw	vмw	vмw	3.2%
MW	MW	мw	9.7%
N	N	N	29.0%
N	N	И	29.0%
N	N	N	29.0%

5a (Re

uo lev

MW

Ν

MS

MS

MS

Optio

Ν

MS

VMS

VMS

VMS

5.1 Short-term

Costs

Option 6 Full Removal (Cut & Lift)

Option 5a Full Removal (Reverse Reel)

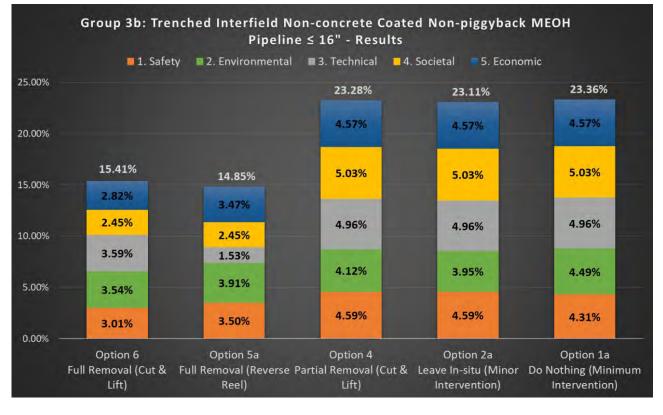
Option 4 tial Removal (Cut & Lift)

Option 2a Leave In-situ (Minor Intervention)

Option 1a lo Nothing (Minimum Intervention)



# Appendix E.3 Group 3b Results Chart





# Appendix E.4 Group 3b Detailed Evaluation Discussion

# Appendix E.4.1 Safety – Personnel Offshore

The assessment of the options indicated that Option 1a, leave in-situ with minimum intervention, Option 2a, leave in-situ with minor intervention and Option 4, partial removal with cut & lift to be the equal most attractive options against the Personnel Offshore sub-criterion. This was due to these options having similar duration offshore scopes, all of which are significantly shorter than the full removal options, where the full 118 km of pipeline would be removed.

Option 5a, the full removal by reverse reeling option was assessed as less attractive than the leave in-situ or partial removal options from a safety risk to offshore personnel perspective. This is due to increased safety risk from the greater offshore work scope associated with reverse reeling operations which requires additional vessels i.e. a Reverse Reel Vessel and a Construction Support Vessel (CSV).

Option 6, the full removal option by cut and lift was considered the least attractive option by some margin due to the much greater safety risk associated with the longer durations to cut the pipeline into short sections and recovery.

# Appendix E.4.2 Safety – Personnel Onshore

As with previous assessments, the safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. The leave in-situ and partial removal options (Option 1a, 2a and 4) were again, considered equally preferred as the quantity of material being returned is relatively similar across these options. It was noted that an additional quantity of material is returned in Option 4 where the exposures are removed and returned, but this additional quantity of material was not considered to increase the safety risk sufficiently to express a preference.

Option 5a and Option 6 both return significantly more material for onshore handling, transportation and processing, than the leave in-situ or partial removal options as the full 118 km of pipeline is retuned in both cases. As such, the full removal options were assessed as being significantly less attractive than the leave in-situ or partial removal options.

# Appendix E.4.3 Safety – Other Users

The impact of performing the decommissioning options on other users of the sea from a safety perspective is related to the duration of operations, the number of vessels involved, and significantly, the number of transits to and from port to the decommissioning site.

The assessment of the decommissioning options against this criterion has indicated that all options except Option 6, full removal by cut & lift are equally preferred as they have a similar, low impact on the safety of other users. This is justified on the basis that, whilst there is a higher number of vessel days associated with Option 5a, full removal by reverse reeling than the partial removal and leave in-situ options, the number of transits of vessels to and from port are similar for these options.

Option 6 is considered to have a higher impact on the safety of other users and therefore is less preferred as there are more vessel days associated with the extended work scope and, more significantly, a much higher number of transits to and from port.



# Appendix E.4.4 Safety – High Consequence Events

The assessment indicated that the leave in-situ and partial removal options would have the least exposure to potential for High Consequence Events and would therefore, be the most attractive against this criterion. This is due to the limited cut and lift operations to recover the pipeline end sections and exposures in these options.

Option 5a and Option 6 were assessed as being less attractive than the leave in-situ and partial removal options due to the potential for High Consequence Events associated with the back of deck handling during the reverse reeling operations in Option 5a and the additional lifting operations associated with the recovery of the 118 km of pipeline in Option 6.

# Appendix E.4.5 Safety – Residual Risk

The residual risk relates to the potential for any safety impact from the decommissioning options. As both Option 5a and Option 6 are full removal options, the residual risk is the lowest for these options and as such, they are equally preferred.

Option 4 and Option 2a were less preferred than the full removal options as the pipeline remains insitu, however, with the ends removed and the existing exposures either removed or rock covered, the residual risk is considered to be mitigated.

Option 1a was assessed as the least attractive option against this criterion due to the pipeline along with the existing exposures remaining in this option.

In addition, any partial removal or leave in-situ solution would have any potential hazards along the pipeline risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

# Appendix E.4.6 Safety – Overall

When combining the assessments conducted at sub-criterion level, the most attractive options, from a safety perspective are Option 4, partial removal by cut & lift and Option 2a, leave in-situ with minimal intervention. Option 1a, leave in-situ with minimal intervention is a close second. Option 5a and Option 6, the full removal options were assessed as significantly less attractive.

The leave in-situ and partial removal options were closely scored as they are all equally preferred in the personnel offshore, personnel onshore, other users and high consequence events criteria. The key differentiator being that Option 1a is less preferred from a residual risk perspective due to the existing exposures remaining as is under this option whereas they are addressed by removal in Option 4 and by rock cover in Option 2a.

# Appendix E.4.7 Environment – Operational Marine Impact

The environmental impact on the marine environment from performing the decommissioning options was considered low across all options. However, there were sufficient, cumulative differences, to indicate preferences across the decommissioning options.

The assessment performed during the workshop indicated that the leave in-situ and partial options are the most attractive from an operational marine impact perspective. This is due to these options having the least impact in terms of marine noise as they have the lowest number of vessel days and the lowest amount of subsea cutting operations.



All options have similar impacts in terms of discharges that occur from the pipeline whilst performing the decommissioning option as the pipeline is to have been cleaned successfully for all options. Options 4 and 6 do have increased quantities of cutting swarf over the leave in-situ options, which may have a small additional environmental impact.

The discharges from vessels relates to the number of vessels and the number of vessel days. Option 4 is considered less attractive than the leave in-situ options due to the additional vessel days required. Option 6 is worse again, due to the additional number of vessel days associated with the full removal option.

# Appendix E.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 5a and Option 6, the full removal options, are the most attractive decommissioning option from a legacy marine environmental impact perspective. This is due to the full pipeline being removed and thus eliminating any legacy impact from degradation products or polymers.

The remaining options were assessed as being equally less attractive due to the majority of the 118 km of pipeline being left in-situ and the associated environmental impact from degradation products and polymers. No distinction was made between the partial removal and the leave in-situ options as the removal of 338 m of exposure in Option 4 was not considered sufficient to express a preference. Further, no distinction was made between the impact of exposed pipeline versus buried or rock covered pipeline.

# Appendix E.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that the leave in-situ and partial removal options are the most attractive against the fuel use and atmospheric emissions criterion. This is due to these options having the least offshore work scope duration and hence vessel use and durations.

Option 5a has increased impact due to the additional offshore work scope associated with reverse reeling the 118 km pipeline and is therefore less preferred. Option 6 has increased impact again, from the additional offshore work scope associated with removing the entire pipeline using cut and lift methods and is the least preferred option.

# Appendix E.4.10 Environment – Other Consumptions

All options were assessed as having a similar environmental impact when considering the material returned versus material left in-situ perspective. The assessment therefore focussed on the quantity of rock required for each option.

Option 5a and Option 6, the full removal options and Option 1a were assessed as being the most attractive as they require no rock for the full removal options and 25 tonnes of rock for Option 1a.

Option 4 and Option 2a were assessed as being less attractive than these options as they require 1,400 tonnes and 3,500 tonnes of rock respectively. This is used to mitigate the snag hazard associated with the cut ends left after the exposures were removed in Option 4 and to rock cover the areas of exposure in Option 2a.



# Appendix E.4.11 Environment – Seabed Disturbance

The leave in-situ and partial removal options are assessed as the most attractive decommissioning options here as the seabed impact is limited to the area relating to the sections of pipeline removal at the LOGGS end and the tee locations.

Option 5a and 6 are significantly less attractive than the leave in-situ or partial removal options as a large area of seabed is impacted by the de-burial along the entire pipeline length using a MFE prior to the pipeline being reverse reeled or cut into sections and removed.

# Appendix E.4.12 Environment – Loss of Habitat

Option 5a and Option 6, the full removal options were assessed as being the most attractive options against this criterion as neither option results in a loss of, or material change to the marine habitat as it currently stands.

Option 1a is assessed as less attractive due to the small quantity of rock placed at the cut pipeline end at LOGGS and the tee locations. Option 4 is assessed as less attractive again, as it involves the introduction of rock to mitigate the snag hazard associated with the cut ends of the pipeline left after the exposures are removed. The introduction of this rock is a material change to around 1,000  $m^2$  of habitat where the existing sandbank is replaced with a hard substrate.

Option 2a is assessed as the least attractive option as almost 3,500 m<sup>2</sup> of existing sandbank is replaced with a hard substrate.

# Appendix E.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from an environmental perspective is Option 1a, followed closely by Option 4, Option 2a, Option 5a and finally Option 6. It is noted that, reflecting the relatively minor environmental impacts across all options, the differences between the options are small.

The leave in-situ Option 1a was assessed as being the most attractive or equal most attractive option against four of the six environment sub-criteria. This relates to the limited work scope associated with the leave in-situ option and the lack of rock required in this option. It was less preferred from a legacy perspective due to the material being left in-situ and marginally less preferred than the full removal options due to the small amount of habitat loss from the minimal rock cover introduced at the cut pipeline locations at LOGGS and the tees.

Option 4 was assessed as being most attractive or equal most attractive in three of the six criteria, with the requirement for additional rock to cover the cut ends of pipeline at the removed exposure locations counting against it.

Option 5a and Option 2a were scored almost the same with a very small preference for Option 2a with the legacy benefits of full removal and no required rock in Option 5a being offset by the seabed disturbance, and the lack of seabed disturbance being offset by the required rock in Option 2a.

Option 6 was the least attractive option due to the additional impact from the extended duration of offshore activities and the seabed disturbance from the MFE de-burial of the line with the benefit of the lack of rock required being insufficient to offset these impacts.



# Appendix E.4.14 Technical – Technical Feasibility

The leave in-situ and partial removal options were assessed as being the most attractive from a Technical Feasibility perspective due to the scope of removing the pipeline end sections, removing the exposures, placing rock cover over exposures and over the cut ends associated with these options being considered routine subsea operations.

Option 6 was the next most attractive option with the technical risks associated with the longer durations to cut the pipeline into short sections and recovering them, and successfully performing the de-burial operations to allow the subsea cutting to be performed being the main concerns.

Option 5a was the least attractive option by some margin due to concern surrounding the ability to reverse reel this line due to concerns around its integrity. The concept maturity was also assessed as being low as reverse reeling of rigid lines is unproven.

Overall, Option 4, Option 2a and Option 1a are the most attractive from a Technical perspective, followed by Option 6 and then Option 5a.

# Appendix E.4.15 Societal – Fishing Industry

Prior to discussing the assessment, some context is provided from the Fishing Baseline Characterisation ref. [7]. As this line is laid alongside the trunkline, the discussion reflects that of Group 1. The fishing activity in the area of this pipeline is considered low, ranging from 5 to 20 days per annum fishing effort and relates mainly to beam trawling fishing operations from the Netherlands. UK beam trawling is less represented and generally target brown shrimp closer to shore. Potting activity by fleets under 15 m in length and scallop dredging have been observed, although the majority of sightings have not been in the immediate vicinity of the pipeline.

Given the above, the partial removal and leave in-situ options are assessed as being the most attractive options due to them presenting the least disruption and disturbance to the fishing industry from having the smallest offshore work scopes.

Option 5a and Option 6 are assessed as the least attractive options due to the extensive disruption to the fishing industry from the removal of the entire 118 km of the pipeline. It was noted that these options are also likely to have the most significant impact on near-shore fishing operations where static creel pots may need to be removed to allow the full removal of the pipeline.

It was noted that, given that fishing operations are already conducted in the area along and around this pipeline, and any infrastructure remaining on the seabed will be subject to an appropriate postdecommissioning monitoring regime, the residual presence of the pipeline was not considered a limitation to fishing activity.

# Appendix E.4.16 Societal – Communities / Amenities

The impact of the decommissioning options on communities and amenities are considered in this criterion.

The leave in-situ and partial removal options are assessed as being the most attractive due to them returning limited quantities of material for processing onshore. Whilst this limits the amount of useful material, such as steel, being returned for recycling, it also results in the least amount of material being returned that will be directed to landfill, such as the polymer coating of the pipeline.

Option 5a and Option 6 were assessed as being the least attractive options as they return the entire 118 km of pipeline and the most quantity of polymer which takes up limited landfill capacity.



# Appendix E.4.17 Societal – Overall

When combining the assessments conducted at sub-criterion level, the partial removal and leave insitu options were considered the equal most attractive options as they were assessed as being the most attractive options against both the Fishing Industry and Communities / Amenities criteria.

Option 5a and Option 6 were less preferred as the impact from the disturbance to the fishing industry and the additional polymer to landfill from these full removal options, were assessed as less attractive.

# Appendix E.4.18 Economic – Short-term Costs

Option 1a, Option 2a and Option 4 were assessed as the equal most attractive options from a short-term costs perspective. This is due to their costs being similar and the lowest cost options at  $\pounds$ 2.3 million,  $\pounds$ 2.4 million and  $\pounds$ 2.9 million respectively.

The costs for the full removal options was significantly higher with Option 5a being £28 million and Option 6 being significantly more expensive at over £130 million.

# Appendix E.4.19 Economic – Long-term Costs

The impact of the decommissioning options in terms of long-term costs i.e. any on-going survey and monitoring costs and Fishing Legacy Trust-fund Company (FLTC) payments, are considered in this criterion.

Option 5a and Option 6 are considered the most attractive options against this criterion due to there being no long-term costs associated with these full removal options.

All other options are considered equally less attractive as the long-term costs associated with them is largely similar being between £500 k and £900 k.

# Appendix E.4.20 Economic – Overall

Overall, the assessment is dominated by the short-term costs as the differentials are much greater than for the long-term costs.

Option 1a, Option 2a and Option 4 are the equal most attractive options from an Economic perspective, followed by Option 5a with Option 6 being the least preferred.

#### APPENDIX F **GROUP 3C – DETAILED EVALUATION RESULTS**

#### Appendix F.1 Group 3c Attributes Table

# Group 3c: Trenched Interfield Concrete Coated Piggyback Pipelines ≤ 16"

- 14.3 km 12" concrete coated gas production pipeline with 3" piggyback methanol pipeline from Callisto to Ganymede with 132 m of exposure (PL1091 & PL1092) - 7.5 km 10" concrete coated gas production pipeline with 3" piggyback methanol pipeline from Vanguard to LOGGS PP with 102.5 m of exposure (PL0456 & PL0457) - 10.6 km 10" concrete coated gas production pipeline with 3" piggyback methanol pipeline from South Valiant to LOGGS PP with 119.7 m of exposure (PL0460 & PL0461) - 4.4 km 10" concrete coated gas production pipeline with 3" piggyback methanol pipeline from North Valiant to LOGGS PP with 129.4 m of exposure (PL0470 & PL0471)

Mark         Law Product Solution         Law Product Solution         Comparison         Description         Comparison			Option 6		Option 4	Option	n 2a	Option 1a
Corr Bin Section and Provent all hydraule chance (P & 10)     Corr Bin Section and Provent (P × 10)     Corr		Full Ren	noval (Cut & Lift)	Pa	artial Removal (Cut & Lift)	Leave In-situ (Min	or Intervention)	Do Nothing (Minimum Intervention)
Control and c		- Unbury pipeline(s) with MFE   R	ecover mattresses and grout bags	- Dredge to uncover pipeli	ine ends	- Dredge to uncover pipeline ends		- Dredge to uncover pipeline ends
Control and c		- Cut pipe into 20m sections with	hvdraulic shears	- Cut 10 m section with h	vdraulic shears (at each end) & recover (8 x 10 m	- Cut 10 m section with hydraulic shear	rs (at each end) & recover (8 x 10 m)	- Cut 10m section with hydraulic shears (at each end) & recover (8 x 10 m)
Picket frame()   Pick documentations are upper local () = Special () as a proper document is provided () = Pick documentations are upper local () = Pick documentations are upper			5		- Cut all exposed sections into 20 m lengths with hydraulic shears		, , , , , , , , , , , , , , , , , , , ,	
Public indicates range that is a special or displayer and provide range of the special or displayerant and pr					<b>o y</b>		•	•
Prote:         Bescare:         Prote:         Bescare:         Prote:         Bescare:         Prote:         Bescare:         Bes		- Backlin trench   Post decommis	sioning survey   Seabed trawi sweep					
					5	8 , 1		
Newset Type: Public Darys / Hours / PLL         Vesset Type: Public Darys / Hours / PLL         Vesset Type: Public Darys / Hours / PLL         Vesset Type: Public Darys / Hours / PLL           DDV: 110 / 57 / 1174 J2 / 387 / 4.2E 04         Dov: 110 / 57 / 1174 J2 / 108 / 0.26 04         Dov: 110 / 58 / 1172 / 0.26 04         Dov: 110 / 58 / 1172 / 0.26 04           Dov: 100 / 57 / 1174 J2 / 387 / 4.2E 04         Table of book 04         Table of book 04         Dov: 110 / 58 / 1172 / 0.26 04         Dov: 110 / 58 / 1172 / 0.26 04           Dov: 100 / 57 / 1174 J2 / 108 / 0.12 / 0.25 / 0.12 / 0.25 / 0.12 / 0				<ul> <li>Post decommissioning</li> </ul>	survey   Seabed trawl sweep	- Note: all areas of exposure will be roc	k dumped	other areas of exposure will remain
Boy: 110 <sup>1</sup> 177 177 462 / ASEC 60         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 476 40         Doi: 100 177 477 40				- Note: all areas of expos	ure will be removed			
Boy: 110 <sup>1</sup> 177 177 462 / ASEC 60         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 177 464 / ASEC 61         Doi: 110 <sup>1</sup> 177 476 40         Doi: 100 177 477 40				Managel Transv DaD / David		Versel Times DeD / Deve / Herma / DH		Versel Turse D-D / Davis / Llawis / DL
Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04   Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 N N N    Particle Diad dihone hour: 24/16/he Particle Diad dihone hour: 22/16/he Particle Diad dihone h	Dre Dre						L	
Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04   Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 N N N    Particle Diad dihone hour: 24/16/he Particle Diad dihone hour: 22/16/he Particle Diad dihone h	Ĕ			,		· · · · · · · · · · · · · · · · · · ·		
Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04   Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04 Burge Vissel: 44/112/589/144E-04   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he Diad dihone hour: 24/16/he   Burge Vissel: 44/112/589/144E-04 N N N    Particle Diad dihone hour: 24/16/he Particle Diad dihone hour: 22/16/he Particle Diad dihone h	Ű		-02			· · · · · · · · · · · · · · · · · · ·		
The definition PLL's Sec. 30 in ms     The definition PLL's Sec. 30     The definition PLL's S		Trawler: 5 / 8.0 / 480 / 3.60E-05		Trawler: 5 / 8.0 / 480 / 3.0	60E-05	Trawler: 5 / 8.0 / 480 / 3.60E-05		Trawler: 5 / 8.0 / 480 / 3.60E-05
The definition PLL's Sec. 30 in ms     The definition PLL's Sec. 30     The definition PLL's S	ne	Survey Vessel: 44 / 11.2 / 5,887	4.42E-04	Survey Vessel: 44 / 11.2	/ 5,887 / 4.42E-04	Survey Vessel: 44 / 11.2 / 5,887 / 4.42	E-04	Survey Vessel: 44 / 11.2 / 5,887 / 4.42E-04
The definition PLL's Sec. 30 in ms     The definition PLL's Sec. 30     The definition PLL's S	2. 5	CSV 76 / 207 5 / 189 194 / 1 42	=-02	-		Rockdump Vessel: 20 / 9 6 / 2 311 / 1	73E-04	
The definition PLL's Sec. 30 in ms     The definition PLL's Sec. 30     The definition PLL's S	L Sie					·······		Total offshore hours: 21,872 hrs
Notes         Total officing PLL: 5.98E-02         Total officing PLL: 6.9E-03         Total officing PLL: 6.9E-03           Notes	ے م	Tatal affahara haura, 240,400 hra		Tatal affahara haura, 07.1	0E hrs	Total affabara bauray 22,002 bra		
W         W         W         N         N         N         N           The assessment of the Personnel Obtex as active the step for the step forms         Control Contente Control Contente Control Contro Contrel Control C	∽.							Total dishole PLL: 5.06E-03
The assessment of the Personnel Offitions sub-criterion is as blows:     Ore rail. Option A option A and Option A series and Barbora Personnel progretive.     Ore rail. Option A option A and Option A series and Barbora Personnel progretive.     Ore rail. Option A option A series and Barbora Personnel progretive.     Prevalues Pyst: Days / Hours / PLL     Ore rail. Option A option A series and Barbora Personnel progretive.     Prevalues Pyst: Days / Hours / PLL     Ore rail. Option A option A series and Barbora Personnel progretive.     Prevalues Pyst: Days / Hours / PLL     Ore rail or phone Description (Cleaning & Dapocal): 1.0 / 64 / 7.87E-06     Ore shore Operations (Cleaning & Dapocal): 1.0 / 64 / 7.87E-06     Ore shore Operations (Cleaning & Dapocal): 1.0 / 64 / 7.87E-06     Ore shore Operations (Description A option A series A series Pyst: Days / Hours / PLL     Ore operations (Description A option A optio								
Special bit is assessed as being Watter than all other options as the risk exposure for other personnel is around 10 minute special value.         Resource Type: Days / Hours / PLL Orabine Operations (Cleaning & Disposal): 324.01 / 20,736 / 2.55E-0)         Resource Type: Days / Hours / PLL Orabine Operations (Cleaning & Disposal): 10.1 / 61 / 7.87E-06         Resource Type: Days / Hours / PLL Orabine Operations (Cleaning & Disposal): 10.1 / 61 / 7.87E-06           Verse         Verse         Verse         Verse         Verse         No         No           Verse         Verse         Verse         Verse         Verse         No         No           Verse         Verse         Verse         Verse         Verse         No         No           Verse         Verse         Verse         Verse         No         No         No           Verse         Verse         Verse         Verse         No         No         No           Verse         Verse         Verse         Verse         No         No         No         No         No           Verse         No         Verse         No         No <td< th=""><td></td><td></td><td></td><td>N</td><td>N</td><td>N</td><td></td><td></td></td<>				N	N	N		
Spins         Operation         A cybic or 2 and Cybic in 1 are assessed as being Neutral to each other as the risk exposure are similar.           Operating 0 point 0, Cybic 0 as and Cybic in 1 are assessed as being Neutral to each other as the risk exposure 0 perations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06         Resource Type: Day's / Hours / PLL Onshore Operations (Cleaning & Disposal): 3.0 / 2.55E-03         Resource Type: Day's / Hours / PLL Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06         Resource Type: Day's / Hours / PLL Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06         Resource Type: Day's / Hours / PLL Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06           Total onshore hours: 20.786 hrs Total onshore hours: 20.786 hrs         Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06         Total onshore hours: 64 hrs Total onshore PLL: 7.87E-06         Total onshore hours: 64 hrs           Option 1 is assessed as being Neutral to Cybic 0 as and Cybic 1 a due to the role kepsouse (more than 300 times higher for Option 6 due to the full pipeline length being returned to shore for in Option 4. Option 2 and Cybicn 1 a.         Option 6 is assessed as being Very Much Weaker than both Option 2 and Option 1 a due to the options.         Option 1 as the onshore Parce Neutral Neu								
Option 4, Option 2 and Option 1 are equally preferent from as its to Obtaince Presentational perspective.       Resource Type: Days / Hours / PLL       Resource Type: Days / Hours / PLL       Resource Type: Days / Hours / PLL       Onchree Operations (Clearing & Disposal): 1.0 / 64 / 7.87E-06       Inchree Operations (Clearing & Disposal): 1.0 / 64 / 7.87E-06         Total orshore Put: 2.55E-03       Total onshore Hours: 20,736 hs Total orshore PLL: 3.5E-05       Total onshore Put: 7.87E-06       Onshore Operations (Clearing & Disposal): 1.0 / 64 / 7.87E-06         MW       VMW       VMW       V       N       N         Contract (With Clearing & Disposal): 0.0 / 64 / 7.87E-06       Total onshore PLL: 7.87E-06       Total onshore PLL: 7.87E-06         MW       VMW       VMW       V       N       N         Total onshore PLL: 3.8E-05       Total onshore PLL: 7.87E-06       Total onshore PLL: 7.87E-06         Ministry (Water Mark (Water Man Option 2 and Option 1 as tolows:       Verset Mark (Water Man Option 2 and Option 1 a due to the mark (more than 300 in 5)       Total onshore PLL: 7.87E-06         Verset Mark (Water Man Option 2 and Option 1 as tolows:       Verset Mark (Water Man Option 2 and Option 1 a due to the mark (more than 300 in 5)       Total onshore PLL: 7.87E-06       Total onshore PLL: 7.87E-06         Verset Days:       Option 2 and Option 1 a triak to habouse throng manored is to finand hyber option of due to the mark option preparedive.       N       N       N	Summon	Option 6 is assessed as being W	eaker than all other options as the ris	k exposure for offshore personr	nel is around 10 times higher for Option 6 due to th	e increased work scope durations and m	nuch greater of divers.	
Memory Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 324.0 / 20,736 / 2.55E 0.3     Resource Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 324.0 / 20,736 / 2.55E 0.3     Resource Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06     Resource Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06       Total orshore Operations (Outsmice A transitions PLL: 2.55E 0.3     Total orshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06     Total orshore PLL: 7.87E-06     Total orshore PLL: 7.87E-06       The assessment of the Personnel On-thore sub-criterion is as follows:     W     W     N     N       Option 6 is assessed as being Wuch Watch Tan Option 1 as the risk exposure for orshore personnel is 65 lines higher for Option 6 due to the full pipeline length being returned to shore for in Option 6 versus less than 500 m of Dipoline on Option 1 a. Option 2 and Option 1 a. Option 1 a. Option 2 and Option 1 a. Option 2 and Option 1 a. Option 2 and Option 1 a. Option 2 and Option 1 a. Option 1 a. Ste Orshore Personnel Personel Personnel Personnel Personnel Personnel Personnel Person	Summary	Option 4, Option 2a and Option 1	a are assessed as being Neutral to ea	ch other as the risk exposures	are similar.			
Memory Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 324.0 / 20,736 / 2.55E 0.3     Resource Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 324.0 / 20,736 / 2.55E 0.3     Resource Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06     Resource Type: Days / Hours / PLL Orshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06       Total orshore Operations (Outsmice A transitions PLL: 2.55E 0.3     Total orshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06     Total orshore PLL: 7.87E-06     Total orshore PLL: 7.87E-06       The assessment of the Personnel On-thore sub-criterion is as follows:     W     W     N     N       Option 6 is assessed as being Wuch Watch Tan Option 1 as the risk exposure for orshore personnel is 65 lines higher for Option 6 due to the full pipeline length being returned to shore for in Option 6 versus less than 500 m of Dipoline on Option 1 a. Option 2 and Option 1 a. Option 1 a. Option 2 and Option 1 a. Option 2 and Option 1 a. Option 2 and Option 1 a. Option 2 and Option 1 a. Option 1 a. Ste Orshore Personnel Personel Personnel Personnel Personnel Personnel Personnel Person		Overall, Option 4. Option 2a au	nd Option 1a are equally preferred	from a risk to Offshore Pers	onnel perspective.			
Onshore Operations (Cleaning & Disposal): 324 0 / 20,736 / 2.55E-03       Onshore Operations (Cleaning & Disposal): 5.0 / 30 / 3.94E-05       Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06       Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06         Total onshore hour:: 20,736 hrs       Total onshore hour:: 20,736 hrs       Total onshore hour:: 20 hrs       Total onshore hour:: 64 hrs       Total onshore PLL:: 7.87E-06       Total onshore PLL:: 7.87E-06         MW       VMW       VMW       V       V       V       N         The assessment of the Personnel Onshore sub-criterion is as follow:       Option 1 a due to the sequence of								
Onshore Operations (Cleaning & Disposal): 324 0 / 20,736 / 2.55E-03       Onshore Operations (Cleaning & Disposal): 5.0 / 30 / 3.94E-05       Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06       Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06         Total onshore hour:: 20,736 hrs       Total onshore hour:: 20,736 hrs       Total onshore hour:: 20 hrs       Total onshore hour:: 64 hrs       Total onshore PLL:: 7.87E-06       Total onshore PLL:: 7.87E-06         MW       VMW       VMW       V       V       V       N         The assessment of the Personnel Onshore sub-criterion is as follow:       Option 1 a due to the sequence of	_	Resource Type: Days / Hours / P	LL	Resource Type: Days / H	lours / PLL	Resource Type: Days / Hours / PLL		Resource Type: Days / Hours / PLL
Year       Yes	ue e						sal): 1.0 / 64 / 7.87E-06	
Year       Yes		channie operations (cleaning a	Disposar). 024.07 20,7007 2.002-00		aning a Disposal). 0.07 0207 0.042-00	Chishole Operations (Cleaning & Dispo	Sul). 1.07 047 7.07 2-00	
Year       Yes	sh s	<b>T</b> ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (		<b>T</b> ( )		<b>T</b> ( ) ( ) ( ) ( )		
Year       Yes	°. č	· · · · · · · · · · · · · · · · · · ·						
MW         VMW         VMW         W         N           The assessment of the Personnel Onshore sub-criterion is as follows:         Option 6 is assessed as being Much Weaker than both Option 4 as the risk exposure for onshore personnel is 65 times higher for Option 6 due to the full pipeline length being returned to shore for in Option 6 versus less than 500 m of pipeline being returned in Option 4. Option 6 is assessed as being Weaker than both Option 2a and Option 1a due to the much higher risk exposure (more than 300 limes higher) for onshore personnel due to handling 37 km of pipeline versus eight short 10m pipeline end sections in Option 2a and Option 1a.           Option 4 is assessed as being Weaker than both Option 2a and Option 1a due to the much higher risk exposure (more than 300 limes higher) for onshore personnel due to handling around 500 m of pipeline versus eight short 10m pipeline end sections in Option 2a and Option 1a.           Option 2 is assessed as being Weaker than both Option 2a and Option 1a due to the risk exposure for onshore personnel perspective.         Vessel Days:         Vessel Days:         Vessel Days:         DSV: 8.2           Option 2a and Option 1a are equally preferred from a risk to Onshore Personnel perspective.         Vessel Days:         DSV: 8.2         Divers: 8.2         Divers: 8.2           The weaker 8.0         Survey Vessel: 11.2         Survey Vessel: 11.2         Survey Vessel: 11.2         Survey Vessel: 9.6         Total wessel days: 37.0 days         Total wessel days: 28.0 days           Total wessel days: 31.7 days         Total wessel days: 32.0 days         Total wessel days: 37.0 days<	~ <u>~</u> ~	Total onshore PLL: 2.55E-03		Total onshore PLL: 3.94E	-05	Total onshore PLL: 7.87E-06		Total onshore PLL: 7.87E-06
The assessment of the Personnel Orishore sub-criterion is as follows: Option 6 is assessed as being Weaker than Doth Option 2 and Option 1 due to the much higher risk exposure (more than 300 times higher) for oshore personnel due to handling 37 km of pipeline ends sections in Option 2 and Option 1 a. Option 4 is assessed as being Weaker than Doth Option 2 and Option 1 due to the much higher risk exposure (more than 300 times higher) for oshore personnel due to handling 37 km of pipeline ends sections in Option 2 and Option 1 a. Option 4 is assessed as being Weaker than Doth Option 2 and Option 1 a due to the much higher risk exposure being around 5 times higher due to handling around 500 m of pipeline onshore versus eight short 10m pipeline end sections in Option 2 and Option 1 a. Option 4 is assessed as being Weaker than Doth Option 2 and Option 1 as the onshore Personnel perspective. Vessel Days: Vessel Days: Divers: 8.2 Survey Vessel: 11.2 Survey Vessel: 11.2 Survey Vessel: 11.2 Survey Vessel: 11.2 Survey Vessel: 12.2 Survey Vessel: 13.7 Total vessel days: 33.7 days Total Vessel days: 37.0 days Total Vessel days: 37.0 days Total Vessel days: 37.0 days Total Vessel days: 37.0 days Total Vessel days: 0								
Summ       Option 6 is assessed as being Wuch Weaker than Option 1 as the risk exposure for onshore personnel is 65 times higher for Option 6 due to handling 37 km of pipeline versus eight short 10m pipeline end sections in Option 2 and Option 1a. Option 1a is assessed as being Weaker than bot Option 2 and Option 1a due to the much higher isk exposure being around 5 times higher (br option 6 due to handling 37 km of pipeline versus eight short 10m pipeline end sections in Option 2 and Option 1a. Option 2 and Option 1a due to the much higher risk exposure being around 5 times higher due to handling 37 km of pipeline versus eight short 10m pipeline end sections in Option 2 and Option 1a. Option 2 and Option 1a as the onshore handling is the same for bot options. Deverall, Option 2 and Option 1a as the onshore handling is the same for bot options.       Vessel Days: Usessel 23 to 24 to 23 to 23 to 24 to 23 to 24 to 23 to 24 to 23 to 24 to				W	W	N		
Numer       Which Weaker than both Option 2a and Option 1a due to the much higher risk exposure forms thigh and the risk exposure forms thigh and the to handling 37 km of pipeline versus eight short 10m pipeline end sections in Option 2a and Option 1a.         Option 4 is assessed as being Weaker than both Option 2a and Option 1a ace to enshore handling is the same for both options.       Versel Days:       Versel Days:         Usersel Days:       Versel Days:       Vessel Days:       Vessel Days:       Vessel Days:         Divers: 87.1       Divers: 0.5       Divers: 0.5       Divers: 0.4       Divers: 0.5         Trawier: 8.0       Trawier: 8.0       Trawier: 8.0       Trawier: 8.0       Trawier: 8.0         Corv: 207.5       Total vessel days: 31.7 days       Total vessel days: 31.7 days       Total vessel days: 32.7 days       Total vessel days: 32.7 days       Total vessel days: 32.0 days         Total vessel days: 31.7 days       Total vessel days: 0.5       Total vessel days: 37.0 days       Total vessel days: 28.0 days         Total vessel days: 31.7 days       Total vessel days: 30.2 days       Total vessel days: 37.0 days       Total vessel days: 28.0 days         Total vessel days: 31.7 days       Total vessel days: 0.5 (fruit wessel days: 0.5 (fruit wessel days: 0.5 (fruit wessel days: 28.0 days       Total vessel days: 28.0 days         Total vessel days: 31.7 days       Total vessel days: 0.7 (fruit wessel days: 0.7 0 days       Total vessel days: 28.0 days								
Summary Option 4 is assessed as being Weaker than both Option 2a and Option 1a due to the risk exposure being around 5 times higher due to handling around 500 m of pipelline onshore versus eight short 10m pipeline end sections in Option 2a and Option 1a. Option 2a is assessed as being Neutral to Option 1a are evally preferred from arisk to Onshore Personel personel       Vessel Days:       Vessel Days:       Vessel Days:       Vessel Days:       Vessel Days:       DSV: 8.2       DSV: 8.7.1       DSV: 10.5       DSV: 10.5       DSV: 8.2		Option 6 is assessed as being M	uch Weaker than Option 4 as the risk	exposure for onshore personne	el is 65 times higher for Option 6 due to the full pip	eline length being returned to shore for ir	n Option 6 versus less than 500 m of	pipeline being returned in Option 4. Option 6 is assessed as being Very
by toon 1 a assessed as being Weaker than both Option 2 and Option 1 a due to the next exposure being around s times higher due to handing around south of pipeline onshore versus eight short 10m pipeline end sections in Option 2 and Option 1a. atter output and Option 1a aster onshore handing around south of pipeline onshore versus eight short 10m pipeline end sections in Option 2 and Option 1a. atter output and Option 1a aster onshore handing around south of pipeline onshore versus eight short 10m pipeline end sections in Option 2 and Option 1a. atter output and Option 1a aster of the options. Source 14 and Option 1a are equally preferred from a risk to Onshore Personnel perspective.  Versel Days: DSV: 87.1 Users: 87	•	Much Weaker than both Option 2	a and Option 1a due to the much high	er risk exposure (more than 30	0 times higher) for onshore personnel due to hand	ling 37 km of pipeline versus eight short	10m pipeline end sections in Option 2	2a and Option 1a.
Option 2a is assessed as being Neutral to Option 1a as the onshore handling is the same for both options. Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal perspective. Vessel Days: Divers: 0.0 trail (Option 2a ard Option 1a are equally preferred from a risk to Onshore Personnal Perspective. Trawler: 0.0 trail (Option 2a ard Option 2	Summary	Option 4 is assessed as being W	eaker than both Option 2a and Option	1a due to the risk exposure be	eing around 5 times higher due to handling around	500 m of pipeline onshore versus eight s	hort 10m pipeline end sections in Op	otion 2a and Option 1a.
Versall, Option 2a and Option 1a are equally preferred from a risk to Onshore Personnel perspective.         Versall       Versall       Versall       Versall       Versall       Versall       Versall       Versall       DSV: 8.0         DSV: 87.1       Divers: 87.1       Divers: 10.5       Divers: 8.0				•	· · · · ·			
Yessel Days:       Vessel Days:       Vessel Days:       Vessel Days:       DSV: 10.5       DSV: 10.5       DSV: 8.2       DSV: 8.9       DIvers: 8.9         Divers: 8.7.1       Divers: 10.5       Divers: 8.2       Divers: 8.2       Divers: 8.9       Divers: 8.9         Survey Vessel: 11.2       Survey Vessel: 11.2       Survey Vessel: 11.2       Survey Vessel: 11.2       Survey Vessel: 9.5       Total vessel days: 39.2 days       Total vessel days: 39.2 days       Total vessel days: 37.0 days       Total vessel days: 28.0 days         Total Vesses       W       W       N       N       N       N         The assessment of the Other Users sub-criterion is as follows:       Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of the other options, these are spread over a longer operational duration and so the actual impact in terms of safety of other users due to vessel traffic volumes increasing is likely be travel to each other as willist (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users.         All other options are assessed as being Neutral to each other as, whills there are differences in the number of vessel days and transits, these differences are insufficient to result in a material differences.		· · ·		<b>S</b> 1				
BSV: 87.1       DSV: 87.1       DSV: 87.1       DSV: 87.1       DSV: 87.1       Divers: 10.5       Divers: 8.0       Divers: 8.0       Divers: 8.9         Trawler: 8.0       Trawler: 8.0       Trawler: 8.0       Trawler: 8.0       Survey Vessel: 11.2       Survey Vessel: 11.2       Trawler: 8.0       Trawler: 8.0       Trawler: 8.0       Total vessel days: 31.7 days       Total vessel days: 31.7 days       Total vessel days: 31.7 days       Total vessel days: 32.0 days       Total vessel days: 37.0 days       Total vessel days: 28.0 days         Total Number of Tramits: 10       Total Number of Tramits: 10       Total vessel days: 37.0 days       Total vessel days: 37.0 days       Total Number of Tramits: 8         The assessment of the Other Users sub-criterion is as follows:       Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of there are hore vessel days for Option 6 than any of the option for 0 the vork site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users.       All other options are assessed as being Neutral to each other as, whilist there are differences in the number of vessel days art transits, these differences are insufficient to result in a material difference in the safety impact on other users.		Overall, Option za and Option	ha are equally preferred from a ris	k to offshore Personner pers	spective.			
BSV: 87.1       DSV: 87.1       DSV: 87.1       DSV: 87.1       DSV: 87.1       Divers: 10.5       Divers: 8.0       Divers: 8.0       Divers: 8.9         Trawler: 8.0       Trawler: 8.0       Trawler: 8.0       Trawler: 8.0       Survey Vessel: 11.2       Survey Vessel: 11.2       Trawler: 8.0       Trawler: 8.0       Trawler: 8.0       Total vessel days: 31.7 days       Total vessel days: 31.7 days       Total vessel days: 31.7 days       Total vessel days: 32.0 days       Total vessel days: 37.0 days       Total vessel days: 28.0 days         Total Number of Tramits: 10       Total Number of Tramits: 10       Total vessel days: 37.0 days       Total vessel days: 37.0 days       Total Number of Tramits: 8         The assessment of the Other Users sub-criterion is as follows:       Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of there are hore vessel days for Option 6 than any of the option for 0 the vork site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users.       All other options are assessed as being Neutral to each other as, whilist there are differences in the number of vessel days art transits, these differences are insufficient to result in a material difference in the safety impact on other users.		Vessel Davs:		Vessel Days:		Vessel Days:		Vessel Davs:
No		,						,
No       No <t< th=""><td>S</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	S							
b Survey Vessel: 11.2 <td>se &lt;</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	se <							
No       No <th< th=""><td><u>ē</u> 7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	<u>ē</u> 7							
No       No <th< th=""><td></td><td>Survey Vessel: 11.2</td><td></td><td>Survey Vessel: 11.2</td><td></td><td>Survey Vessel: 11.2</td><td></td><td>Survey Vessel: 11.2</td></th<>		Survey Vessel: 11.2		Survey Vessel: 11.2		Survey Vessel: 11.2		Survey Vessel: 11.2
No       No <th< th=""><td>5</td><td>CSV: 207.5</td><td></td><td>Rockdump Vessel: 9.5</td><td></td><td>Rockdump Vessel: 9.6</td><td></td><td></td></th<>	5	CSV: 207.5		Rockdump Vessel: 9.5		Rockdump Vessel: 9.6		
Total vessel days: 31.7 days Total Number of Tansits: 100       Total vessel days: 39.2 days Total Number of Transits: 10       Total vessel days: 37.0 days Total Number of Transits: 10       Total Number of Transits: 8         W       W       W       N       N       N       N       N       N         The assessment of the Other Users sub-criterion is as follows:       Total number of the other options as, although there are more vessel days for Option 6 than any of the other options, these are spread over a longer operational duration and so the actual impact in terms of safety of other users due to vessel traffic volumes increasing is likely be negligible between these options. There are however, a higher number of vessel transits to / from the work site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users. All other options are assessed as being Neutral to each other as, whilst there are differences in the -wither of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.       Total Number of Transits: 8	e.							Total vessel days: 28.0 days
Total Number of Tirusits: 100       Total Number of Transits: 10       Total Number of Transits: 10         W       W       W       N       N         The assessment of the Other Users sub-criterion is as follows:       Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of the other options, these are spread over a longer operational duration and so the actual impact in terms of safety of other users due to vessel traffic volumes increasing is likely be negligible between these options. There are however, a higher number of vessel transits to / from the work site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users. All other options are assessed as being Neutral to each other as, whilst there are differences in the number of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.	-	Total vessel days: 313 7 days		Total vessel days: 39.2 d	avs	Total vessel days: 37.0 days		
W       W       W       W       N       N         The assessment of the Other Users sub-criterion is as follows:       Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of the other options, these are spread over a longer operational duration and so the actual impact in terms of safety of other users due to vessel traffic volumes increasing is likely be negligible between these options. There are however, a higher number of vessel transits to / from the work site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users. All other options are assessed as being Neutral to each other as, whilst there are differences in the number of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.		, , ,						
The assessment of the Other Users sub-criterion is as follows: Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of the other options, these are spread over a longer operational duration and so the actual impact in terms of safety of other users due to vessel traffic volumes increasing is likely be negligible between these options. There are however, a higher number of vessel transits to / from the work site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users. All other options are assessed as being Neutral to each other as, whilst there are differences in the number of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.								
Option 6 is assessed as being Weaker than all other options as, although there are more vessel days for Option 6 than any of the other options, these are spread over a longer operational duration and so the actual impact in terms of safety of other users due to vessel traffic volumes increasing is likely be negligible between these options. There are however, a higher number of vessel transits to / from the work site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users. All other options are assessed as being Neutral to each other as, whilst there are differences in the number of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.				IN		IN		
Summary be negligible between these options. There are however, a higher number of vessel transits to / from the work site (100 versus 10 or 8) which provide a small increase in the potential safety impact on other users. All other options are assessed as being Neutral to each other as, whilst there are differences in the number of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.				ab there are more uponed down	for Option 6 than any of the other options, these	re aproad over a longer aparetics of durat	ion and as the actual impact in terms	a of apfatu of other uppersidue to upped traffic uplumes increasing in likely to
All other options are assessed as being Neutral to each other as, whilst there are differences in the number of vessel days and transits, these differences are insufficient to result in a material difference in the safety impact on other users.			•	<b>S S</b>				s of salety of other users due to vesser trailic volumes increasing is likely to
	Summary				, , ,			
Overall, Option 4, Option 2a and Option 1a are equally preferred from a risk to Other Users perspective.						s are insufficient to result in a material di	ifference in the safety impact on othe	er users.
		Overall, Option 4, Option 2a a	nd Option 1a are equally preferred	from a risk to Other Users p	erspective.			

NOTE: Pipeline Numbers in Appendix with a "0" after the "PL" are equivalent to those in the main body of the document with the same numbering but that do not contain the "0" in front of the "PL". The Main body of the text utilises the correct reference for the pipeline numbers.



			tion 6 /al (Cut & Lift)		P	Option 4 artial Removal (Cut & Li	ift)	en e	tion 2a Minor Intervention)	Do No
	- Cut pipe into 20m - Bundle cut sectio	s) with MFE   Reco n sections with hydons and recover	over mattresses and	0 0	<ul> <li>Dredge to uncover pipel</li> <li>Cut 10 m section with h</li> <li>Cut all exposed section</li> <li>Bundle cut sections an</li> <li>Place rock to remediate</li> </ul>	line ends hydraulic shears (at each e ns into 20 m lengths with h id recover e snag risk at exposed end survey   Seabed trawl swe	end) & recover (8 x 10 m) nydraulic shears ds	- Dredge to uncover pipeline ends	nears (at each end) & recover (8 x 10 m) at exposed ends xposed sections eabed trawl sweep	- Dredge to uncover pipe
Consequence Events	option. This is bas	ed on the number take place to fully	Events is assessed of both cutting and v remove the pipeline	lifting operations	option. This is based on	onsequence Events is asse the number of both cutting place to remove the pipelir	g and lifting operations	The potential for High Consequence option. This is based on the numbe that would need to take place to the Number of Lifts: 8	r of both cutting and lifting operations	The potential for High Co option. This is based on that would need to take p Number of Lifts: 8
	W	W	W		N	N		Ν		
	As the pipelines we legacy risk associa			, there would be no	appropriate depth. There	km of pipelines are trenche e is 483 m of exposed pipe		The majority of the 36.8 km of pipel appropriate depth. There is 483 m		The majority of the 36.8 k
						al snag hazard associated		dumped to mitigate the potential sn	ag hazard associated with these	appropriate depth. There their current state.
ıal Risk					mitigated by spot rock p decommissioning trawl s	lacement designed to be c sweep will be conducted.	overtrawlable. A post-	exposed areas. The areas of rock povertrawlable and a post-decommis	ag hazard associated with these placement will be designed to be sioning trawl sweep will be conducted.	their current state. The survey & monitoring potential snag hazard from
l.5 Residual Risk					mitigated by spot rock p decommissioning trawl s As such, the potential sr	lacement designed to be c sweep will be conducted. nag hazard post-decommis d would be lower than for th	overtrawlable. A post- ssioning activities is	exposed areas. The areas of rock	ag hazard associated with these blacement will be designed to be sioning trawl sweep will be conducted. post-decommissioning activities is	their current state. The survey & monitoring potential snag hazard from
Residual					mitigated by spot rock p decommissioning trawl s As such, the potential sr adequately mitigated and current state of exposure The survey & monitoring	lacement designed to be c sweep will be conducted. nag hazard post-decommis d would be lower than for the e. programme is committed m left in-situ infrastructure	overtrawlable. A post- ssioning activities is he pipelines in their to ensuring that the	exposed areas. The areas of rock povertrawlable and a post-decommis As such, the potential snag hazard adequately mitigated and would be	ag hazard associated with these blacement will be designed to be sioning trawl sweep will be conducted. post-decommissioning activities is lower than for the pipelines in their e is committed to ensuring that the tu infrastructure continues to be	their current state. The survey & monitoring



# Option 1a pipeline ends with hydraulic shears (at each end) & recover (8 x 10 m) ediate snag risk at exposed ends oning survey | Seabed trawl sweep exposure at pipeline ends will be removed with ends, sure will remain In Consequence Events is assessed as Low for this d on the number of both cutting and lifting operations ake place to the pipeline ends only. mber of lifts for the other options. 36.8 km of pipelines is trenched and buried to an There is 483 m of exposed pipeline which will remain in poring programme is committed to ensuring that the rd from left in-situ infrastructure continues to be ad as appropriate.

tigated by rock placement. Option 6 is assessed as re managed as appropriate. n 1a will remain in-situ where there is a minor

			tion 6			Option 4	1 :#\	Option 2a	Ded
	- Unbury pipeline(s	s) with MFE   Reco	val (Cut & Lift) over mattresses an	d grout bags	- Dredge to uncover pipe	Partial Removal (Cut & eline ends	Lity	Leave In-situ (Minor Intervention)     Dredge to uncover pipeline ends	Do N - Dredge to uncover pip
		n sections with hydrogen		a groat bago			h end) & recover (8 x 10 m)	- Cut 10 m section with hydraulic shears (at each end) & recover (8 x 10 m	
l	- Bundle cut section	-				ns into 20 m lengths with		- Place rock to remediate snag risk at exposed ends	- Place rock to remedia
- E	Backfill trench   F	Post decommissio	ning survey   Seab	ed trawl sweep	- Bundle cut sections ar			- Place rock across all remaining exposed sections	- Post decommissionin
						te snag risk at exposed e		- Post decommissioning survey   Seabed trawl sweep	- Note: all areas of exp
					<ul> <li>Post decommissioning</li> <li>Note: all areas of expo</li> </ul>	g survey   Seabed trawl sv osure will be removed	weep	- Note: all areas of exposure will be rock dumped	other areas of exposur
ł					·				
	Vessel Noise (day	/s on-site):  days   CSV - 196		ava Traular 5	Vessel Noise (days on-s	site):   DSV - 6.5 days   Rock I		Vessel Noise (days on-site): Survey Vessel - 3 days   DSV - 4 days   Rock Dump Vessel - 6.6   Trawler	Vessel Noise (days or
	days	uays   CSV - 190	uays   D3 v - 60 ua	ays   Hawler - 5	Trawler - 5 days	D3V - 0.5 days   ROCK	Duritp vessel - 0.5	5 days	- Survey Vesser - Suay
	,				,				
	Tooling Noise:				Tooling Noise:			Tooling Noise:	Tooling Noise:
	MFE for Unburial -	- 15.33 days   Hydr	raulic Shears - 76.	77 days	Dredging - 2 days   Hyd	raulic Shears - 2.34 days	Rock Dumping - 5 days	Dredging - 1 days   Hydraulic Shears - 1.33 days   Rock Dumping - 5 days	Dredging - 2 days   Hy
	Operational Disch	argos:			Operation Discharges:			Operation Discharges:	Operation Discharges
		al for hydrocarbon r	releases through c	utting operations		ydrocarbon releases thro	uah cutting operations	Negligible potential for hydrocarbon releases through cutting operations	Negligible potential for
ļ			•	Planned discharges			fully. Planned discharges	because the pipeline has been cleaned successfully. Planned discharges	because the pipeline h
		within acceptable		•		n acceptable limits and in	, ,	would therefore be within acceptable limits and included in operational	would therefore be wit
	permits. No cuttir	ng swarf as cutting	performed by hyd	raulic shears but	permits. No cutting swa	arf as cutting performed b	y hydraulic shears but	permits. No cutting swarf as cutting performed by hydraulic shears but	permits. No cutting sv
	potential for some	concrete loss.			potential for some conci	rete loss.		potential for some concrete loss.	
	Vaccal Discharge	<u>c</u> .			Vascal Discharges			Vessel Discharges	Vessel Discharges: This includes Ballast
ļ	Vessel Discharges		k Water this is dr	iven by duration of	Vessel Discharges: This includes Ballast G	Frey and Black Water, this	s is driven by duration of	Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of	This includes Ballast, vessel operations and
				will be highest of the	,	aving a less intensive ves	,	vessel operations and having a less intensive vessel usage than the full	removal option, this op
	evaluated options.	0 0				ion will have a lower disch	•	removal option, this option will have a lower discharge than Option 6 but	similar for all other opt
					similar for all other optio	ons.		similar for all other options.	
	W	W	W		N	N		N	
	There will be no le								
		egacy marine impac	cts from this full re	moval option.		km of pipelines is trench		The majority of the 36.8 km of pipelines is trenched and buried to an	
		egacy marine impac	cts from this full re	moval option.	appropriate depth. Ther	re is 483 m of exposed pi		appropriate depth. There is 483 m of exposed pipeline which will be rock	
		gacy marine impa	cts from this full re	moval option.		re is 483 m of exposed pi			
		gacy marine impa	cts from this full re	moval option.	appropriate depth. Ther removed with the cut en	re is 483 m of exposed pi	peline which will be	appropriate depth. There is 483 m of exposed pipeline which will be rock	appropriate depth. Th is.
		gacy marine impa	cts from this full re	moval option.	appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and	re is 483 m of exposed pil ds rock dumped. acts relate to the left in-sit buried, concrete coated,	peline which will be tu materials, i.e. the	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the	appropriate depth. Th is. The legacy marine imp remaining trenched an
		gacy marine impa	cts from this full re	moval option.	appropriate depth. Ther removed with the cut en The legacy marine impa	re is 483 m of exposed pil ds rock dumped. acts relate to the left in-sit buried, concrete coated,	peline which will be tu materials, i.e. the	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the	The majority of the 36. appropriate depth. The is. The legacy marine imp remaining trenched an polymer coated metha
		gacy marine impa	cts from this full re	moval option.	appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and polymer coated methan	re is 483 m of exposed pinds rock dumped. Acts relate to the left in-sit buried, concrete coated, ol pipelines.	peline which will be tu materials, i.e. the steel pipelines, and the	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines.	appropriate depth. The is. The legacy marine imp remaining trenched an polymer coated metha
		gacy marine impa	cts from this full re	moval option.	appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and polymer coated methan Given the buried status	re is 483 m of exposed pil ds rock dumped. acts relate to the left in-sit buried, concrete coated,	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline	appropriate depth. The is. The legacy marine imp remaining trenched an polymer coated methal Given the buried status
		gacy marine impa	cts from this full re	moval option.	appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and polymer coated methan Given the buried status having been cleaned to	re is 483 m of exposed pinds rock dumped. Acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines.	appropriate depth. The is. The legacy marine im remaining trenched an polymer coated method for the buried statul having been cleaned to the second statul second to the second statul s
	S	S	S		appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and polymer coated methan Given the buried status having been cleaned to	re is 483 m of exposed pip ds rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable left	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine	<ul><li>appropriate depth. There is 483 m of exposed pipeline which will be rock dumped.</li><li>The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines.</li><li>Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine</li></ul>	appropriate depth. Th is. The legacy marine imp remaining trenched an polymer coated metha Given the buried statu having been cleaned to
	The assessment of	S of the Legacy Marin	S ne Impact sub-crite	erion is as follows:	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to impact is considered low	re is 483 m of exposed pij dds rock dumped. Acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b>	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N	appropriate depth. The is. The legacy marine impremaining trenched ar polymer coated metha Given the buried statu having been cleaned t impact is considered b
	The assessment of Option 6 is assess	S of the Legacy Marin sed as being Stron	S ne Impact sub-crite nger than all other of	erion is as follows: options as the full rer	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to impact is considered low	re is 483 m of exposed pil dds rock dumped. Acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b>	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option.	appropriate depth. The is. The legacy marine im remaining trenched ar polymer coated metha Given the buried statu having been cleaned t impact is considered
ry	The assessment of Option 6 is assess enough to express	S of the Legacy Marin sed as being Stron s a small preferenc	S ne Impact sub-crite nger than all other of the for the full remov	erion is as follows: options as the full rer val option.	appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and polymer coated methanic Given the buried status having been cleaned to impact is considered low <b>N</b> noval option removes all r	re is 483 m of exposed pil dds rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other o	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N	appropriate depth. The is. The legacy marine im remaining trenched ar polymer coated metha Given the buried statu having been cleaned t impact is considered
Ĩ	The assessment of Option 6 is assess enough to express All other options a	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne	S ne Impact sub-crite ger than all other e for the full remove utral to each othe	erion is as follows: options as the full rer val option.	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> moval option removes all r and types of material and ti	re is 483 m of exposed pil dds rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other o	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N	appropriate depth. The is. The legacy marine im remaining trenched ar polymer coated metha Given the buried statu having been cleaned t impact is considered
ĺ	The assessment of Option 6 is assess enough to express All other options a	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe	S ne Impact sub-crite ger than all other e for the full remove utral to each othe	erion is as follows: options as the full rer ral option. er as the quantities an	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> moval option removes all r and types of material and ti	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left if a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N	appropriate depth. The is. The legacy marine im remaining trenched ar polymer coated metha Given the buried statu having been cleaned t impact is considered expected to be low for t
-	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe	S ne Impact sub-crite ger than all other e for the full remove utral to each othe	erion is as follows: options as the full rer ral option. er as the quantities an	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> moval option removes all r and types of material and the perspective.	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left if a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N tes and types of material in-situ. Whilst the legacy environmental impact is be similar for these options.	appropriate depth. Th is. The legacy marine impremaining trenched ar polymer coated metha Given the buried statu having been cleaned t impact is considered l expected to be low for t
1	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe	S ne Impact sub-crite ger than all other e for the full remove utral to each othe	erion is as follows: options as the full rer ral option. er as the quantities an	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to impact is considered low <b>N</b> noval option removes all r and types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left if a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. <b>N</b> ties and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711	appropriate depth. Th is. The legacy marine imp remaining trenched an polymer coated metha Given the buried statu having been cleaned to impact is considered I expected to be low for the Vessel Emissions (in Fuel: 710 CO2e: 2,328
1	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339 NOx: 459.19	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe	S ne Impact sub-crite ger than all other e for the full remove utral to each othe	erion is as follows: options as the full rer ral option. er as the quantities an	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to impact is considered low <b>N</b> moval option removes all r and types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852 NOX: 51.69	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left if a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. <b>N</b> ies and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711 NOX: 49.12	appropriate depth. Th is. The legacy marine impremaining trenched an polymer coated metha Given the buried statu having been cleaned to impact is considered I expected to be low for the Vessel Emissions (in Fuel: 710 CO2e: 2,328 NOX: 42.18
	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe	S ne Impact sub-crite ger than all other e for the full remove utral to each othe	erion is as follows: options as the full rer ral option. er as the quantities an	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to impact is considered low <b>N</b> noval option removes all r and types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left if a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. <b>N</b> ties and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711	appropriate depth. The is. The legacy marine impremaining trenched an polymer coated metha Given the buried statu: having been cleaned to impact is considered I expected to be low for the Vessel Emissions (in Fuel: 710 CO2e: 2,328
	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339 NOx: 459.19 SO2: 30.92 Vessel Energy Us	S of the Legacy Marin sed as being Strom s a small preferenc are assessed as Ne 6 is the most prefe s (in tonnes):	S ne Impact sub-crite oger than all other e for the full remove utral to each othe erred from a Leg	erion is as follows: options as the full rer ral option. er as the quantities an	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> noval option removes all r nd types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852 NOX: 51.69 SO2: 3.48 Vessel Energy Use: 37,	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme onnes):	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N ies and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711 NOX: 49.12 SO2: 3.31 Vessel Energy Use: 35,561 GJ	appropriate depth. Th is. The legacy marine impremaining trenched ar polymer coated metha Given the buried statu having been cleaned to impact is considered I expected to be low for to Vessel Emissions (in Fuel: 710 CO2e: 2,328 NOX: 42.18 SO2: 2.84
	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339 NOx: 459.19 SO2: 30.92 Vessel Energy Us	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe s (in tonnes): se: 332,409 GJ W	S ne Impact sub-crite oger than all other the full remove utral to each othe terred from a Leg	erion is as follows: options as the full rer ral option. er as the quantities an acy Marine Impact	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> noval option removes all r nd types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852 NOX: 51.69 SO2: 3.48 Vessel Energy Use: 37, <b>N</b>	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme onnes):	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. <b>N</b> ies and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711 NOX: 49.12 SO2: 3.31	appropriate depth. Th is. The legacy marine impremaining trenched an polymer coated metha Given the buried statu having been cleaned to impact is considered I expected to be low for the Vessel Emissions (in Fuel: 710 CO2e: 2,328 NOX: 42.18
	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339 NOx: 459.19 SO2: 30.92 Vessel Energy Us W The assessment of	S of the Legacy Marin sed as being Strom s a small preferenc are assessed as Ne 6 is the most prefe s (in tonnes): se: 332,409 GJ W of the Fuel Use & A	S ne Impact sub-crite oger than all other of earred from a Leg	erion is as follows: options as the full rer ral option. er as the quantities an acy Marine Impact	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> noval option removes all r nd types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852 NOX: 51.69 SO2: 3.48 Vessel Energy Use: 37, <b>N</b> as follows:	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme onnes):	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N ies and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711 NOX: 49.12 SO2: 3.31 Vessel Energy Use: 35,561 GJ N	appropriate depth. Th is. The legacy marine impremaining trenched ar polymer coated metha Given the buried statu having been cleaned to impact is considered I expected to be low for to Vessel Emissions (in Fuel: 710 CO2e: 2,328 NOX: 42.18 SO2: 2.84
Emissions	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339 NOX: 459.19 SO2: 30.92 Vessel Energy Us W The assessment of Option 6 is assess	S of the Legacy Marin sed as being Stron as a small preference are assessed as Ne 6 is the most preference is (in tonnes): se: 332,409 GJ W of the Fuel Use & A sed as being Weat	S ne Impact sub-crite ger than all other of e for the full remove eutral to each othe erred from a Leg W Atmospheric Emiss ker than all other o	erion is as follows: options as the full rer al option. or as the quantities an acy Marine Impact	appropriate depth. Ther removed with the cut en The legacy marine impa remaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> moval option removes all r nd types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852 NOx: 51.69 SO2: 3.48 Vessel Energy Use: 37, <b>N</b> as follows: ed and emissions general	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme onnes):	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N ies and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711 NOX: 49.12 SO2: 3.31 Vessel Energy Use: 35,561 GJ N	appropriate depth. Tr is. The legacy marine im remaining trenched an polymer coated metha Given the buried statu having been cleaned to impact is considered expected to be low for the Vessel Emissions (in Fuel: 710 CO2e: 2,328 NOX: 42.18 SO2: 2.84
Emissions	The assessment of Option 6 is assess enough to express All other options a <b>Overall, Option 6</b> Vessel Emissions Fuel: 7,730 CO2e: 25,339 NOX: 459.19 SO2: 30.92 Vessel Energy Us W The assessment of Option 6 is assess All other options a	S of the Legacy Marin sed as being Stron s a small preferenc are assessed as Ne 6 is the most prefe s (in tonnes): se: 332,409 GJ W of the Fuel Use & A sed as being Weak are assessed as Ne	S ne Impact sub-crite ger than all other of e for the full remove eutral to each othe erred from a Leg W Atmospheric Emissive ker than all other of eutral to each othe	erion is as follows: options as the full rer al option. r as the quantities an acy Marine Impact	appropriate depth. Ther removed with the cut en The legacy marine imparemaining trenched and polymer coated methanic Given the buried status having been cleaned to a impact is considered low <b>N</b> noval option removes all r nd types of material and th <b>perspective.</b> Vessel Emissions (in to Fuel: 870 CO2e: 2,852 NOX: 51.69 SO2: 3.48 Vessel Energy Use: 37, <b>N</b> as follows:	re is 483 m of exposed pill dis rock dumped. acts relate to the left in-sit buried, concrete coated, ol pipelines. of the material being left i a regulatory acceptable le w but greater than the full <b>N</b> material whilst the other of hus the legacy environme onnes):	peline which will be tu materials, i.e. the steel pipelines, and the in-situ and the pipeline evel, the legacy marine removal option. Options leave similar quantiti ental impact is expected to her than for the other option is.	appropriate depth. There is 483 m of exposed pipeline which will be rock dumped. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and the polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeline having been cleaned to a regulatory acceptable level, the legacy marine impact is considered low but greater than the full removal option. N ies and types of material in-situ. Whilst the legacy environmental impact is be similar for these options. Vessel Emissions (in tonnes): Fuel: 827 CO2e: 2,711 NOX: 49.12 SO2: 3.31 Vessel Energy Use: 35,561 GJ N	appropriate depth. T is. The legacy marine in remaining trenched a polymer coated meth Given the buried stat having been cleaned impact is considered expected to be low for Vessel Emissions (ii Fuel: 710 CO2e: 2,328 NOx: 42.18 SO2: 2.84



Option 1a Nothing (Minimum Intervention)
eline ends hydraulic shears (at each end) & recover (8 x 10 m) ate snag risk at exposed ends g survey   Seabed trawl sweep osure at pipeline ends will be removed with ends, e will remain
-site): s   DSV - 5 day   Trawler - 5 days
draulic Shears - 1.33 days
hydrocarbon releases through cutting operations as been cleaned successfully. Planned discharges in acceptable limits and included in operational varf as cutting performed by hydraulic shears.
Grey and Black Water, this is driven by duration of naving a less intensive vessel usage than the full tion will have a lower discharge than Option 6 but ons.
express a small preference for the other options.
8 km of pipelines is trenched and buried to an re is 483 m of exposed pipeline which will be left as-
acts relate to the left in-situ materials, i.e. the d buried, concrete coated, steel pipelines, and the nol pipelines.
of the material being left in-situ and the pipeline a regulatory acceptable level, the legacy marine w but greater than the full removal option.
ese options, there is polymer remaining and this is
onnes):
),536 GJ

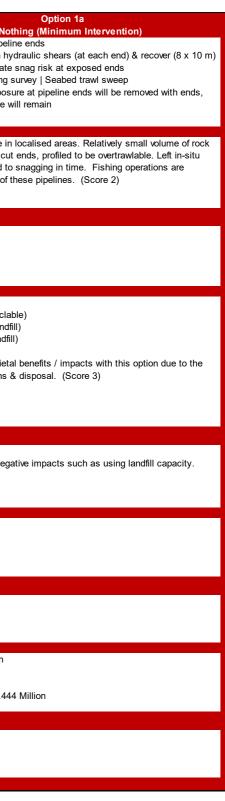
			Opt	tion 6			Option 4		0	otion 2a	
			Full Remova	al (Cut & Lift)			Partial Removal (Cut & L	_ift)	Leave In-situ	Minor Intervention)	Do I
			) with MFE   Recov		d grout bags	- Dredge to uncover pipe			- Dredge to uncover pipeline ends		- Dredge to uncover pip
			n sections with hyd	fraulic shears			hydraulic shears (at each			hears (at each end) & recover (8 x 10 m	·
		- Bundle cut section		ing our my I Cook	ad travel average	<ul> <li>Cut all exposed section</li> <li>Bundle cut sections and</li> </ul>	ns into 20 m lengths with	hydraulic shears	- Place rock to remediate snag risk	•	- Place rock to remedia
		- Backfill trench   P	Post decommission	ning survey   Seab	ed trawl sweep			ada	- Place rock across all remaining e		<ul> <li>Post decommissionir</li> <li>Note: all areas of exp</li> </ul>
							te snag risk at exposed er g survey   Seabed trawl sw		<ul> <li>Post decommissioning survey   S</li> <li>Note: all areas of exposure will be</li> </ul>	•	other areas of exposure
						- Note: all areas of expos		leeb	- Note: all aleas of exposure will be	lock dumped	other areas of exposure
펄	s	Material Emissions	s (CO2 in tonnes):			Material Emissions (CO	2 in tonnes):		Material Emissions (CO2 in tonnes	):	Material Emissions (Co
ien	ion	Recovered Materia				Recovered Material: 124			Recovered Material: 21		Recovered Material: 21
mn	br th	Remaining Materia	al: N/A			Remaining Material: 13,3	343		Remaining Material: 13,488		Remaining Material: 13
viro	2.4 Other nsumptio	Total: 9,685				Total: 13,467			Total: 13,510		Total: 13,510
ш		Rock: N/A				Rock: 2,750 tonnes			Rock: 5,040 tonnes		Rock: 200 tonnes
°i	Ū		-								
		S	S	N	in in an falloway	N	W		W		
		The assessment o		•		ara is no requirement for r	ock in Ontion 6 vorsus a r	oquiromont for a roasonah	le amount of rock in Ontion 4 and O	otion 2a. Option 6 is assessed as being	Noutral to Ontion 1a as
				• •						terial and / or to produce replacement m	
						sumption for each option.			in the second		
Sur	mmary	Option 4 is assess	ed as being Neutra	al to Option 2a as	whilst there are diffe	rences between the quant	tity of rock consumed bet	ween the options, the diffe	erential was considered insufficient to	express a preference. Option 4 is asse	essed as being Weaker t
		reasonable amount	t rock in Option 4 v	versus a very smal	Il amount of rock in 0	Option 1a.					
						nore rock required in Optic					
		Overall, Option 6	and Option 1a a	re equally prefer	rred from an Other	Consumptions perspect	tive.				
a l	ø	Short Term Disturb	ance (MFE): 181.5	555 m2		There is a small amount	t of short-term disturbance	e resulting from removing	There is limited short-term disturba	nce from rock dumping the 483 m of	There is limited short-to
Environmental	5 Disturbance						along these lines and rock	• •	exposed pipelines for this option.	···· · · · · · · · · · · · · · · · · ·	rock dump only.
Ĕ	rba					This is considered insign	nificant.				
Ior	stu										
N.	ā										
2. E	5.5										
		MW	MW	MW		N	N		N		
		The assessment o	f the Seabed Distu	Irbance (short-term	n impact) sub-criterio	on is as follows:					
Sur		The assessment o Option 6 is assess	f the Seabed Distu sed as being Much	irbance (short-term Weaker than all o	other options due to t	on is as follows: the large area of seabed d	listurbance from the unbur		ines using a Mass Flow Excavator w	hen compared to the small area of low ir	npact disturbance with th
Sur	mmary	The assessment o Option 6 is assess Option 4, Option 2	f the Seabed Distu sed as being Much a and Option 1a ar	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	on is as follows: the large area of seabed d ch other as the seabed dis	listurbance from the unbur sturbance is considered ne		ines using a Mass Flow Excavator w	hen compared to the small area of low ir	npact disturbance with th
Sur	mmary	The assessment o Option 6 is assess Option 4, Option 2	f the Seabed Distu sed as being Much a and Option 1a ar	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	on is as follows: the large area of seabed d	listurbance from the unbur sturbance is considered ne		ines using a Mass Flow Excavator w	hen compared to the small area of low ir	npact disturbance with ti
	mmary	The assessment o Option 6 is assess Option 4, Option 2	f the Seabed Distu sed as being Much a and Option 1a and b, <b>Option 2a and C</b>	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	on is as follows: the large area of seabed d ch other as the seabed dis	listurbance from the unbur sturbance is considered ne e perspective.		ines using a Mass Flow Excavator w		
	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b>	f the Seabed Distu sed as being Much a and Option 1a and b, <b>Option 2a and C</b>	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b>	listurbance from the unbur sturbance is considered ne e perspective.		ines using a Mass Flow Excavator w s these options.		
	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b>	f the Seabed Distu sed as being Much a and Option 1a and b, <b>Option 2a and C</b>	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b>	listurbance from the unbur sturbance is considered ne e perspective.		ines using a Mass Flow Excavator w s these options.		
	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b>	f the Seabed Distu sed as being Much a and Option 1a and b, <b>Option 2a and C</b>	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b>	listurbance from the unbur sturbance is considered ne e perspective.		ines using a Mass Flow Excavator w s these options.		npact disturbance with th Habitat Loss (Rockdun
Environmental	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b>	f the Seabed Distu sed as being Much a and Option 1a and b, <b>Option 2a and C</b>	irbance (short-term Weaker than all o re all assessed as	other options due to the being Neutral to each	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b>	listurbance from the unbur sturbance is considered ne e perspective.		ines using a Mass Flow Excavator w s these options.		
	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock	f the Seabed Distu sed as being Much a and Option 1a arc <b>, Option 2a and C</b> kdump): N/A	rbance (short-term Weaker than all o re all assessed as <b>Option 1a are eq</b>	other options due to the being Neutral to each	n is as follows: the large area of seabed d ch other as the seabed dis <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump	listurbance from the unbur sturbance is considered ne e perspective. p): 2,200 m2		ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m		
Environmental	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and C</b> kdump): N/A	rbance (short-term Weaker than all o re all assessed as Option 1a are equ	ther options due to t being Neutral to eac ually preferred from	n is as follows: the large area of seabed d ch other as the seabed dis <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump	listurbance from the unbur sturbance is considered ne e perspective.		ines using a Mass Flow Excavator w s these options.		
Environmental	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock S The assessment o	f the Seabed Distu sed as being Much a and Option 1a arc , <b>Option 2a and C</b> kdump): N/A <b>S</b> f the Loss of Habita	rbance (short-term Weaker than all o re all assessed as Option 1a are equination of the second S at (legacy / long-te	ther options due to the being Neutral to each ually preferred from the	n is as follows: the large area of seabed d ch other as the seabed dis <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump <b>S</b> erion is as follows:	listurbance from the unbur sturbance is considered ne e perspective. p): 2,200 m2	egligible and similar acros	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m	2	Habitat Loss (Rockdun
Environmental	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock <b>S</b> The assessment o Option 6 is assess	f the Seabed Distu sed as being Much a and Option 1a arc , <b>Option 2a and C</b> kdump): N/A <b>S</b> f the Loss of Habita sed as being Strong	Veaker than all of Weaker than all of re all assessed as Option 1a are equination S at (legacy / long-te ger than Option 4,	ther options due to the being Neutral to each ually preferred from ually preferred from the preferred from the preferred from the preferred states of the preferred from the preferred f	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump <b>S</b> erion is as follows: on 1a as the rock placed in	listurbance from the unbur sturbance is considered ne e perspective. p): 2,200 m2 W n each of these options cl	egligible and similar acros	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area	2 of habitat loss whereas there is no habit	Habitat Loss (Rockdun
2. Environmental	mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock <b>S</b> The assessment o Option 6 is assess Option 4 is assess	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and C</b> ( <b>Option 2a and C</b> ( <b>Markov</b> ): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Strong	rbance (short-term Weaker than all o re all assessed as Option 1a are equination S at (legacy / long-te ger than Option 4, ger than Option 2a	ther options due to the being Neutral to each ually preferred from ually preferred from the preferred from the preferred from the preferred state and option 2a and Option 2a and Option as the area of habit	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump <b>S</b> erion is as follows: on 1a as the rock placed in tat loss in Option 2a is gree	listurbance from the unbur sturbance is considered ne e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Optio	egligible and similar acros hanges the current seabed on 4 is assessed as being	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area	2	Habitat Loss (Rockdun
2. Environmental	2.6 Loss of Habitat Mumary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock Mathematics) The assessment o Option 6 is assess Option 4 is assess Option 2a is assess	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and C</b> (Mump): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Wea	S at (legacy / long-te ger than Option 1a aker than Option 1a at seessed as sphion 1a are equination at see than Option 4, ger than Option 1a	ther options due to the being Neutral to each ually preferred from ually preferred from the preferred from the preferred from the preferred state and option 2a and Option 2a and Option as the area of habit	n is as follows: the large area of seabed dist other as the seabed dist <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump Babilat Loss (Rockdump and Loss (Rockdump Serion is as follows: on 1a as the rock placed in that loss in Option 2a is great tat loss in Option 2a is more	listurbance from the unbur sturbance is considered ne e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Optio	egligible and similar acros hanges the current seabed on 4 is assessed as being	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area	2 of habitat loss whereas there is no habit	Habitat Loss (Rockdun
2. Environmental	2.6 Loss of Habitat mmary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock Detion 6 is assess Option 4 is assess Option 2 is assess Note: Habitat loss	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Wea is from the replace	S at (legacy / long-te ger than Option 2 ker than Option 3 ker than Option 3 ker than Option 4 ker than 0 ker than 0	erm impact) sub-crite Option 2a and Option as the area of habit a as the area of habit	n is as follows: the large area of seabed dis in a Seabed Disturbance Habitat Loss (Rockdump Babitat Loss (Rockdump Serion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is ma ard substrate (rock).	listurbance from the unbur sturbance is considered ne e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Optio	egligible and similar acros hanges the current seabed on 4 is assessed as being	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area	2 of habitat loss whereas there is no habit	Habitat Loss (Rockdun
2. Environmental G	mmary 2.6 Loss of Habitat Manary	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock S The assessment o Option 6 is assess Option 4 is assess Note: Habitat loss <b>Overall, Option 6</b>	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and C</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Strong sed as being Wea is from the replace <b>is the most prefe</b>	S at (legacy / long-te ger than Option 1a are equilation at (legacy / long-te ger than Option 1a exerced from a Loss	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit bank features with ha s of Habitat perspe	n is as follows: the large area of seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Babilitat Loss (Rockdump and the seabed Disturbance Habitat Loss (Rockdump Babilitat Loss (Rockdump and seabed Disturbance Babilitat Loss (Rockdump Babilitat Loss (Rockdump Babi	iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Option uch greater than Option 1:	egligible and similar acros hanges the current seaber on 4 is assessed as being a.	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of h	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller	Habitat Loss (Rockdun at loss in Option 6.
2. Environmental G	mmary 2.6 Loss of Habitat Manary	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock <b>S</b> The assessment o Option 6 is assess Option 4 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b>	f the Seabed Distu sed as being Much a and Option 1a are <b>, Option 2a and C</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Strong sed as being Strong sed as being Mea is from the replace <b>: is the most prefe</b> : Cutting using hyd	S at (legacy / long-te ger than Option 1a are equilable at (legacy / long-te ger than Option 1a are equilable at than Option 1a are than O	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit a onk features with has s of Habitat perspe	n is as follows: the large area of seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Barion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is mard substrate (rock). ctive.	iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl eater than Option 4. Option uch greater than Option 1. ting using hydraulic shears	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of h <b>Concept Maturity:</b> All operations	2 of habitat loss whereas there is no habit	Habitat Loss (Rockdun at loss in Option 6. than Option 4.
2. Environmental G	mmary 2.6 Loss of Habitat Manary	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock S The assessment o Option 6 is assess Option 4 is assess Note: Habitat loss <b>Overall, Option 6</b>	f the Seabed Distu sed as being Much a and Option 1a are <b>, Option 2a and C</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Strong sed as being Strong sed as being Mea is from the replace <b>: is the most prefe</b> : Cutting using hyd	S at (legacy / long-te ger than Option 1a are equilable at (legacy / long-te ger than Option 1a are equilable at than Option 1a are than O	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit a onk features with has s of Habitat perspe	n is as follows: the large area of seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Barion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is mard substrate (rock). ctive.	iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Option uch greater than Option 1:	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of h	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller	Habitat Loss (Rockdun
2. Environmental G	mmary 2.6 Loss of Habitat Manary	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock <b>S</b> The assessment o Option 6 is assess Option 4 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b>	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Strong sed as being Wea is from the replace is from the replace is from the replace cutting using hyd ameter is considered	S at (legacy / long-te ger than Option 1a are equiver than all of a are equiver at (legacy / long-te ger than Option 1a are than Option 2a iker than Option 2a iker than Option 2a iker than Option 2a are than Option 2a are than Option 2a are than Option 2a iker than Option 2a are than Option 2a iker than Option 2a are than Option 2a ar	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit a as the area of habit a of Habitat perspe concrete coated 3)	n is as follows: the large area of seabed d th other as the seabed dis <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump Habitat Loss (Rockdump serion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is mo ard substrate (rock). ctive. Concept Maturity: Cutt pipelines of this diamete	iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl eater than Option 4. Option uch greater than Option 1. ting using hydraulic shears	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated Score 3)	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of th Concept Maturity: All operations routine. (Score 3)	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3)
fechnical 2. Environmental 6	Technical 2.6 Loss of Alama assibility Habitat	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock Define 6 is assess Option 6 is assess Option 2 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Strong sed as being Wea is from the replace <b>is the most prefe</b> :: Cutting using hyd ameter is considered	S at (legacy / long-te ger than Option 1a are equilation at (legacy / long-te ger than Option 2a aker than Option 1a ament of the sandte arred from a Loss draulic shears for c ed routine. (Score	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit bank features with ha <b>s of Habitat perspe</b> concrete coated 3) moval by unburial	n is as follows: the large area of seabed dist the large area of seabed dist a Seabed Disturbance Habitat Loss (Rockdump Babitat Loss (Rockdump at Loss (Rockdump at loss in Option 2a is great tat loss in Option 2a is great tat loss in Option 2a is marked at loss in Option 2a	Iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Option uch greater than Option 1: ting using hydraulic shears er is considered routine. (S	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of th Concept Maturity: All operations routine. (Score 3)	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3)
fechnical 2. Environmental 6	mmary 2.6 Loss of Habitat Manary	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock The assessment o Option 6 is assess Option 4 is assess Option 2 a is asses Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks</b> :	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A f the Loss of Habita sed as being Strong sed as being Strong sed as being Strong sed as being Wea is from the replace is from the replace is the most prefe cutting using hyd ameter is considered Risk to successfull the pipeline due to the	S at (legacy / long-te ger than Option 1a ger than Option 1a ger than Option 2a aker than Option 2a aker than Option 2a arred from a Loss draulic shears for c ed routine. (Score ly achieving full rei the long durations	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit bank features with ha <b>s of Habitat perspe</b> concrete coated 3) moval by unburial	n is as follows: the large area of seabed dist the large area of seabed dist a Seabed Disturbance Habitat Loss (Rockdump Babitat Loss (Rockdump at Loss (Rockdump at loss in Option 2a is great tat loss in Option 2a is great tat loss in Option 2a is marked at loss in Option 2a	Iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl eater than Option 4. Option uch greater than Option 1. ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of	Ines using a Mass Flow Excavator was these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of h Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi
fechnical 2. Environmental 6	Technical 2.6 Loss of Alama assibility Habitat	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock Detion 6 is assess Option 6 is assess Option 2 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks:</b> and cut and lift of t	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Strong sed as being Strong sed as being Wea is from the replace <b>is the most prefe</b> : Cutting using hyd ameter is considered Risk to successfull the pipeline due to to seen unburial issue	S at (legacy / long-te ger than Option 1a ger than Option 1a ger than Option 2a aker than Option 2a aker than Option 2a arred from a Loss draulic shears for c ed routine. (Score ly achieving full rei the long durations	erm impact) sub-crite option 2a and Optio a as the area of habit a as the area of habit bank features with ha <b>s of Habitat perspe</b> concrete coated 3) moval by unburial	n is as follows: the large area of seabed dist of the ras the seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Habitat Loss (Rockdump as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is marked substrate (rock). ctive. Concept Maturity: Cutt pipelines of this diamete Technical Risks: Limite pipeline sections as the therefore no unburial risk	Iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Option uch greater than Option 1: ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of	ines using a Mass Flow Excavator w s these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of h Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica and short duration of work scopes.	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi
fechnical 2. Environmental 6	Technical 2.6 Loss of Alama assibility Habitat	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock The assessment o Option 6 is assess Option 2 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks</b> : and cut and lift of t potential for unfore	the Seabed Distu a and Option 1a and <b>Option 2a and O</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b>	S at (legacy / long-te ger than Option 1a are equivalent at (legacy / long-te ger than Option 4, ger than Option 1a aker than Option 1a aker than Option 1a aker than Option 1a aker than Option 1a before a Loss draulic shears for c ed routine. (Score ly achieving full reat the long durations es. (Score 2) W	erm impact) sub-crite option 2a and option a as the area of habit a as the area of habit a as the area of habit ank features with has sof Habitat perspe- concrete coated 3) moval by unburial involved and the	n is as follows: the large area of seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Habitat Loss (Rockdump Serion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is great tat loss in Option 2a is great tat loss in Option 2a is me ard substrate (rock). ctive. Concept Maturity: Cutt pipelines of this diamete Technical Risks: Limite pipeline sections as the	Iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl eater than Option 4. Option uch greater than Option 1. ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo	egligible and similar acros hanges the current seabed on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of	Ines using a Mass Flow Excavator was these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of h Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi
fechnical 2. Environmental 6	Technical 2.6 Loss of Alama assibility Habitat	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock The assessment o Option 6 is assess Option 2 a is assess Option 2 a is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks:</b> and cut and lift of t potential for unfore: <b>W</b> The assessment o	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Strong sed as being Strong sed as being Strong research as being Wea is from the replace <b>is the most prefe</b> cutting using hyd ameter is considered Risk to successfull the pipeline due to to seen unburial issue <b>W</b> f the Technical Ris	S at (legacy / long-te ger than Option 1a are equivary at (legacy / long-te ger than Option 1, ger than Option 2, aker than Option 2, aker than Option 2, aker than Option 2, ger than Option 2, aker than Aker than	erm impact) sub-crite option 2a and option a as the area of habit a as the area of habit a as the area of habit a sof Habitat perspection concrete coated 3) moval by unburial involved and the	n is as follows: the large area of seabed dist other as the seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Habitat Loss (Rockdump Serion is as follows: on 1a as the rock placed in tat loss in Option 2a is great and substrate (rock). ctive. Concept Maturity: Cutt pipelines of this diamete pipeline sections as the therefore no unburial risk N	iisturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl eater than Option 4. Option uch greater than Option 1: ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo k. (Score 3) N	egligible and similar acros hanges the current seaber on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of oved are already exposed	ines using a Mass Flow Excavator was these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of the Weaker than Option 1a as area of the Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica and short duration of work scopes. N	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi and short duration of w
3. Technical 2. Environmental	Technical 2.6 Loss of Alama assibility Habitat	The assessment o Option 6 is assess Option 4, Option 2: <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock The assessment o Option 6 is assess Option 2 is assess Option 2 is assess <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks:</b> and cut and lift of t potential for unfore <b>W</b> The assessment o Option 6 is assess Option 6 is assess	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Strong sed as being Strong sed as being Wea is from the replace <b>is the most prefe</b> cutting using hyd ameter is considered Risk to successfull the pipeline due to to seen unburial issue <b>W</b> f the Technical Ris sed as being Weak	S At (legacy / long-te ger than Option 1a are equivary at (legacy / long-te ger than Option 4, ger than Option 1a ament of the sandte berred from a Loss draulic shears for c ed routine. (Score ly achieving full rei the long durations es. (Score 2) W at sub-criterion is a ter than all other option ter ter than all other option ter ter ter ter ter ter ter ter ter ter	erm impact) sub-crite option 2a and Option a as the area of habit a as the area of habit a as the area of habit a as the area of habit concrete coated 3) moval by unburial involved and the as follows: ptions as Option 6 fa	n is as follows: the large area of seabed dist other as the seabed dist in a Seabed Disturbance Habitat Loss (Rockdump Habitat Loss (Rockdump Serion is as follows: on 1a as the rock placed in tat loss in Option 2a is great and substrate (rock). ctive. Concept Maturity: Cutt pipelines of this diamete pipeline sections as the therefore no unburial risk N	isturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 W n each of these options cl eater than Option 4. Option uch greater than Option 1: ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo k. (Score 3) N	egligible and similar acros hanges the current seaber on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of oved are already exposed to gain access to perform	ines using a Mass Flow Excavator was these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of the Weaker than Option 1a as area of the Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica and short duration of work scopes. N	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required (Score 3)	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi and short duration of w
3. Technical 2. Environmental	3.1 Technical 2.6 Loss of Habitat Arammeter Habitat Arammeter Ar	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock The assessment o Option 6 is assess Option 4 is assess Option 2 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks:</b> and cut and lift of t potential for unfore <b>W</b> The assessment o Option 6 is assess Option 2 is assess Option 4 is assess Option 6 is assess Option 6 is assess Option 6 is assess Option 7 is assess Option 7 is assess	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Strong sed as being Wea is from the replace <b>is the most prefe</b> r: Cutting using hyd ameter is considered Risk to successfull the pipeline due to seen unburial issue <b>W</b> f the Technical Ris sed as being Weak sed as being Weat sed as being Weat	S at (legacy / long-te ger than Option 1a are equilation of the sandte are all assessed as option 1a are equilation at (legacy / long-te ger than Option 2a at (legacy / long-te ger than Option 1a at sub-criterion is a at to Option 1a as	erm impact) sub-crite option 2a and Option a sthe area of habit a as the area of habit a as the area of habit a sthe area of habit bank features with ha <b>s of Habitat perspe</b> concrete coated 3) moval by unburial involved and the as follows: ptions as Option 6 fe 2a and Option 1a as s the concept maturi	n is as follows: the large area of seabed dish other as the seabed dish other as the seabed dish <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump Habitat Loss (Rockdump <b>S</b> arion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is great tat loss in Option 2a is great tat loss in Option 2a is me ard substrate (rock). ctive. Concept Maturity: Cutt pipelines of this diameter therefore no unburial risk <b>N</b> acces challenges in perform the concept maturity and ty and technical risks are	isturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl aater than Option 4. Option uch greater than Option 1. ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo k. (Score 3) N ning the unburial required to technical risks are considered similar.	egligible and similar acros hanges the current seaber on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of oved are already exposed to gain access to perform	ines using a Mass Flow Excavator was these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of the Weaker than Option 1a as area of the Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica and short duration of work scopes. N	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required (Score 3)	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi and short duration of w
3. Technical 2. Environmental	3.1 Technical 2.6 Loss of Habitat Arammeter Habitat Arammeter Ar	The assessment o Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> Habitat Loss (Rock Habitat Loss (Rock The assessment o Option 6 is assess Option 4 is assess Option 2 is assess Note: Habitat loss <b>Overall, Option 6</b> <b>Concept Maturity</b> pipelines of this dia <b>Technical Risks:</b> and cut and lift of t potential for unfore <b>W</b> The assessment o Option 6 is assess Option 2 is assess Option 4 is assess Option 6 is assess Option 6 is assess Option 6 is assess Option 7 is assess Option 7 is assess	f the Seabed Distu sed as being Much a and Option 1a and <b>Option 2a and O</b> kdump): N/A <b>S</b> f the Loss of Habita sed as being Strong sed as being Strong sed as being Wea is from the replace <b>is the most prefe</b> r: Cutting using hyd ameter is considered Risk to successfull the pipeline due to seen unburial issue <b>W</b> f the Technical Ris sed as being Weak sed as being Weat sed as being Weat	S at (legacy / long-te ger than Option 1a are equilation of the sandte are all assessed as option 1a are equilation at (legacy / long-te ger than Option 2a at (legacy / long-te ger than Option 1a at sub-criterion is a at to Option 1a as	erm impact) sub-crite option 2a and Option a sthe area of habit a as the area of habit a as the area of habit a sthe area of habit bank features with ha <b>s of Habitat perspe</b> concrete coated 3) moval by unburial involved and the as follows: ptions as Option 6 fe 2a and Option 1a as s the concept maturi	n is as follows: the large area of seabed dish other as the seabed dish <b>n a Seabed Disturbance</b> Habitat Loss (Rockdump <b>S</b> erion is as follows: on 1a as the rock placed in at loss in Option 2a is great tat loss in Option 2a is me ard substrate (rock). ctive. <b>Concept Maturity:</b> Cutt pipelines of this diamete <b>Technical Risks:</b> Limite pipeline sections as the therefore no unburial risk <b>N</b> aces challenges in perform the concept maturity and	isturbance from the unbur sturbance is considered no e perspective. p): 2,200 m2 w n each of these options cl aater than Option 4. Option uch greater than Option 18 ting using hydraulic shears er is considered routine. (S ed technical risks from cut areas being cut and remo k. (Score 3) N ning the unburial required to technical risks are considered similar.	egligible and similar acros hanges the current seaber on 4 is assessed as being a. s for concrete coated Score 3) tting and removal of oved are already exposed to gain access to perform	ines using a Mass Flow Excavator was these options. Habitat Loss (Rockdump): 5,000 m W d habitat and thus results in an area Weaker than Option 1a as area of the Weaker than Option 1a as area of the Concept Maturity: All operations routine. (Score 3) Technical Risks: Limited technica and short duration of work scopes. N	2 of habitat loss whereas there is no habit abitat loss in Option 1a is much smaller to deliver this option are considered I risks due to the limited cutting required (Score 3)	Habitat Loss (Rockdun at loss in Option 6. than Option 4. Concept Maturity: All routine. (Score 3) Technical Risks: Limi and short duration of w



Option 1a Nothing (Minimum Intervention)
peline ends h hydraulic shears (at each end) & recover (8 x 10 m) ate snag risk at exposed ends ng survey   Seabed trawl sweep posure at pipeline ends will be removed with ends, re will remain
O2 in tonnes): 1 3,488
whilst there is a small amount of rock required in considered insignificant in terms of this assessment. than Option 1a as there is a requirement for a
term disturbance for this option from the small area of
he other options.
mp): 160 m2
l operations to deliver this option are considered
,
ited technical risks due to the limited cutting required vork scopes. (Score 3)
1a.

			otion 6			Option 4	160	Optio		
			val (Cut & Lift)		P - Dredge to uncover pipe	artial Removal (Cut & L	.ift)	Leave In-situ (Min	ior Intervention)	Do Not
	- Bundle cut section	pipe into 20m sections with hydraulic shears dle cut sections and recover kfill trench   Post decommissioning survey   Seabed trawl sweep			•			<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10 m section with hydraulic sheat</li> <li>Place rock to remediate snag risk at</li> <li>Place rock across all remaining expose</li> <li>Post decommissioning survey   Seabe</li> <li>Note: all areas of exposure will be roce</li> </ul>	exposed ends sed sections ed trawl sweep	<ul> <li>Dredge to uncover pipelir</li> <li>Cut 10m section with hyd</li> <li>Place rock to remediate</li> <li>Post decommissioning s</li> <li>Note: all areas of exposu other areas of exposure with</li> </ul>
8	the pipelines distu operations. The in	rbs (displacement npact is low due t	abed, the operationa and restricted acce o the relatively short onducted in the area	ess) current fishing	infrastructure may lead to	n localised areas. Relative s in intermittent rock piles o snagging in time. Fishi these pipelines. (Score 2	. Left in-situ ng operations are	Short term disturbance in localised are covering installed over exposures, profil infrastructure may lead to snagging in t conducted in the area of these pipeline	led to be overtrawlable. Left in-situ time. Fishing operations are	Short term disturbance in covering installed over cut infrastructure may lead to conducted in the area of th
	W	W	W		N	N		N		
es		d; Option 2a and d: ss (recyclable) onnes (landfill) es (landfill)	Option 1a are the		from a Societal impact Materials Returned: Steel: 68 tonnes (recycla Concrete: 53 tonnes (land Polymer: 4 tonnes (landf	on Fishing perspective able) dfill)	· · · · · · · · · · · · · · · · · · ·	shing industry as the improvement to fis Materials Returned: Steel: 12 tonnes (recyclable) Concrete: 9 tonnes (landfill) Polymer: 1 tonnes (landfill) There are minimal societal benefits / im		idered negligible. Materials Returned: Steel: 12 tonnes (recyclab Concrete: 9 tonnes (landfill) Polymer: 1 tonnes (landfill) There are minimal societal
	tonnage of recycla	ble steel, this is n inated and hard to	afits from the returnin nore than offset by t o segregate concrete (Score 2)	he significant	minimal onshore returns	& disposal. (Score 3)		minimal onshore returns & disposal. (\$ N	Score 3)	minimal onshore returns &
nary	The assessment of Note: Assessment Option 6 is assess All other options a	f the Societal imp t of the societal in sed as being Wea re assessed as be	hact on Other Users npact of options is d ker than all other op eing Neutral to each	ominated by any ne tions due to the larg other as the positiv	ollows: gative impacts from mater	rial returned as the positiv ted and difficult to segreg enefits are similar.	ate concrete and polymer	able material or any job creation / retent that are likely to end up in landfill. £3.113 Million	tion offered by an option is considered	d less significant than negat £2.871 Million
term Costs										
	MW	MW	MW		Ν	N		Ν		
ary	Option 6 is assess All other options a	sed as being Mucl re assessed as be	eing Neutral to each	her options as the o other as the costs	costs are more than ten tir are around the same. n a Short-term Cost pers	C C				
	Surveys: N/A FLTC: N/A				Surveys: £0.333 Million FLTC: N/A			Surveys: £0.334 Million FLTC: N/A		Surveys: £0.334 Million FLTC: £0.11 Million
5.2 tern	Total Legacy Cost	: £0 Million			Total Legacy Cost: £0.33	33 Million		Total Legacy Cost: £0.334 Million		Total Legacy Cost: £0.444
	S	S	S		Ν	N		Ν		
	The assessment of									







1.1 Personnel Offshore	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	s	N	N	N	27.3%

1.2 Personnel Onshore	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	VMW	vмw	4.9%
Option 4 Partial Removal (Cut & Lift)	MS	N	w	w	20.8%
Option 2a Leave In-situ (Minor Intervention)	VMS	S	N	N	37.1%
Option 1a Do Nothing (Minimum Intervention)	VMS	S	N	N	37.1%

1.3 Other Users	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

2.1 Operational Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

1.4 High Consequence Events	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

1.5 Residual Risk	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lifi	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	MS	38.1%
Option 4 Partial Removal (Cut & Lift)	w	N	N	s	23.6%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	S	23.6%
Option 1a Do Nothing (Minimum Intervention)	MW	w	w	N	14.7%

t)



2.2 Legacy Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	w	N	N	N	22.2%

2.3 Fuel Use & Atmospheric Emissions	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

¢

2.4 Other Consumptions	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
	Full	Partial	Le	Do	
Option 6 Full Removal (Cut & Lift)	N	S	S	N	30.0%
Option 4 Partial Removal (Cut & Lift)	W	N	N	w	20.0%
Option 2a Leave In-situ (Minor Intervention)	W	N	N	w	20.0%
Option 1a Do Nothing (Minimum Intervention)	N	S	S	N	30.0%

2.5 Disturbance	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	MW	MW	10.0%
Option 4 Partial Removal (Cut & Lift)	MS	N	N	N	30.0%
Option 2a Leave In-situ (Minor Intervention)	MS	N	N	N	30.0%
Option 1a Do Nothing (Minimum Intervention)	MS	N	N	N	30.0%

2.6 Loss of Habitat	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.0%
Option 4 Partial Removal (Cut & Lift)	w	N	s	w	22.0%
Option 2a Leave In-situ (Minor Intervention)	w	w	N	w	18.0%
Option 1a Do Nothing (Minimum Intervention)	W	S	S	N	27.0%

3.1 Technical Feasibility	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	s	N	N	N	27.3%

CHRYSAOR

4.1 Fishing	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

4.2 Communities / Ammenities	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

intervention					
5.2 Long-term Costs	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	w	N	N	N	22.2%



Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
MW	MW	MW	10.0%
N	И	И	30.0%
N	N	N	30.0%
N	N	N	30.0%

n 6 (Cut & Lift)

Option Full Removal (

Ν

MS

MS

MS

5.1 Short-term

Costs

Option 6 Full Removal (Cut & Lift)

Option 4

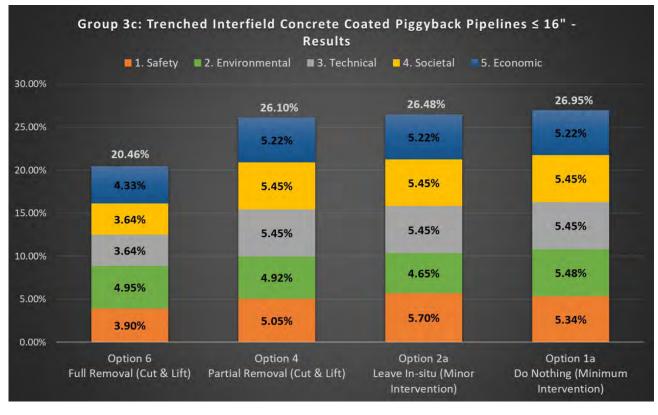
Partial Removal (Cut & Lift)

Option 2a Leave In-situ (Minor

Intervention)

Option 1a Do Nothing (Minimum Intervention)





# Appendix F.3 Group 3c Results Chart



# Appendix F.4 Group 3c Detailed Evaluation Discussion

### Appendix F.4.1 Safety – Personnel Offshore

The assessment of the options indicated that Option 1a, leave in-situ with minimum intervention, Option 2a, leave in-situ with minor intervention and Option 4, partial removal by cut & lift to be the equal most attractive options against the Personnel Offshore sub-criterion. This was due to these options having similar duration offshore scopes, all of which are significantly shorter than the full removal option, where the full 36 km of pipelines would be removed.

Option 6, the full removal option by cut and lift was considered the least attractive option due to the greater safety risk associated with the longer durations to cut the pipelines into short sections and recover.

# Appendix F.4.2 Safety – Personnel Onshore

As with previous assessments, the safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. The leave in-situ options (Option 1a and 2a) were considered equally preferred as the quantity of material from removing the pipeline ends is the same in both options.

The partial removal option (Option 4) returns more material for onshore handling, transportation and processing from the removed exposures which made this option marginally less preferred to the leave in-situ options.

The full removal option (Option 6) returns significantly more material for onshore handling, transportation and processing, than the leave in-situ or partial removal options as the full 36 km of pipelines are retuned. As such, the full removal option is assessed as being significantly less attractive than the leave in-situ or partial removal options.

# Appendix F.4.3 Safety – Other Users

The assessment of the decommissioning options against this criterion has indicated that all options except Option 6, full removal by cut & lift are equally preferred as they have a similar, low impact on the safety of other users as the vessel days and transits to and from port is similar in these options.

Option 6 is considered to have a higher impact on the safety of other users and therefore is less preferred as there are more vessel days associated with the extended work scope and, more significantly, a much higher number of transits to and from port.

# Appendix F.4.4 Safety – High Consequence Events

The assessment during the workshop indicated that the partial removal and leave in-situ options would have the least exposure to potential for High Consequence Events and would therefore, be the most attractive against this criterion. This is due to the limited cut and lift operations to recover the pipeline end sections in Option 1a and Option 2a with the increased number of cut and lift operations to remove the exposures in Option 4 being insufficient to differentiate from a potential for High Consequence Events perspective.

Option 6 would be exposed to a greater potential for a dropped object as there is significantly more lifting associated with the recovery of the entire 36 km of pipelines in sections.



# Appendix F.4.5 Safety – Residual Risk

The residual risk relates to the potential for any safety impact from the decommissioning options. Option 6 is assessed as the most attractive option from a residual safety risk perspective as it is a full removal option and therefore removes all residual risk.

Option 4 and Option 2a were assessed as being equally attractive from a residual risk perspective as the removal of the exposures in Option 4 or the rock placement over the exposures in Option 2a were considered to provide similar mitigation of any potential residual risk.

Option 1a was assessed as the least attractive option against this criterion due to the existing pipeline exposures remaining in this option.

It should be noted that, as part of any partial removal or leave in-situ solution being selected, any potential hazards along the pipeline would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

# Appendix F.4.6 Safety – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from a safety perspective is Option 2a, followed closely by Option 1a. These options were assessed as being equally preferred against all sub-criteria except the residual risk, where Option 2a was preferred.

Option 4 was assessed as marginally less attractive than Option 1a due to the impact from returning more material for onshore handling.

Option 6 was assessed as significantly less attractive than the other options in all areas except residual risk.

# Appendix F.4.7 Environment – Operational Marine Impact

The environmental impact on the marine environment from performing the decommissioning options was considered low across all options. However, there were sufficient, cumulative differences, to indicate preferences across the decommissioning options.

The assessment performed during the workshop indicated that the leave in-situ and partial removal options are the most attractive from an operational marine impact perspective. This is due to these options having the least impact in terms of marine noise as they have the lowest number of vessel days and the lowest amount of subsea cutting operations with the increases for partial removal by cut & lift over the leave in-situ options being insufficient to express a preference.

All options have similar impacts in terms of discharges that occur from the pipelines whilst performing the decommissioning option as they will have been cleaned successfully for all options. Options 4 and 6 do have increased quantities of cutting swarf over the leave in-situ options, which may have a small additional environmental impact.

The discharges from vessels relates to the number of vessels and the number of vessel days. Option 6 is less attractive than the options due to the additional number of vessel days associated with the full removal option.



# Appendix F.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 6, full removal of the pipeline, is the most attractive decommissioning option from a legacy marine environmental impact perspective. This is due to the pipelines being fully removed and thus eliminating any legacy impact from degradation products or polymers.

The partial removal and leave in-situ options were assessed as less attractive than the full removal option as the majority of the lines are left in-situ in these options. The additional removal of 483 m of exposure was not considered sufficient to differentiate between Option 4 and the leave in-situ options. No distinction was made between the impact of exposed pipeline versus buried or rock covered pipeline.

# Appendix F.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that the partial removal and leave in-situ options are the most attractive against the fuel use and atmospheric emissions criterion. This is due to these options having lower offshore work scope durations and hence lower vessel use and durations.

Option 6 has increased impact due to the additional offshore work scope associated with fully removing the 36 km of pipelines.

# Appendix F.4.10 Environment – Other Consumptions

All options were assessed as having a similar environmental impact when considering the material returned versus material left in-situ perspective. The assessment therefore focussed on the quantity of rock required for each option.

Option 6, the full removal option and Option 1a were assessed as being the most attractive as they require no rock and 200 tonnes of rock respectively.

Option 4 was less attractive than these options as it required 2,750 tonnes of rock, used to mitigate the snag hazard associated with the cut ends left after the exposures were removed in this option. Option 2a was similarly less attractive which uses 5,040 tonnes of rock to cover the exposures.

### Appendix F.4.11 Environment – Seabed Disturbance

The leave in-situ and partial removal options are assessed as the most attractive decommissioning options here as the seabed impact is limited to the area relating to the sections of pipeline removal at the line ends.

Option 6 is significantly less attractive than the leave in-situ or partial removal options as a large area of seabed is impacted by the de-burial along the pipelines using an MFE prior to them being cut into sections and removed.

# Appendix F.4.12 Environment – Loss of Habitat

Option 6, the full removal option was assessed as being the most attractive option against this criterion as there is no loss of, or material change to the marine habitat as it currently stands.

Option 1a is assessed as less attractive due to the small quantity of rock placed at the cut pipeline ends. Option 4 is assessed as less attractive again, as it involves the introduction of rock to mitigate the snag hazard associated with the cut ends of the pipelines left after the exposures are removed.



The introduction of this rock is a material change to around 2,200 m<sup>2</sup> of habitat where the existing sandbank is replaced with a hard substrate.

Option 2a is assessed as the least attractive option as 5,000 m<sup>2</sup> of existing sandbank is replaced with a hard substrate.

# Appendix F.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from an environmental perspective is Option 1a, followed by Option 6 which is followed closely by Option 4 and Option 2a. It is noted that, reflecting the relatively minor environmental impacts across all options, the differences between the options are small.

The leave in-situ Option 1a was assessed as being the most attractive or equal most attractive option against four of the six environment sub-criteria. This relates to the limited work scope associated with the leave in-situ option and the lack of rock required in this option. It was less preferred from a legacy perspective due to the pipelines being left in-situ and marginally less preferred than the full removal option due to the small amount of habitat loss from the minimal rock cover introduced at the cut pipeline ends.

Option 6 was assessed as being most attractive in the legacy and loss of habitat criteria due to the full removal of the pipelines and no habitat loss from rock placement. The longer duration operations counted against it in other areas.

The lower environmental impact from the shorter durations associated with performing Option 4 and Option 2a were offset by the impact from the rock cover required under these options.

# Appendix F.4.14 Technical – Technical Feasibility

The leave in-situ and partial removal options were assessed as being the most attractive from a Technical Feasibility perspective due to the scope of removing the pipeline end sections, removing the exposures, placing rock cover over exposures and over the cut ends associated with these options being considered routine subsea operations.

Option 6 was less attractive as the technical risks associated with the longer durations to cut the pipeline into short sections and recovering them, and successfully performing the de-burial operations to allow the subsea cutting to be performed being the main concerns.

Overall, Option 4, Option 2a and Option 1a are the most attractive from a Technical perspective, followed by Option 6.

# Appendix F.4.15 Societal – Fishing Industry

Prior to discussing the assessment, some context is provided from the Fishing Baseline Characterisation ref. [7]. Fishing activity in the LOGGS south area, where the pipelines are installed, is moderate to high in terms of value and effort (up to 100 days of effort) and predominantly undertaken by Dutch beam trawl fleet with a minor amount of fishing undertaken by UK demersal fishing (generally beam trawling).

Given the above, the partial removal and leave in-situ options are assessed as being the most attractive options due to them presenting the least disruption and disturbance to the fishing industry from having the smallest offshore work scopes.



Option 6 is assessed as the least attractive option due to the extensive disruption to the fishing industry from the removal of the entire 36 km of pipelines.

It was noted that, given that fishing operations are already conducted in the area along and around this pipeline, and any infrastructure remaining on the seabed will be subject to an appropriate post-decommissioning monitoring regime, the residual presence of the pipeline was not considered a limitation to fishing activity.

# Appendix F.4.16 Societal – Communities / Amenities

The impact of the decommissioning options on communities and amenities are considered in this criterion.

The leave in-situ and partial removal options are assessed as being the most attractive due to them returning limited quantities of material for processing onshore. Whilst this limits the amount of useful material, such as steel, being returned for recycling, it also results in the least amount of material being returned that will be directed to landfill, such as the polymer coating of the pipelines.

Option 6 was assessed as being the least attractive option as it returns the entire 36 km of pipeline and the most quantity of polymer which takes up limited landfill capacity.

### Appendix F.4.17 Societal – Overall

When combining the assessments conducted at sub-criterion level, the partial removal and leave insitu options were considered the equal most attractive options as they were assessed as being the most attractive options against both the Fishing Industry and Communities / Amenities criteria.

Option 6 was less preferred as the impact from the disturbance to the fishing industry and the additional polymer to landfill from the full removal option, being assessed as less attractive.

### Appendix F.4.18 Economic – Short-term Costs

Option 1a, Option 2a and Option 4 were assessed as the equal most attractive options from a short-term costs perspective. This is due to their costs being similar and the lowest cost options at  $\pounds$ 2.9 million,  $\pounds$ 3.1 million and  $\pounds$ 3.6 million respectively.

The costs for the full removal option was significantly higher with Option 6 being £43 million.

### Appendix F.4.19 Economic – Long-term Costs

The impact of the decommissioning options in terms of long-term costs i.e. any on-going survey and monitoring costs and Fishing Legacy Trust-fund Company (FLTC) payments, are considered in this criterion.

Option 6 is considered the most attractive option against this criterion. This is due to there being no long-term costs associated with this full removal option.

All other options are considered equally less attractive as the long-term costs associated with them is largely similar being between £300 k and £400 k.



# Appendix F.4.20 Economic – Overall

Overall, the assessment is dominated by the short-term costs as the differentials are much greater than for the long-term costs.

The partial removal and leave in-situ options are all considered equal most attractive options from an Economic perspective. These are followed by Option 6 which is significantly less attractive.

# APPENDIX G GROUP 4 - DETAILED EVALUATION RESULTS

# Appendix G.1 Group 4 Attributes Table

# Group 4: Trenched Interfield Concrete Coated Piggyback Pipelines > 16"

- 43.2 km 14" concrete coated gas production pipeline with piggyback methanol pipeline from Saturn to LOGGS PR with 14 m of exposure at pipeline ends (PL2107 & PL2108) - 19.5 km 18" concrete coated gas production pipeline with piggyback methanol pipeline from Ganymede to LOGGS PR with 74.5 m of exposure (PL1093 & PL1094) - 16.1 km 18" concrete coated gas production pipeline with piggyback methanol pipeline from Vulcan to LOGGS PP with 253.0 m of exposure (PL0458 & PL0459)

		Optic	on 6			Option 4	Option 2a	Option 1a
		Full Removal				Partial Removal (Cut & Lift)	Leave In-situ (Minor Intervention)	Do Nothing (Minimum Intervention)
	- Unbury pipeline(s	) with MFE   Recove	r mattresses and	grout bags	- Dredge to uncover pipe	eline ends	<ul> <li>Dredge to uncover pipeline ends</li> </ul>	- Dredge to uncover pipeline ends
	- Cut pipe into 20m	sections with diam	ond wire		- Cut 10 m section with	diamond wire (at each end) and recover (6	6 x 10 m) - Cut 10 m section with diamond wire (at each end) and recover	(6 x 10 m) - Cut 10m section with diamond wire (at each end) and recover (6 x 10 m)
	- Bundle cut sectio	ons and recover			- Cut all exposed sectio	ons into 20 m lengths with diamond wire	- Place rock to remediate snag risk at exposed ends	- Place rock to remediate snag risk at exposed ends
/		ost decommissionir	na survev   Seaber	d trawl sween	- Bundle cut sections ar	5	- Place rock across all remaining exposed sections	- Post decommissioning survey   Seabed trawl sweep
1			.9	a aam onoop		te snag risk at exposed ends	- Post decommissioning survey   Seabed trawl sweep	- Note: areas of exposure at pipeline ends will be removed with ends, other
1						g survey   Seabed trawl sweep	- Note: all areas of exposure will be rock dumped	areas of exposure will remain
							- Note, all aleas of exposure will be fock duffped	
					- Note: all areas of expo	osure will be removed		
	Vessel Type: PoB	/ Days / Hours / PL	1		Vessel Type: PoB / Day	vs / Hours / PU	Vessel Type: PoB / Days / Hours / PLL	Vessel Type: PoB / Days / Hours / PLL
5		907,434 / 6.81E-02			DSV: 110 / 9.9 / 13,108		DSV: 110 / 7.2 / 9.464 / 7.10E-04	DSV: 110 / 7.7 / 10.138 / 7.60E-04
, r		,			,		,	
5		296,978 / 2.88E-01			Divers: 18 / 9.9 / 4,290 /		Divers: 18 / 7.2 / 3,097 / 3.00E-03	Divers: 18 / 7.7 / 3,318 / 3.22E-03
0	Trawler: 5 / 8.0 / 48				Trawler: 5 / 8.0 / 480 / 3		Trawler: 5 / 8.0 / 480 / 3.60E-05	Trawler: 5 / 8.0 / 480 / 3.60E-05
		/ 14.7 / 7,740 / 5.81	E-04		Survey Vessel: 44 / 14.		Survey Vessel: 44 / 14.7 / 7,740 / 5.81E-04	Survey Vessel: 44 / 14.7 / 7,740 / 5.81E-04
Sor	CSV: 76 / 528.0 / 4	481,509 / 3.61E-02			Rockdump Vessel: 20 /	7.4 / 1,776 / 1.33E-04	Rockdump Vessel: 20 / 7.5 / 1,798 / 1.35E-04	
ie i								Total offshore hours: 21,676 hrs
	Total offshore hours	s: 1,694,142 hrs			Total offshore hours: 27	,394 hrs	Total offshore hours: 22,580 hrs	Total offshore PLL: 4.60E-03
	Total offshore PLL:	3.93E-01			Total offshore PLL: 5.89	9E-03	Total offshore PLL: 4.47E-03	
	MW	MW	MW		N	N	N	
		f the Personnel Offs		ie ee fellewe				
							in a bish a fa Ostina C due to the lange under a second second for full second	al the superstances of diverse according to the mention served anti-
							mes higher for Option 6 due to the larger work scope required for full remove	al the greater use of divers compared to the partial removal options.
				0	thers as the risk exposu			
	Overall, Option 4,	, Option 2a and Op	otion 1a are equa	ally preferred fron	n a risk to Offshore Per	rsonnel perspective.		
	Resource Type: Da	we / Houre / PLL			Resource Type: Days /	Hours / PLI	Resource Type: Days / Hours / PLL	Resource Type: Days / Hours / PLL
e			1) 054 0 / 00 0/	04 / 7 405 00				
2 2	Onshore Operation	is (Cleaning & Dispo	sal): 951.0 / 60,86	64 / 7.49E-03	Onshore Operations (Ci	eaning & Disposal): 5.0 / 320 / 3.94E-05	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06
s di								
ē č	Total onshore hours	s: 60 864 hrs			Total onshore hours: 32	10 hrs	Total onshore hours: 64 hrs	Total onshore hours: 64 hrs
.2 Personnel Onshore	Total onshore PLL:				Total onshore PLL: 3.94		Total onshore PLL: 7.87E-06	Total onshore PLL: 7.87E-06
1.2 P Or	Total onshore PLL:	7.49E-03			Total onshore PLL: 3.94	4E-05	Total onshore PLL: 7.87E-06	
1.2 P Or	Total onshore PLL:	7.49E-03	VMW					
1.2 P Or	Total onshore PLL:	7.49E-03		is as follows:	Total onshore PLL: 3.94	4E-05	Total onshore PLL: 7.87E-06	
1.1	Total onshore PLL: <b>MW</b> The assessment of	7.49E-03 VMW f the Personnel Ons	hore sub-criterion		Total onshore PLL: 3.94	₩	Total onshore PLL: 7.87E-06	
1.2	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being	7.49E-03 VMW f the Personnel Ons d as being Much V	hore sub-criterion Veaker than Optio	on 4 as the risk expo	Total onshore PLL: 3.94	NE-05	Total onshore PLL: 7.87E-06	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is
<b>1</b>	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being	7.49E-03 <b>VMW</b> f the Personnel Ons ted as being Much V Very Much Weaker	hore sub-criterion Veaker than Optio r than both Option	on 4 as the risk expo 1 2a and Option 1a c	Total onshore PLL: 3.94 W osure for onshore person due to the much higher ris	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a.
Gummary	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake	hore sub-criterion Veaker than Optio r than both Option r than both Option	on 4 as the risk expo a 2a and Option 1a c a 2a and Option 1a c	Total onshore PLL: 3.94 W osure for onshore person due to the much higher ris due to the risk exposure l	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a.
Gummary	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess Option 2a is asses	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo 2a and Option 1a c 2a and Option 1a c onshore handling is	Total onshore PLL: 3.94 W osure for onshore personi due to the much higher ri- due to the risk exposure l to the same for both optior	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a.
Gummary	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess Option 2a is asses <b>Overall, Option 2</b>	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo 2a and Option 1a c 2a and Option 1a c onshore handling is	Total onshore PLL: 3.94 W osure for onshore person due to the much higher ri- due to the risk exposure l the same for both optior Onshore Personnel pe	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06  N  the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a.
Summary	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Option 2a is asses Overall, Option 2a Vessel Days:	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo 2a and Option 1a c 2a and Option 1a c onshore handling is	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure I is the same for both option Onshore Personnel per Vessel Days:	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect Vessel Days:	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days:
Summary	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Overall, Option 2 Vessel Days: DSV: 687.5	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo 2a and Option 1a c 2a and Option 1a c onshore handling is	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure l the same for both optior Onshore Personnel per Vessel Days: DSV: 9.9	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect Vessel Days: DSV: 7.2	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7
Gummary	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Option 2a is asses Overall, Option 2a Vessel Days:	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo 2a and Option 1a c 2a and Option 1a c onshore handling is	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure I is the same for both option Onshore Personnel per Vessel Days:	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect Vessel Days:	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days:
Summary	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Overall, Option 2 Vessel Days: DSV: 687.5	7.49E-03 <b>VMW</b> f the Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo 2a and Option 1a c 2a and Option 1a c onshore handling is	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure l the same for both optior Onshore Personnel per Vessel Days: DSV: 9.9	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06  N  to the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect Vessel Days: DSV: 7.2	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7
Summary	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Option 2a is asses Overall, Option 2a Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0	7.49E-03 the Personnel Ons ded as being Much V Very Much Weake ded as being Weake sed as being Neutra a and Option 1a an	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure lo the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06         N         o the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect         Vessel Days: DSV: 7.2 Divers: 7.2 Trawler: 8.0	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7
Summary	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14.	7.49E-03 the Personnel Ons ded as being Much V Very Much Weake ded as being Weake sed as being Neutra a and Option 1a an	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W bosure for onshore personn due to the much higher ri- due to the risk exposure lo the same for both optior Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0
Other Users	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Option 2a is asses Overall, Option 2a Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0	7.49E-03 the Personnel Ons ded as being Much V Very Much Weake ded as being Weake sed as being Neutra a and Option 1a an	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure lo the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0	NE-05 W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns.	Total onshore PLL: 7.87E-06         N         o the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect         Vessel Days: DSV: 7.2 Divers: 7.2 Trawler: 8.0	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7
3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0	7.49E-03 The Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra a and Option 1a and 7	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure I the same for both optior <b>Onshore Personnel per</b> Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4	Nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns. erspective.	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0
3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14.	7.49E-03 The Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra a and Option 1a and 7	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W bosure for onshore personn due to the much higher ri- due to the risk exposure lo the same for both optior Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7	Nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns. erspective.	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days
1.3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days:	7.49E-03 The Personnel Ons ed as being Much V Very Much Weake ed as being Weake sed as being Neutra a and Option 1a and 7	hore sub-criterion Veaker than Optio r than both Option r than both Option al to Option 1a as	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure l is the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0	Nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns. erspective.	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5         Total vessel days: 37.3 days	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7
1.3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days: Transits: 91	7.49E-03 The Personnel Ons red as being Much V Very Much Weaker red as being Weaker red as being Neutra a and Option 1a and 7 1,238.1 days	hore sub-criterion Veaker than Option r than both Option r than both Option al to Option 1a as re equally prefer	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure l is the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0 Transits: 10	Nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns. erspective.	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5         Total vessel days: 37.3 days         Transits: 10	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days
1.3 Other Users	Total onshore PLL: MW The assessment of Option 6 is assess assessed as being Option 4 is assess Overall, Option 2: Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days: Transits: 91 W	7.49E-03 VMW f the Personnel Ons led as being Much V Very Much Weake led as being Weakel led as being Neutra a and Option 1a and 7 1,238.1 days W	hore sub-criterion Veaker than Option r than both Option r than both Option al to Option 1a as re equally prefer	on 4 as the risk expo n 2a and Option 1a o n 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure l is the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0	Nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns. erspective.	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5         Total vessel days: 37.3 days	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days
1.3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days: Transits: 91 <b>W</b> The assessment of	7.49E-03 <b>VMW</b> f the Personnel Ons red as being Much V Very Much Weaker red as being Weaker red as being Neutra <b>a and Option 1a an</b> 7 1,238.1 days <b>W</b> f the Other Users su	hore sub-criterion Veaker than Option r than both Option a to Option 1a as re equally prefer	on 4 as the risk expo n 2a and Option 1a o n 2a and Option 1a o onshore handling is rred from a risk to	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ri- due to the risk exposure l is the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0 Transits: 10 N	NE-05	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5         Total vessel days: 37.3 days         Transits: 10	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days Transits: 8
1.3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2</b> ; Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days: Transits: 91 <b>W</b> The assessment of Option 6 is assess	7.49E-03 The Personnel Ons and as being Much V Very Much Weaker and Option 1a and 7 1,238.1 days M f the Other Users sur- red as being Weaker	hore sub-criterion Veaker than Option r than both Option r than both Option al to Option 1a as re equally prefer wub-criterion is as for r than all other opt	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to streed from a risk to blows: tions as, although th	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure l is the same for both option Onshore Personnel per Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0 Transits: 10 N here are more vessel day	W nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handli ns. erspective. days xs for Option 6 than any of the other option	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5         Total vessel days: 37.3 days         Transits: 10	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is n pipeline end sections in Option 2a and Option 1a. tions Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days
1.3 Other Users	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days: Transits: 91 <b>W</b> The assessment of Option 6 is assess be negligible betweentimes <b>MU</b>	7.49E-03 the Personnel Ons and as being Much V Very Much Weaker a and Option 1a and 7 1,238.1 days the Other Users su and as being Weaker and being Weaker and as being Weaker and be	hore sub-criterion Veaker than Option r than both Option r than both Option al to Option 1a as re equally prefer w b-criterion is as for r than all other opt There are however,	on 4 as the risk expo a 2a and Option 1a o a 2a and Option 1a o onshore handling is rred from a risk to streed from a risk to blows: tions as, although th a higher number of	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure l the same for both optior <b>Onshore Personnel pe</b> Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0 Transits: 10 N here are more vessel day f vessel transits to / from	W         nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) fo being around 5 times higher due to handlins.         erspective.         days         N         vs for Option 6 than any of the other option the work site (91 versus 10 or 8) which provide the state of t	Total onshore PLL: 7.87E-06         N         o the full pipeline lengths being returned to shore for handling in Option 6 ver or onshore personnel due to handling 79 km of pipeline versus six short 10m ng around 350 m of pipeline onshore versus six short 10m pipeline end sect         Vessel Days: DSV: 7.2 Divers: 7.2 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.5 Total vessel days: 37.3 days Transits: 10         N         N         N	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is a pipeline end sections in Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days Transits: 8 pact in terms of safety of other users due to vessel traffic volumes increasing is likely
Summary	Total onshore PLL: <b>MW</b> The assessment of Option 6 is assess assessed as being Option 4 is assess <b>Overall, Option 2:</b> Vessel Days: DSV: 687.5 Divers: 687.5 Trawler: 8.0 Survey Vessel: 14. CSV: 528.0 Total vessel days: Transits: 91 <b>W</b> The assessment of Option 6 is assess be negligible betwe All other options ar	7.49E-03 the Personnel Ons and as being Much V Very Much Weake a abeing Weake a and Option 1a and 7 1,238.1 days the Other Users su a as being Weake en these options. The a assessed being N	hore sub-criterion Veaker than Option r than both Option r than both Option al to Option 1a as re equally prefer w b-criterion is as for r than all other opt There are however, leutral to each oth	on 4 as the risk exponent 2 a and Option 1 a contract of 2 and Option 1 a contract of 2 and Option 1 a contract of the contrac	Total onshore PLL: 3.94 W osure for onshore personn due to the much higher ris due to the risk exposure l the same for both optior <b>Onshore Personnel pe</b> Vessel Days: DSV: 9.9 Divers: 9.9 Trawler: 8.0 Survey Vessel: 14.7 Rockdump Vessel: 7.4 Total vessel days: 40.0 Transits: 10 N here are more vessel day f vessel transits to / from	W         nel is 190 times higher for Option 6 due to sk exposure (almost 1000 times higher) for being around 5 times higher due to handlins.         rspective.         days         N         vs for Option 6 than any of the other option the work site (91 versus 10 or 8) which pin ber of vessel days and transits, these differences	Vessel Days:         DSV: 7.2         Divers: 7.2         Trawler: 8.0         Survey Vessel: 14.7         Rockdump Vessel: 7.5         Total vessel days: 37.3 days         Transits: 10	Total onshore PLL: 7.87E-06 rsus less than 500 m of pipeline being returned to shore in Option 4. Option 6 is a pipeline end sections in Option 2a and Option 1a. Vessel Days: DSV: 7.7 Divers: 7.7 Trawler: 8.0 Survey Vessel: 14.7 Total vessel days: 30.3 days Transits: 8 pact in terms of safety of other users due to vessel traffic volumes increasing is likely

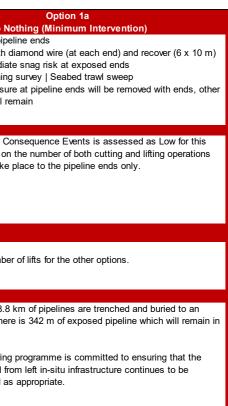
NOTE: Pipeline Numbers in Appendix with a "0" after the "PL" are equivalent to those in the main body of the document with the same numbering but that do not contain the "0" in front of the "PL". The Main body of the text utilises the correct reference for the pipeline numbers.



		Opt Full Remova	on 6 al (Cut & Liff)		<b>P</b> :	Option 4 artial Removal (Cut & L	ift)		on 2a inor Intervention)	Do No
	- Unbury pipeline(s - Cut pipe into 20m - Bundle cut sectio - Backfill trench   P	) with MFE   Recover sections with diar ons and recover	er mattresses and nond wire		<ul> <li>Dredge to uncover pipel</li> <li>Cut 10 m section with c</li> <li>Cut all exposed section</li> <li>Bundle cut sections and</li> <li>Place rock to remediate</li> </ul>	line ends diamond wire (at each end ns into 20 m lengths with o d recover e snag risk at exposed en survey   Seabed trawl swi	d) and recover (6 x 10 m) diamond wire	- Dredge to uncover pipeline ends	e (at each end) and recover (6 x 10 m) at exposed ends posed sections abed trawl sweep	<ul> <li>Dredge to uncover pipe</li> <li>Cut 10m section with d</li> <li>Place rock to remediat</li> <li>Post decommissioning</li> <li>Note: areas of exposure areas of exposure will re</li> </ul>
1.4 Hign Consequence Events	The potential for Hi option. This is base that would need to Live pipeline - Shel Number of Lifts: 98	ed on the number of take place to fully	ivents is assessed of both cutting and remove the pipelin	as Medium for this lifting operations e.		nsequence Events is asso the number of both cutting place to remove the pipelin	g and lifting operations	The potential for High Consequence E option. This is based on the number of that would need to take place to the p Number of Lifts: 1	of both cutting and lifting operations	The potential for High Co option. This is based on that would need to take p Number of Lifts: 1
	W	W	W		N	N		Ν		
immary	Option 6 is assess Option 4, Option 2a	ed as being Weak a and Option 1a ar	er than all other op e assessed as bei	ng Neutral to each o	nigh number of lifting opera	ligh Consequence Events		peline which presents a heightened po hese options due to limited lifting opera		ompared to a lower number
	Option 6 is assess Option 4, Option 2a <b>Overall, Option 4</b>	ed as being Weak a and Option 1a ard , <b>Option 2a and C</b> ould be fully remove	er than all other op e assessed as bein option 1a are equ ed from the seabed	tions as there is a h ng Neutral to each o ally preferred fron	high number of lifting opera other as the potential for Hi n a High Consequence I The majority of the 78.8 k appropriate depth. There removed with the potentia by spot rock placement of	igh Consequence Events Events perspective. km of pipelines are trench e is 342 m of exposed pipe al snag hazard associated designed to be overtrawlal	is considered similar for the ned and buried to an eline which will be d the cut ends mitigated	The majority of the 78.8 km of pipelin appropriate depth. There is 342 m of dumped to mitigate the potential snag exposed areas. The areas of rock pla	ations. es are trenched and buried to an exposed pipeline which will be rock g hazard associated with these acement will be designed to be	The majority of the 78.8 k appropriate depth. There their current state.
	Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> As the pipelines we	ed as being Weak a and Option 1a ard , <b>Option 2a and C</b> ould be fully remove	er than all other op e assessed as bein option 1a are equ ed from the seabed	tions as there is a h ng Neutral to each o ally preferred fron	high number of lifting opera other as the potential for Hi <b>n a High Consequence I</b> The majority of the 78.8 H appropriate depth. There removed with the potentia by spot rock placement of decommissioning trawl s As such, the potential sn	igh Consequence Events Events perspective. km of pipelines are trench e is 342 m of exposed pipe al snag hazard associated designed to be overtrawlat sweep will be conducted. nag hazard post-decommi d would be lower than for t	is considered similar for the ned and buried to an eline which will be d the cut ends mitigated ble. A post- issioning activities is	hese options due to limited lifting opera The majority of the 78.8 km of pipelin appropriate depth. There is 342 m of dumped to mitigate the potential snag	ations. es are trenched and buried to an rexposed pipeline which will be rock g hazard associated with these acement will be designed to be ioning trawl sweep will be conducted. iost-decommissioning activities is	The majority of the 78.8 k appropriate depth. There
1.5 Residual Risk	Option 6 is assess Option 4, Option 2 <b>Overall, Option 4</b> As the pipelines we	ed as being Weak a and Option 1a ard , <b>Option 2a and C</b> ould be fully remove	er than all other op e assessed as bein option 1a are equ ed from the seabed	tions as there is a h ng Neutral to each o ally preferred fron	high number of lifting opera other as the potential for Hi <b>n a High Consequence B</b> The majority of the 78.8 H appropriate depth. There removed with the potentia by spot rock placement of decommissioning trawl s As such, the potential sr adequately mitigated and current state of exposure The survey & monitoring	igh Consequence Events Events perspective. km of pipelines are trench a is 342 m of exposed pipe al snag hazard associated designed to be overtrawlal sweep will be conducted. hag hazard post-decommi d would be lower than for t a. programme is committed om left in-situ infrastructure	is considered similar for the eline which will be d the cut ends mitigated ble. A post- issioning activities is the pipeline in their to ensuring that the	The majority of the 78.8 km of pipelin appropriate depth. There is 342 m of dumped to mitigate the potential snag exposed areas. The areas of rock pla overtrawlable and a post-decommissi As such, the potential snag hazard p adequately mitigated and would be lo	ations. es are trenched and buried to an exposed pipeline which will be rock g hazard associated with these acement will be designed to be ioning trawl sweep will be conducted. ost-decommissioning activities is wer than for the pipeline in their is committed to ensuring that the infrastructure continues to be	The majority of the 78.8 k appropriate depth. There their current state. The survey & monitoring p potential snag hazard fror

Overall, Option 6 is the most preferred from a Residual Risk perspective.





gated by rock placement. Option 6 is assessed as e managed as appropriate. 1a will remain in-situ where there is a minor

		Opti			Option 4		ion 2a	Option 1a
		Full Remova			rtial Removal (Cut & Lift)		linor Intervention)	Do Nothing (Minimum Intervention)
		e(s) with MFE   Recov 0m sections with dian	er mattresses and grout bags nond wire	<ul> <li>Dredge to uncover pipelin</li> <li>Cut 10 m section with dia</li> </ul>	e ends amond wire (at each end) and recover (6 x 10 m)	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10 m section with diamond wire</li> </ul>	e (at each end) and recover (6 x 10 m)	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10m section with diamond wire (at each end) and recover (6 x 1</li> </ul>
		ctions and recover			into 20 m lengths with diamond wire	- Place rock to remediate snag risk a	, , , , , ,	<ul> <li>Place rock to remediate snag risk at exposed ends</li> </ul>
			ing survey   Seabed trawl sweep	- Bundle cut sections and	0	- Place rock across all remaining exp	•	- Post decommissioning survey   Seabed trawl sweep
	Duotan tronon				snag risk at exposed ends	- Post decommissioning survey   Sea		- Note: areas of exposure at pipeline ends will be removed with ends,
					urvey   Seabed trawl sweep	- Note: all areas of exposure will be re		areas of exposure will remain
				- Note: all areas of exposu				
	Vasaal Naisa (d	lovo op cito):		Vennel Neine (dave en eite		Vassal Naisa (dava an aita):		Vessel Noise (days on site):
	Vessel Noise (d	. ,	dava   DSV 662 dava   Traudor 5	Vessel Noise (days on-site		Vessel Noise (days on-site): Survey Vessel - 6.5 days   DSV - 3.1	7 dava   Baak Dump Vasaal 4 5	Vessel Noise (days on-site):
		0.5 days   CSV - 510	days   DSV - 662 days   Trawler - 5		DSV - 6 days   Rock Dump Vessel - 4.4		7 days   Rock Durnp Vessel - 4.5	Survey Vessel - 6.5 days   DSV - 4 days   Trawler - 5 days
	days			Trawler - 5 days		Trawler - 5 days		
Ħ	Tooling Noise:			Tooling Noise:		Tooling Noise:		Tooling Noise:
Impact	MFE for Unburia	al - 32.87 days   Diamo	ond Wire Cutting - 657.4 days		nond Wire Cutting - 2.84 days   Rock Dumping -	Dredging - 1.5 days   Diamond Wire (	Cutting - 1 day   Rock Dumping - 3	Dredging - 1.5 days   Diamond Wire Cutting - 1 day
E	0 / <sup>1</sup> / D <sup>1</sup>			2.9 days		days		
Marine	Operational Disc	•						Operation Discharges:
			leases through cutting operations	Operation Discharges:		Operation Discharges:		Negligible potential for hydrocarbon releases through cutting operation
5			d successfully. Planned discharges imits and included in operational		Irocarbon releases through cutting operations	Negligible potential for hydrocarbon re	<b>o o</b> .	because the pipeline has been cleaned successfully. Planned discharge and the subscription of the subscrip
8					been cleaned successfully. Planned discharges	because the pipeline has been cleane would therefore be within acceptable	, , , , , , , , , , , , , , , , , , , ,	would therefore be within acceptable limits and included in operational permits. No cutting swarf as cutting performed by hydraulic shears.
operational		ne concrete loss.	performed by hydraulic shears but		acceptable limits and included in operational			permits. No cutting swarr as cutting periormed by hydraulic shears.
	POLETILIAI IOI SOIT			permits. No cutting swarr	as cutting performed by hydraulic shears but	permits. No cutting swarf as cutting potential for some concrete loss.	penomeu by nyulaulic snears but	Vessel Discharges
5	Vessel Discharg	10C ·		Porential IOI SUITE COTICIELE	5 1033.	potential for some concrete loss.		Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duratic
5			Water, this is driven by duration of	Vessel Discharges:		Vessel Discharges:		vessel operations and having a less intensive vessel usage than the fi
•			est vessel usage will be highest of the		y and Black Water, this is driven by duration of	This includes Ballast, Grey and Black	k Water this is driven by duration of	removal option, this option will have a lower discharge than Option 6 I
	evaluated option	0 0	est vessel usage will be highest of the		ng a less intensive vessel usage than the full	vessel operations and having a less in		similar for all other options.
	evaluated option	15.			will have a lower discharge than Option 6 but	removal option, this option will have a	5	
				similar for all other options	•	similar for all other options.	i lower discharge man option o but	
	W	W	W	N	N	N		
nmary	Option 6 is asse All other options	essed as being Weake are assessed being I	arine Impact sub-criterion is as follows er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine t from these options are sin	nilar.	ischarges and vessel discharges is mir	nimal for Option 6, cumulatively, they a	are significant enough to express a small preference for the other option
mary	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac	actual environmental marine t from these options are sin <b>n an Operational Marine</b> The majority of the 78.8 km	nilar. Impact perspective. n pipelines is trenched and buried to an	The majority of the 78.8 km pipelines	is trenched and buried to an	The majority of the 78.8 km pipelines is trenched and buried to an
mary	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine t from these options are sin <b>n an Operational Marine</b> The majority of the 78.8 km appropriate depth. There is	nilar. Impact perspective. n pipelines is trenched and buried to an s 342 m of exposed pipeline which will be	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of	is trenched and buried to an	
nary	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine t from these options are sin <b>n an Operational Marine</b> The majority of the 78.8 km	nilar. Impact perspective. n pipelines is trenched and buried to an s 342 m of exposed pipeline which will be	The majority of the 78.8 km pipelines	is trenched and buried to an	The majority of the 78.8 km pipelines is trenched and buried to an
nary	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine t from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 kn appropriate depth. There is removed with the cut ends	nilar. Impact perspective. n pipelines is trenched and buried to an s 342 m of exposed pipeline which will be	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of	is trenched and buried to an exposed pipeline which will be rock	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be l is.
nary	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine t from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts	nilar. Impact perspective. n pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped.	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped.	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be lis. The legacy marine impacts relate to the left in-situ materials, i.e. the
Marue Impact	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine t from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts	nilar. <b>Impact perspective.</b> In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the	The majority of the 78.8 km pipelines is trenched and buried to an
Marine Impact	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine to from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p	nilar. <b>Impact perspective.</b> In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines.	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines.	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be l is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines.
nary nary	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine to from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the	nilar. <b>Impact perspective.</b> In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli
hary 6	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine to from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a methanic status of the	nilar. Impact perspective. Impleting is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli
	Option 6 is asse All other options <b>Overall, Optio</b> r	essed as being Weake s are assessed being I n 4, Option 2a and O	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror	actual environmental marine to from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a methanic status of the	nilar. Impact perspective. Impletions is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the tried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be l is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy marine impacts and polymer coated methanol to a regulatory acceptable level, the legacy marine having been cleaned to a regulatory acceptable level.
2.2 Legacy Marine Impact	Option 6 is asse All other options <b>Overall, Option</b> There will be no <b>S</b> The assessment	essed as being Weake a are assessed being I an 4, Option 2a and O legacy marine impact	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred fror is from this full removal option.	actual environmental marine the from these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a methanol p impact is considered low b	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. Is relate to the left in-situ materials, i.e. the tried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b>	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be l is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option.
2.2 Legacy marine impact	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no The assessment Option 6 is asse	essed as being Weake a are assessed being I in 4, Option 2a and O legacy marine impact being the second second second second t of the Legacy Marine essed as being Strong	er than all other options as, whilst the Neutral to each other as marine impac ption 1a are equally preferred from is from this full removal option.	actual environmental marine the from these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a methanol p impact is considered low b	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. Is relate to the left in-situ materials, i.e. the tried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b>	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be l is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy marine impacts and polymer coated methanol to a regulatory acceptable level, the legacy marine having been cleaned to a regulatory acceptable level.
nary marine impact	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no Detion 6 is asse enough to expre	sessed as being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine essed as being Strong ass a small preference	er than all other options as, whilst the Neutral to each other as marine impact ption 1a are equally preferred from is from this full removal option.	actual environmental marine the from these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a marine impact is considered low b <b>N</b>	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the tried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy marimpact is considered low but greater than the full removal option.
nary warme impact	Option 6 is asse All other options <b>Overall, Option</b> There will be no <b>S</b> The assessment Option 6 is asse enough to expre All other options	S     S	er than all other options as, whilst the Neutral to each other as marine impact ption 1a are equally preferred from is from this full removal option.	actual environmental marine trifom these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a m impact is considered low b <b>N</b> noval option removes all marine d types of material and thus	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. Is relate to the left in-situ materials, i.e. the tried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy marimpact is considered low but greater than the full removal option.
nary walle line of the second	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no S The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b>	sare assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer	S     Impact sub-criterion is as follows:     In family of the regulation of the full removal option.	actual environmental marine trifom these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a m impact is considered low b <b>N</b> noval option removes all marine d types of material and thus	nilar. Impact perspective. Impletines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy marimpact is considered low but greater than the full removal option.
nary 2.2 Legacy Marine Impact any marine impact	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no S The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission	sare assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer	S     Impact sub-criterion is as follows:     In family of the regulation of the full removal option.	actual environmental marine trifom these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a m impact is considered low b <b>N</b> noval option removes all matine to types of material and thus perspective.	nilar. Impact perspective. Impletines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While be similar for these options.	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option.
narine impact 2.2 Legacy Marine impact ns and starting in the second starting in the second starting in the second starting in the second starting is a second starting is a second starting in the second starting is a secon	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no <b>S</b> The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526	sare assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer	S     Impact sub-criterion is as follows:     In family of the regulation of the full removal option.	actual environmental marine trom these options are sin <b>a n Operational Marine</b> The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of if having been cleaned to a m impact is considered low b <b>N</b> noval option removes all marine d types of material and thus <b>perspective.</b>	nilar. Impact perspective. Impletines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater in <b>N</b> ties and types of material in-situ. While be similar for these options.	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be l is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option.
narine impact 2.2 Legacy Marine impact ns and starting in the second starting in the second starting in the second starting in the second starting is a second starting is a second starting in the second starting is a secon	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no <b>S</b> The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526	sare assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer	S     Impact sub-criterion is as follows:     In family of the regulation of the full removal option.	actual environmental marine trifom these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a minimpact is considered low b <b>N</b> noval option removes all matine d types of material and thus <b>perspective.</b> Vessel Emissions (in tonni Fuel: 1,048	nilar. Impact perspective. Impletines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. Whils be similar for these options. Vessel Emissions (in tonnes): Fuel: 997	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the Vessel Emissions (in tonnes): Fuel: 914
nary variation and the impact of the second se	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no <b>S</b> The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526	sare assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer	S     Impact sub-criterion is as follows:     In family of the regulation of the full removal option.	actual environmental marine trifom these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a re- impact is considered low b <b>N</b> noval option removes all math types of material and thus <b>perspective.</b> Vessel Emissions (in tonne Fuel: 1,048 CO2e: 3,436	nilar. Impact perspective. Impletines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While be similar for these options. Vessel Emissions (in tonnes): Fuel: 997 CO2e: 3,268	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the Vessel Emissions (in tonnes): Fuel: 914 CO2e: 2,995
nary variation and the impact of the second se	Option 6 is asse All other options <b>Overall, Option</b> There will be no The assessmeni Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526 CO2e: 93,501 NOx: 1,694.42 SO2: 114.10	sare assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer	S     Impact sub-criterion is as follows:     In family of the regulation of the full removal option.	actual environmental marine trifom these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a m impact is considered low b <b>N</b> noval option removes all marine d types of material and thus <b>perspective.</b> Vessel Emissions (in tonn Fuel: 1,048 CO2e: 3,436 NOX: 62.27	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantit s the legacy environmental impact is expected to ues):	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While be similar for these options. Vessel Emissions (in tonnes): Fuel: 997 CO2e: 3,268 NOX: 59.22	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the Vessel Emissions (in tonnes): Fuel: 914 CO2e: 2,995 NOX: 54.28
nary maine induct and a second maine induct second se	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526 CO2e: 93,501 NOx: 1,694.42 SO2: 114.10 Vessel Energy U	S are assessed being Weake are assessed being I an 4, Option 2a and O legacy marine impact being the Legacy Marine assed as being Strong ass a small preference are assessed as Neu an 6 is the most prefer Ins (in tonnes): Use: 1,226,602 GJ	S     Impact sub-criterion is as follows:     Interference of the sub-criterion is a sub-criterion is as follows:     Interference of the sub-criterion is as follows:     Interference of the sub-criterion is a sub-criterion is as follows:     Interference of the sub-criterion is as follows:	actual environmental marine trifom these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of the having been cleaned to a re- impact is considered low b <b>N</b> noval option removes all math the types of material and thus <b>perspective.</b> Vessel Emissions (in tonno Fuel: 1,048 CO2e: 3,436 NOX: 62.27 SO2: 4.19 Vessel Energy Use: 45,07	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the tried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to les): 6 GJ	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. Whils be similar for these options. Vessel Emissions (in tonnes): Fuel: 997 CO2e: 3,268 NOX: 59.22 SO2: 3.99 Vessel Energy Use: 42,870 GJ	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the CO2e: 2,995 NOX: 54.28 SO2: 3.65
nary variation and the impact of the second se	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no The assessment Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526 CO2e: 93,501 NOx: 1,694.42 SO2: 114.10 Vessel Energy U <b>MW</b>	Sessed as being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu in 6 is the most prefer ins (in tonnes):	S Impact sub-criterion is as follows: ler than all other options as, whilst the Neutral to each other as marine impact is from this full removal option. S Impact sub-criterion is as follows: ler than all other options as the full removal for the full removal option. Itral to each other as the quantities ar rred from a Legacy Marine Impact	actual environmental marine tr from these options are sin <b>m an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a m impact is considered low b <b>N</b> noval option removes all math types of material and thus <b>perspective.</b> Vessel Emissions (in tonne Fuel: 1,048 CO2e: 3,436 NOx: 62.27 SO2: 4.19 Vessel Energy Use: 45,07 <b>N</b>	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the uried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantit s the legacy environmental impact is expected to ues):	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While be similar for these options. Vessel Emissions (in tonnes): Fuel: 997 CO2e: 3,268 NOX: 59.22 SO2: 3.99	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the CO2e: 2,995 NOX: 54.28 SO2: 3.65
Emissions Ala Contract and the impact	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no There will be no Determined the no Option 6 is asse enough to expre All other options <b>Overall, Option</b> Vessel Emission Fuel: 28,526 CO2e: 93,501 NOx: 1,694.42 SO2: 114.10 Vessel Energy L MW The assessment Option 6 is asse	Sessed as being Weake are assessed being I an 4, Option 2a and O legacy marine impact t of the Legacy Marine assed as being Strong ass a small preference are assessed as Neu- n 6 is the most prefer Ins (in tonnes): Use: 1,226,602 GJ MW t of the Fuel Use & At	er than all other options as, whilst the Neutral to each other as marine impact iption 1a are equally preferred from is from this full removal option.	actual environmental marine t from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a re- impact is considered low b <b>N</b> moval option removes all marine d types of material and thus <b>perspective.</b> Vessel Emissions (in tonne Fuel: 1,048 CO2e: 3,436 NOx: 62.27 SO2: 4.19 Vessel Energy Use: 45,07 <b>N</b> as follows:	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the rried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option. N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to les): 6 GJ N	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While be similar for these options. Vessel Emissions (in tonnes): Fuel: 997 CO2e: 3,268 NOX: 59.22 SO2: 3.99 Vessel Energy Use: 42,870 GJ <b>N</b>	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be I is. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipelin having been cleaned to a regulatory acceptable level, the legacy mari impact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the CO2e: 2,995 NOX: 54.28 SO2: 3.65
Emissions Arrive to 2.2 Legacy Manue Inipact Emissions Array and the Inipact	Option 6 is asse All other options <b>Overall, Option</b> There will be no There will be no The assessmeni Option 6 is asse enough to expre All other options <b>Overall, Optior</b> Vessel Emission Fuel: 28,526 CO2e: 93,501 NOx: 1,694.42 SO2: 114.10 Vessel Energy L MW The assessmeni Option 6 is asse	Sessed as being Weake are assessed being I an 4, Option 2a and O legacy marine impact to f the Legacy Marine assed as being Strong ass a small preference are assessed as Neu an 6 is the most prefer ins (in tonnes): Use: 1,226,602 GJ MW to f the Fuel Use & At assed as being Much	er than all other options as, whilst the Neutral to each other as marine impact iption 1a are equally preferred from is from this full removal option.	actual environmental marine t from these options are sin <b>n an Operational Marine</b> I The majority of the 78.8 km appropriate depth. There is removed with the cut ends The legacy marine impacts remaining trenched and bu polymer coated methanol p Given the buried status of thaving been cleaned to a re- impact is considered low b <b>N</b> moval option removes all marine d types of material and thus <b>perspective.</b> Vessel Emissions (in tonno Fuel: 1,048 CO2e: 3,436 NOx: 62.27 SO2: 4.19 Vessel Energy Use: 45,07 <b>N</b> as follows: uel used and emissions gen	nilar. Impact perspective. In pipelines is trenched and buried to an s 342 m of exposed pipeline which will be rock dumped. s relate to the left in-situ materials, i.e. the rried, concrete coated, steel pipelines, and the pipelines. the material being left in-situ and the pipeline egulatory acceptable level, the legacy marine but greater than the full removal option.  N terial whilst the other options leave similar quantil s the legacy environmental impact is expected to les): 6 GJ	The majority of the 78.8 km pipelines appropriate depth. There is 342 m of dumped. The legacy marine impacts relate to t remaining trenched and buried, concr polymer coated methanol pipelines. Given the buried status of the materia having been cleaned to a regulatory a impact is considered low but greater to <b>N</b> ties and types of material in-situ. While be similar for these options. Vessel Emissions (in tonnes): Fuel: 997 CO2e: 3,268 NOX: 59.22 SO2: 3.99 Vessel Energy Use: 42,870 GJ <b>N</b>	is trenched and buried to an exposed pipeline which will be rock the left in-situ materials, i.e. the rete coated, steel pipelines, and the al being left in-situ and the pipeline acceptable level, the legacy marine than the full removal option.	The majority of the 78.8 km pipelines is trenched and buried to an appropriate depth. There is 342 m of exposed pipeline which will be lis. The legacy marine impacts relate to the left in-situ materials, i.e. the remaining trenched and buried, concrete coated, steel pipelines, and polymer coated methanol pipelines. Given the buried status of the material being left in-situ and the pipeli having been cleaned to a regulatory acceptable level, the legacy marimpact is considered low but greater than the full removal option. expected to be low for these options, there is polymer remaining and the tree set of the set of th

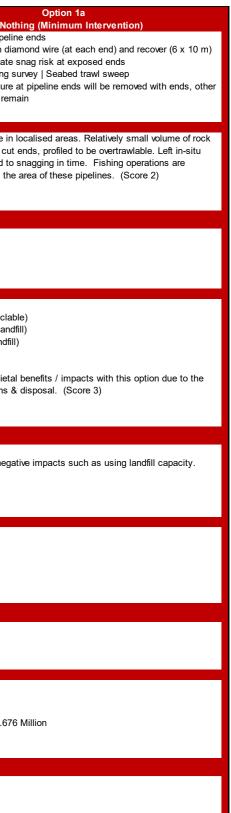


		Option 6	Option 4	Option 2a	Option 1a
		Full Removal (Cut & Lift)	Partial Removal (Cut & Lift)	Leave In-situ (Minor Intervention)	Do Nothing (Minimum Intervention)
		- Unbury pipeline(s) with MFE   Recover mattresses and grout bags	- Dredge to uncover pipeline ends	- Dredge to uncover pipeline ends	- Dredge to uncover pipeline ends
		- Cut pipe into 20m sections with diamond wire	- Cut 10 m section with diamond wire (at each end) and recover (6 x 10 m)	- Cut 10 m section with diamond wire (at each end) and recover (6 x 10 r	n) - Cut 10m section with diamond wire (at each end) and recover (6 x 10 m)
		- Bundle cut sections and recover	- Cut all exposed sections into 20 m lengths with diamond wire	- Place rock to remediate snag risk at exposed ends	- Place rock to remediate snag risk at exposed ends
		- Backfill trench   Post decommissioning survey   Seabed trawl sweep	- Bundle cut sections and recover	- Place rock across all remaining exposed sections	- Post decommissioning survey   Seabed trawl sweep
		- Dackin tierich   1 ost decontrissioning sulvey   Geabed tawi sweep	- Place rock to remediate snag risk at exposed ends	<b>U</b>	
			5 1	- Post decommissioning survey   Seabed trawl sweep	- Note: areas of exposure at pipeline ends will be removed with ends, other
			- Post decommissioning survey   Seabed trawl sweep	- Note: all areas of exposure will be rock dumped	areas of exposure will remain
			- Note: all areas of exposure will be removed		
a	(0	Material Emissions (CO2 in tonnes):	Material Emissions (CO2 in tonnes):	Material Emissions (CO2 in tonnes):	Material Emissions (CO2 in tonnes):
ant	ű	Recovered Material: 28,789	Recovered Material: 124	Recovered Material: 23	Recovered Material: 23
e a	ē ē	Remaining Material: N/A	Remaining Material: 39,859	Remaining Material: 40,001	Remaining Material: 40,001
5 5	ΞĒ	Total: 28,789	Total: 39,983	Total: 40.024	Total: 40,024
4 Vir	t ns	10141. 20,703	Total. 35,305	10(a). 40,024	10tai: 40,024
~ ~	Consumptions		Darly 4 550 terrar	Dealer 0.500 tangen	Deals 450 houses
2. Environmental 2.4 Other	o	Rock: N/A	Rock: 1,550 tonnes	Rock: 3,560 tonnes	Rock: 150 tonnes
		S S N	N W	W	
			N VV	VV	
		The assessment of the Other Consumptions sub-criterion is as follows:			
			nere is no requirement for rock in Option 6 versus a requirement for a reasonab		
		Option 1a, this is insufficient to express a preference from a consumption	perspective. Note: the differences between the options in tonnage of CO2 ass	ociated with processing returned material and / or to produce replacement	material left in-situ were considered insignificant in terms of this assessment.
Sum	manu	As such, the preference judgements were driven by the quantity of rock co	onsumption for each option.		
Sum	inary	<sup>y</sup> Option 4 is assessed as being Neutral to Option 2a as whilst there are dif	ferences between the quantity of rock consumed between the options, the diffe	rential was considered insufficient to express a preference. Option 4 is a	sessed as being Weaker than Option 1a as there is a requirement for a
		reasonable amount of rock in Option 4 versus a very small amount of rock	in Option 1a.		
		Option 2a is assessed as being Weaker than Option 1a as there is much			
		Overall, Option 6 and Option 1a are equally preferred from an Othe			
2	e	Short Term Disturbance (MFE): 392,735 m2	There is a small amount of short-term disturbance resulting from removing	There is limited short-term disturbance from rock dumping the 342 m of	There is limited short-term disturbance for this option from the small area of
ent	2.5 Disturbance		the 342 m of exposure along these lines and rock dumping the cut ends.	exposed pipelines for this option.	rock dump only.
Ĕ.	,pa		This is considered insignificant.		
lo .	ā.		······································		
vir	jis				
Ш	5				
2. Environmental	r,				
		MW MW MW	N N	N	
		MW         MW           The assessment of the Seabed Disturbance (short-term impact) sub-criter		N	
		The assessment of the Seabed Disturbance (short-term impact) sub-criter	ion is as follows:		impact disturbance with the other options.
Sumi	mary	The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to		nes using a Mass Flow Excavator when compared to the small area of lov	impact disturbance with the other options.
Sumi		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros	nes using a Mass Flow Excavator when compared to the small area of lov	r impact disturbance with the other options.
Sumi		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros	nes using a Mass Flow Excavator when compared to the small area of lov	impact disturbance with the other options. Habitat Loss (Rockdump): 120 m2
		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ex <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b>	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective.	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ex <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b>	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective.	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ex <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b>	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective.	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ex <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b>	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective.	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
_		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ex <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b>	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective.	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
		The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b> Habitat Loss (Rockdump): N/A	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	
		S       S       S	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 S W	nes using a Mass Flow Excavator when compared to the small area of lov s these options.	
		S       S         S       S         The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 S W terion is as follows:	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2
		S       S         S       S         The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 S W	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2
2. Environmental 2.6 Loss of	Habitat	S       S         S       S         S       S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from the top option 4, Option 4, Option 2a and Option 1a are equally preferred from the top option 4 is assessed as being Stronger than Option 4, Option 2a and Option 4, Option 4, Option 2a and Option 4, Op	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 S W terion is as follows:	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6.
	Habitat	S       S         S       S         S       S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from the top option 4, Option 4, Option 2a and Option 1a are equally preferred from the top option 4 is assessed as being Stronger than Option 4, Option 2a and Option 4, Option 4, Option 2a and Option 4, Op	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 bits as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6.
2. Environmental 2.6 Loss of	Habitat	S       S         The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         S         S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option         Option 4 is assessed as being Stronger than Option 2a as the area of habitat	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 terion is as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6.
2. Environmental 2.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Colspan="2">S         Signal Colspan="2">S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option         Y       Option 4 is assessed as being Weaker than Option 1a as the area of hab	ion is as follows:         it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros on a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         terion is as follows:         ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being bitat loss in Option 2a is much greater than Option 1a.	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6.
2. Environmental 2.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Colspan="2">S         S       S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option         Option 2a is assessed as being Stronger than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the overall, Option 6 is the most preferred from a Loss of Habitat perspination	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 terion is as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a. hard substrate (rock). ective.	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s	Habitat Loss (Rockdump): 120 m2 Ditat loss in Option 6. maller than Option 4.
2. Environmental 2.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Colspan="2">S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option         Option 4 is assessed as being Weaker than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the sandbank feature	ion is as follows:         it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros on a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         terion is as follows:         ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being bitat loss in Option 2a is much greater than Option 1a.	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6.
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Colspan="2">S         S       S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option         Option 2a is assessed as being Stronger than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the overall, Option 6 is the most preferred from a Loss of Habitat perspination	ion is as follows: the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 terion is as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a. hard substrate (rock). ective.	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s	Habitat Loss (Rockdump): 120 m2 Ditat loss in Option 6. maller than Option 4.
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         S       S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 2a and Option 2a and Option 2a as the area of habitat loss is from the replacement of the sandbank features with 1         Option 2a is assessed as being Weaker than Option 1a as the area of habitat loss is from the replacement of the sandbank features with 1         Overall, Option 6 is the most preferred from a Loss of Habitat persp	ion is as follows:         the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros om a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2 Habitat Loss (Rockdump): 1,240 m2 terion is as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being bitat loss in Option 2a is much greater than Option 1a. hard substrate (rock). ective. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline of 28" has Habitat Loss (Rockdump): DWC for cutting concrete coated pipeline dit to the coated pipeline dit to the coated pipeline di	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4.
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal and Sig	ion is as follows:         the large area of seabed disturbance from the unburial of the 78.8 km of pipeli         ach other as the seabed disturbance is considered negligible and similar acros         ion is as follows:         Habitat Loss (Rockdump): 1,240 m2         Eterion is as follows:         ion 1a as the rock placed in each of these options changes the current seabed         itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.         arad substrate (rock).         ective.         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Content of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option 2a as the area of habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 2a as the area of habitat (logacy / long-term impact) sub-criter         Option 2a is assessed as being Stronger than Option 2a as the area of habitat (logacy / long-term impact) sub-criter         Option 2a is assessed as being Weaker than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the Overall, Option 6 is the most preferred from a Loss of Habitat perspection         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Risk to successfully achieving full removal by unburial	ion is as follows:         it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli         ach other as the seabed disturbance is considered negligible and similar acros         is a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         terion is as follows:         ion 1a as the rock placed in each of these options changes the current seabed         itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.         inard substrate (rock).         ective.         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Limited technical risks from cutting and removal of	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Second state in the sease of the sease	In the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros or a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 Habitat Loss (Rockdump): 1,240 m2 terion is as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being bitat loss in Option 2a is much greater than Option 1a. hard substrate (rock). ective. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks from cutting and removal of pipeline sections as the areas being cut and removed are already exposed	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Content of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option 2a as the area of habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 2a as the area of habitat (logacy / long-term impact) sub-criter         Option 2a is assessed as being Stronger than Option 2a as the area of habitat (logacy / long-term impact) sub-criter         Option 2a is assessed as being Weaker than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the Overall, Option 6 is the most preferred from a Loss of Habitat perspection         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Risk to successfully achieving full removal by unburial	ion is as follows:         it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli         ach other as the seabed disturbance is considered negligible and similar acros         is a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         terion is as follows:         ion 1a as the rock placed in each of these options changes the current seabed         itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.         inard substrate (rock).         ective.         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Limited technical risks from cutting and removal of	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b> Habitat Loss (Rockdump): N/A The assessment of the Loss of Habitat (legacy / long-term impact) sub-crit Option 6 is assessed as being Stronger than Option 4, Option 2a and Opti Option 4 is assessed as being Stronger than Option 2a as the area of hab Option 2a is assessed as being Weaker than Option 1a as the area of hab Note: Habitat loss is from the replacement of the sandbank features with 1 <b>Overall, Option 6 is the most preferred from a Loss of Habitat persp</b> <b>Concept Maturity:</b> DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) <b>Technical Risks:</b> Risk to successfully achieving full removal by unburial and cut and lift of the pipelines due to the long durations involved and the potential for unforeseen unburial issues. (Score 2)	<ul> <li>ion is as follows:</li> <li>it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros on a Seabed Disturbance perspective.</li> <li>Habitat Loss (Rockdump): 1,240 m2</li> <li>ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.</li> <li>concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)</li> <li>Technical Risks: Limited technical risks from cutting and removal of pipeline sections as the areas being cut and removed are already exposed therefore no unburial risk. (Score 3)</li> </ul>	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Second state in the sease of the sease	In the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros or a Seabed Disturbance perspective. Habitat Loss (Rockdump): 1,240 m2 Habitat Loss (Rockdump): 1,240 m2 terion is as follows: ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being bitat loss in Option 2a is much greater than Option 1a. hard substrate (rock). ective. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks from cutting and removal of pipeline sections as the areas being cut and removed are already exposed	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter Option 6 is assessed as being Much Weaker than all other options due to Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea <b>Overall, Option 4, Option 2a and Option 1a are equally preferred fro</b> Habitat Loss (Rockdump): N/A The assessment of the Loss of Habitat (legacy / long-term impact) sub-crit Option 6 is assessed as being Stronger than Option 4, Option 2a and Opti Option 4 is assessed as being Stronger than Option 2a as the area of hab Option 2a is assessed as being Weaker than Option 1a as the area of hab Note: Habitat loss is from the replacement of the sandbank features with 1 <b>Overall, Option 6 is the most preferred from a Loss of Habitat persp</b> <b>Concept Maturity:</b> DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) <b>Technical Risks:</b> Risk to successfully achieving full removal by unburial and cut and lift of the pipelines due to the long durations involved and the potential for unforeseen unburial issues. (Score 2)	<ul> <li>ion is as follows:</li> <li>it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros on a Seabed Disturbance perspective.</li> <li>Habitat Loss (Rockdump): 1,240 m2</li> <li>ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.</li> <li>concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)</li> <li>Technical Risks: Limited technical risks from cutting and removal of pipeline sections as the areas being cut and removed are already exposed therefore no unburial risk. (Score 3)</li> </ul>	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting
2. S Environmental 3.6 Loss of	Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         S       S         The assessment of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 2a as the area of habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 2a as the area of habitat loss is from the replacement of the sandbank features with 1         Option 2a is assessed as being Weaker than Option 1a as the area of habitat loss is from the replacement of the sandbank features with 1         Overall, Option 6 is the most preferred from a Loss of Habitat persp         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Risk to successfully achieving full removal by unburial and cut and lift of the pipelines due to the long durations involved and the potential for unforeseen unburial issues. (Score 2)         MW       MW         MW       MW	<ul> <li>ion is as follows:</li> <li>it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros on a Seabed Disturbance perspective.</li> <li>Habitat Loss (Rockdump): 1,240 m2</li> <li>ion 1a as the rock placed in each of these options changes the current seabed itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being pitat loss in Option 2a is much greater than Option 1a.</li> <li>concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)</li> <li>Technical Risks: Limited technical risks from cutting and removal of pipeline sections as the areas being cut and removed are already exposed therefore no unburial risk. (Score 3)</li> </ul>	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)
3. Technical 2. Brvironmental 3.1 Technical 3.1 2.6 Loss of	Feasibility Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Second state of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option 6 is assessed as being Stronger than Option 2a as the area of habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the Option 2a is assessed as being Weaker than Option 1a as the area of habitat perspection form a Loss of Habitat perspection form a Loss of Habitat perspection during the Viking decommissioning. (Score 3)         Technical Risks: Risk to successfully achieving full removal by unburial and cut and lift of the pipelines due to the long durations involved and the potential for unforeseen unburial issues. (Score 2)         MW       MW         MW       MW         MW       MW	In its as follows:       In iteration is as follows:         It the large area of seabed disturbance from the unburial of the 78.8 km of pipeli ach other as the seabed disturbance is considered negligible and similar acros or a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         It to sea the seabed disturbance is considered negligible and similar acros or a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         It to sea to be according to the search of these options changes the current seabed it to search of these options changes the current seabed it to search of these option 1a.         It to search of these options changes the current seabed it to search of the search of these option 1a.         It to search of these options changes the current seabed it to search of the	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)
3. Technical 2. Brvironmental 3.1 Technical 3.1 2.6 Loss of	Feasibility Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Signal Content of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option 6 is assessed as being Stronger than Option 2a as the area of habitat loss is from the replacement of the sandbank features with 1         Overall, Option 6 is the most preferred from a Loss of Habitat persp.         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Risk to successfully achieving full removal by unburial and cut and lift of the pipelines due to the long durations involved and the potential for unforeseen unburial issues. (Score 2)         MW       MW         MW       MW         MW       MW         MW       MW         Option 6 is assessed as being Much Weaker than all other options as Op Option 4 is assessed as being neutral to both Option 2a and Option 1a as	ion is as follows:         it he large area of seabed disturbance from the unburial of the 78.8 km of pipeli         ach other as the seabed disturbance is considered negligible and similar acros         is a Seabed Disturbance perspective.         Habitat Loss (Rockdump): 1,240 m2         ion 1a as the rock placed in each of these options changes the current seabed         itat loss in Option 2a is greater than Option 4. Option 4 is assessed as being         iotat loss in Option 2a is much greater than Option 1a.         anard substrate (rock).         ective.         Concept Maturity: DWC for cutting concrete coated pipeline of 28" has         been demonstrated during the Viking decommissioning. (Score 3)         Technical Risks: Limited technical risks from cutting and removal of         pipeline sections as the areas being cut and removed are already exposed         therefore no unburial risk. (Score 3)         N       N         N       N	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)
3. Technical 2. Brvironmental 3.1 Technical 3.1 2.6 Loss of	Feasibility Habitat	The assessment of the Seabed Disturbance (short-term impact) sub-criter         Option 6 is assessed as being Much Weaker than all other options due to         Option 4, Option 2a and Option 1a are all assessed as being Neutral to ea         Overall, Option 4, Option 2a and Option 1a are equally preferred from         Habitat Loss (Rockdump): N/A         Image: Second state of the Loss of Habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 4, Option 2a and Option 6 is assessed as being Stronger than Option 2a as the area of habitat (legacy / long-term impact) sub-criter         Option 6 is assessed as being Stronger than Option 1a as the area of habitat loss is from the replacement of the sandbank features with the Option 2a is assessed as being Weaker than Option 1a as the area of habitat perspection form a Loss of Habitat perspection form a Loss of Habitat perspection during the Viking decommissioning. (Score 3)         Technical Risks: Risk to successfully achieving full removal by unburial and cut and lift of the pipelines due to the long durations involved and the potential for unforeseen unburial issues. (Score 2)         MW       MW         MW       MW         MW       MW	Image: Second	nes using a Mass Flow Excavator when compared to the small area of low s these options. Habitat Loss (Rockdump): 3,530 m2 W d habitat and thus results in an area of habitat loss whereas there is no ha Weaker than Option 1a as the area of habitat loss in Option 1a is much s Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)	Habitat Loss (Rockdump): 120 m2 bitat loss in Option 6. maller than Option 4. Concept Maturity: DWC for cutting concrete coated pipeline of 28" has been demonstrated during the Viking decommissioning. (Score 3) Technical Risks: Limited technical risks due to the limited cutting required and no requirement for unburial. Rock dump routine. (Score 3)



			tion 6			Option 4			Option 2a	
			al (Cut & Lift)			Partial Removal (Cut &	Lift)		(Minor Intervention)	Do No
	- Bundle cut section	n sections with dia			<ul> <li>Cut all exposed sectio</li> <li>Bundle cut sections ar</li> <li>Place rock to remediat</li> </ul>	diamond wire (at each en ns into 20 m lengths with nd recover e snag risk at exposed e g survey   Seabed trawl sw	ends	<ul> <li>Dredge to uncover pipeline ends</li> <li>Cut 10 m section with diamond</li> <li>Place rock to remediate snag ris</li> <li>Place rock across all remaining</li> <li>Post decommissioning survey  </li> <li>Note: all areas of exposure will b</li> </ul>	wire (at each end) and recover (6 x 10 m) sk at exposed ends exposed sections Seabed trawl sweep	<ul> <li>Dredge to uncover pipel</li> <li>Cut 10m section with di</li> <li>Place rock to remediate</li> <li>Post decommissioning</li> <li>Note: areas of exposure</li> <li>areas of exposure will rer</li> </ul>
	the pipelines distui operations. The in	rbs (displacement npact is low due to operations are cur	and restricted acc the relatively shor	ess) current fishing	infrastructure may lead	n localised areas. Relativ s in intermittent rock pile to snagging in time. Fish he area of these pipelines	s. Left in-situ ing operations are	covering installed over exposures,	d areas. Relatively small volume of rock profiled to be overtrawlable. Left in-situ g in time. Fishing operations are these pipelines. (Score 2)	Short term disturbance in covering installed over cut infrastructure may lead to currently conducted in the
	W	W	W		N	N		N		
		c) Option 2a and ( d: es (recyclable) connes (landfill) es (landfill) ig: 123 tonnes (lan ome societal benef ble steel, this is m inated and hard to	Option 1a are the dfill) fits from the returni tore than offset by segregate concret	equally preferred	from a Societal impact Materials Returned: Steel: 66 tonnes (recycl Concrete: 56 tonnes (land Polymer: 2 tonnes (land	tal benefits / impacts with	2.	Materials Returned: Steel: 12 tonnes (recyclable) Concrete: 10 tonnes (landfill) Polymer: 1 tonnes (landfill)	to fishing from removal of pipeline is cons as / impacts with this option due to the al. (Score 3)	Materials Returned: Steel: 12 tonnes (recyclab Concrete: 10 tonnes (land Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns 8
	Which will take up	W	W		N	N	-	N		
ary	Option 6 is assess All other options a	ed as being Weak re assessed as be	ker than all other op ing Neutral to each	otions due to the larg		ated and difficult to segree enefits are similar.	gate concrete and polymer	able material or any job creation / that are likely to end up in landfill. £2.873 Million	retention offered by an option is considere	ed less significant than nega
	VMW	VMW	VMW		N	N		N		
ry	All other options a	sed as being Very re assessed as be , <b>Option 2a and (</b>	Much Weaker thar ing Neutral to each	n all other options as n other as the costs	s the costs are much (100 are similar. n a Short-term Cost per Surveys: £0.439 Million FLTC: N/A Total Legacy Cost: £0.4	spective.	s.	Surveys: £0.44 Million FLTC: N/A Total Legacy Cost: £0.44 Million		Surveys: £0.44 Million FLTC: £0.236 Million Total Legacy Cost: £0.676
Costs	-		-							
200	All other options a	ed as being Strong	ger than all other c ing Neutral to each	ptions as there are in other as the long-te	erm costs are largely simi		otion versus similar long-ter	N m costs for all other options.		







1.1 Personnel Offshore	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	MW	MW	10.0%
Option 4 Partial Removal (Cut & Lift)	MS	N	N	N	30.0%
Option 2a Leave In-situ (Minor Intervention)	MS	N	N	N	30.0%
Option 1a Do Nothing (Minimum Intervention)	MS	N	N	N	30.0%

1.2 Personnel Onshore	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	VMW	vмw	4.9%
Option 4 Partial Removal (Cut & Lift)	MS	N	w	×	20.8%
Option 2a Leave In-situ (Minor Intervention)	VMS	S	N	N	37.1%
Option 1a Do Nothing (Minimum Intervention)	VMS	S	N	N	37.1%

1.3 Other Users	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

1.4 High Consequence Events	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

1.5 Residual Risk	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	MS	38.1%
Option 4 Partial Removal (Cut & Lift)	w	N	N	s	23.6%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	S	23.6%
Option 1a Do Nothing (Minimum Intervention)	MW	w	w	N	14.7%

2.1 Operational Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%



2.2 Legacy Marine Impact	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	w	N	N	N	22.2%

2.3 Fuel Use & Atmospheric Emissions	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	мw	MW	10.0%
Option 4 Partial Removal (Cut & Lift)	MS	N	N	N	30.0%
Option 2a Leave In-situ (Minor Intervention)	MS	N	N	N	30.0%
Option 1a Do Nothing (Minimum Intervention)	MS	N	N	N	30.0%

- 1

2.4 Other Consumptions	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	N	30.0%
Option 4 Partial Removal (Cut & Lift)	w	N	N	w	20.0%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	w	20.0%
Option 1a Do Nothing (Minimum Intervention)	N	S	S	N	30.0%

2.5 Disturbance	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	мw	MW	MW	10.0%
Option 4 Partial Removal (Cut & Lift)	MS	N	N	N	30.0%
Option 2a Leave In-situ (Minor Intervention)	MS	N	N	N	30.0%
Option 1a Do Nothing (Minimum Intervention)	MS	N	N	N	30.0%

2.6 Loss of Habitat	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting	
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.0%	
Option 4 Partial Removal (Cut & Lift)	w	N	S	w	22.0%	
Option 2a Leave In-situ (Minor Intervention)	w	w	N	w	18.0%	
Option 1a Do Nothing (Minimum Intervention)	w	S	S	N	27.0%	

3.1 Technical Feasibility	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	MW	MW	MW	10.0%
Option 4 Partial Removal (Cut & Lift)	MS	N	N	N	30.0%
Option 2a Leave In-situ (Minor Intervention)	MS	N	N	N	30.0%
Option 1a Do Nothing (Minimum Intervention)	MS	N	N	N	30.0%

CHRYSAOR

4.1 Fishing	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

4.2 Communities / Ammenities	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting	5.1 Short-term Costs
Option 6 Full Removal (Cut & Lift)	N	w	w	w	18.2%	Option 6 Full Removal (Cut & Lift)
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%	Option 4 Partial Removal (Cut & Lift)
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%	Option 2a Leave In-situ (Minor Intervention)
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%	Option 1a Do Nothing (Minimum Intervention)

5.2 Long-term Costs	Option 6 Full Removal (Cut & Lift)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 6 Full Removal (Cut & Lift)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	w	N	N	N	22.2%



Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)		Weighting
VMW	VMW	vмw		3.6%
N	N	N N		32.1%
N	N N			32.1%
N	N	N		32.1%

& Lift)

ຶ່ງ

ŏ

5

Full

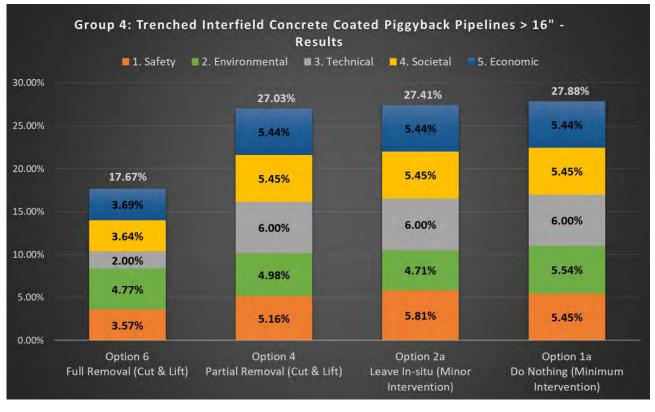
Ν

VMS

VMS

VMS





## Appendix G.3 Group 4 Results Chart



## Appendix G.4 Group 4 Detailed Evaluation Discussion

## Appendix G.4.1 Safety – Personnel Offshore

The assessment of the options indicated that Option 1a, leave in-situ with minimum intervention, Option 2a, leave in-situ with minor intervention and Option 4, partial removal by cut & lift to be the equal most attractive options against the Personnel Offshore sub-criterion. This was due to these options having similar duration offshore scopes, all of which are significantly shorter than the full removal option, where the full 80 km of pipelines would be removed.

Option 6, the full removal option by cut and lift was considered the least attractive option due to the greater safety risk associated with the longer durations to cut the pipelines into short sections and recover.

## Appendix G.4.2 Safety – Personnel Onshore

As with previous assessments, the safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. The leave in-situ options (Option 1a and 2a) were considered equally preferred as the quantity of material from removing the pipeline ends is the same in both options.

The partial removal option (Option 4) returns more material for onshore handling, transportation and processing from the removed exposures which made this option marginally less preferred to the leave in-situ options.

The full removal option (Option 6) returns significantly more material for onshore handling, transportation and processing, than the leave in-situ or partial removal options as the full 80 km of pipelines are retuned. As such, the full removal option is assessed as being significantly less attractive than the leave in-situ or partial removal options.

## Appendix G.4.3 Safety – Other Users

The assessment of the decommissioning options against this criterion has indicated that all options except Option 6, full removal by cut & lift, are equally preferred as they have a similar, low impact on the safety of other users as the vessel days and transits to and from port is similar in these options.

Option 6 is considered to have a higher impact on the safety of other users and therefore is less preferred as there are more vessel days associated with the extended work scope and, more significantly, a much higher number of transits to and from port.

## Appendix G.4.4 Safety – High Consequence Events

The assessment during the workshop indicated that the partial removal and leave in-situ options would have the least exposure to potential for High Consequence Events and would therefore, be the most attractive against this criterion. This is due to the limited cut and lift operations to recover the pipeline end sections in Option 1a and Option 2a with the increased number of cut and lift operations to remove the exposures in Option 4 being insufficient to differentiate from a potential for High Consequence Events perspective.

Option 6 would be exposed to a greater potential for a dropped object as there is significantly more lifting associated with the recovery of the entire 80 km of pipelines in sections.



## Appendix G.4.5 Safety – Residual Risk

The residual risk relates to the potential for any safety impact from the decommissioning options. Option 6 is assessed as the most attractive option from a residual safety risk perspective as it is a full removal option and therefore removes all residual risk.

Option 4 and Option 2a were assessed as being equally attractive from a residual risk perspective as the removal of the exposures in Option 4 or the rock placement over the exposures in Option 2a were considered to provide similar mitigation of any potential residual risk.

Option 1a was assessed as the least attractive option against this criterion due to the existing pipeline exposures remaining in this option.

It should be noted that, as part of any partial removal or leave in-situ solution being selected, any potential hazards along the pipeline would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

## Appendix G.4.6 Safety – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from a safety perspective is Option 2a, followed closely by Option 1a. These options were assessed as being equally preferred against all sub-criteria except the residual risk, where Option 2a was preferred.

Option 4 was assessed as marginally less attractive than Option 1a due to the impact from returning more material for onshore handling.

Option 6 was assessed as significantly less attractive than the other options in all areas except residual risk.

## Appendix G.4.7 Environment – Operational Marine Impact

The environmental impact on the marine environment from performing the decommissioning options was considered low across all options. However, there were sufficient, cumulative differences, to indicate preferences across the decommissioning options.

The assessment performed during the workshop indicated that the leave in-situ and partial removal options are the most attractive from an operational marine impact perspective. This is due to these options having the least impact in terms of marine noise as they have the lowest number of vessel days and the lowest amount of subsea cutting operations with the increases for partial removal by cut & lift over the leave in-situ options being insufficient to express a preference.

All options have similar impacts in terms of discharges that occur from the pipelines whilst performing the decommissioning option as they will have been cleaned successfully for all options. Options 4 and 6 do have increased quantities of cutting swarf over the leave in-situ options, which may have a small additional environmental impact.

The discharges from vessels relates to the number of vessels and the number of vessel days. Option 6 is less attractive than the other options due to the additional number of vessel days associated with the full removal option.



## Appendix G.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 6, full removal of the pipeline, is the most attractive decommissioning option from a legacy marine environmental impact perspective. This is due to the pipelines being fully removed and thus eliminating any legacy impact from degradation products or polymers.

The partial removal and leave in-situ options were assessed as less attractive than the full removal option as the majority of the lines are left in-situ in these options. The additional removal of 342 m of exposure was not considered sufficient to differentiate between Option 4 and the leave in-situ options. No distinction was made between the impact of exposed pipeline versus buried or rock covered pipeline.

## Appendix G.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that the partial removal and leave in-situ options are the most attractive against the fuel use and atmospheric emissions criterion. This is due to these options having lower offshore work scope durations and hence lower vessel use and durations.

Option 6 has increased impact due to the additional offshore work scope associated with fully removing the 80 km of pipelines.

## Appendix G.4.10 Environment – Other Consumptions

All options were assessed as having a similar environmental impact when considering the material returned versus material left in-situ perspective. The assessment therefore focussed on the quantity of rock required for each option.

Option 6, the full removal option and Option 1a were assessed as being the most attractive as they require no rock and 150 tonnes of rock respectively.

Option 4 was less attractive than these options as it required 1,550 tonnes of rock, used to mitigate the snag hazard associated with the cut ends left after the exposures were removed in this option. Option 2a was similarly less attractive which uses 3,560 tonnes of rock to cover the exposures.

## Appendix G.4.11 Environment – Seabed Disturbance

The leave in-situ and partial removal options are assessed as the most attractive decommissioning options here as the seabed impact is limited to the area relating to the sections of pipeline removal at the line ends.

Option 6 is significantly less attractive than the leave in-situ or partial removal options as a large area of seabed is impacted by the de-burial along the pipelines using an MFE prior to them being cut into sections and removed.

## Appendix G.4.12 Environment – Loss of Habitat

Option 6, the full removal option was assessed as being the most attractive option against this criterion as there is no loss of, or material change to the marine habitat as it currently stands.

Option 1a is assessed as less attractive due to the small quantity of rock placed at the cut pipeline ends. Option 4 is assessed as less attractive again, as it involves the introduction of rock to mitigate the snag hazard associated with the cut ends of the pipelines left after the exposures are removed.



The introduction of this rock is a material change to around 1,240 m<sup>2</sup> of habitat where the existing sandbank is replaced with a hard substrate.

Option 2a is assessed as the least attractive option as 3,530 m<sup>2</sup> of existing sandbank is replaced with a hard substrate.

## Appendix G.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from an environmental perspective is Option 1a, followed by Option 4 which is followed closely by Option 6 and Option 2a. It is noted that, reflecting the relatively minor environmental impacts across all options, the differences between the options are small.

The leave in-situ Option 1a was assessed as being the most attractive or equal most attractive option against four of the six environment sub-criteria. This relates to the limited work scope associated with the leave in-situ option and the lack of rock required in this option. It was less preferred from a legacy perspective due to the pipelines being left in-situ and marginally less preferred than the full removal option due to the small amount of habitat loss from the minimal rock cover introduced at the cut pipeline ends.

Option 4 was also assessed as being equal most attractive in four of the six sub-criteria. It was less preferred from a habitat loss perspective as more rock is required at the locations where the exposures are removed.

Option 6 was assessed as being most attractive in the legacy and loss of habitat criteria due to the full removal of the pipelines and no habitat loss from rock placement. The longer duration operations counted against it in other areas.

The lower environmental impact from the shorter durations associated with performing Option 2a was offset by the impact from the rock cover required under this option.

## Appendix G.4.14 Technical – Technical Feasibility

The leave in-situ and partial removal options were assessed as being the most attractive from a Technical Feasibility perspective due to the scope of removing the pipeline end sections, removing the exposures, placing rock cover over exposures and over the cut ends associated with these options being considered routine subsea operations.

Option 6 was less attractive as the technical risks associated with the longer durations to cut the pipeline into short sections and recovering them, and successfully performing the de-burial operations to allow the subsea cutting to be performed being the main concerns.

Overall, Option 4, Option 2a and Option 1a are the most attractive from a Technical perspective, followed by Option 6.

## Appendix G.4.15 Societal – Fishing Industry

Prior to discussing the assessment, some context is provided from the Fishing Baseline Characterisation ref. [7]. Fishing activity in the LOGGS south area, where the pipelines are installed, is moderate to high in terms of value and effort (up to 100 days of effort) and predominantly undertaken by Dutch beam trawl fleet with a minor amount of fishing undertaken by UK demersal fishing (generally beam trawling).



Given the above, the partial removal and leave in-situ options are assessed as being the most attractive options due to them presenting the least disruption and disturbance to the fishing industry from having the smallest offshore work scopes.

Option 6 is assessed as the least attractive option due to the extensive disruption to the fishing industry from the removal of the entire 80 km of pipelines.

It was noted that, given that fishing operations are already conducted in the area along and around this pipeline, and any infrastructure remaining on the seabed will be subject to an appropriate postdecommissioning monitoring regime, the residual presence of the pipeline was not considered a limitation to fishing activity.

## Appendix G.4.16 Societal – Communities / Amenities

The impact of the decommissioning options on communities and amenities are considered in this criterion.

The leave in-situ and partial removal options are assessed as being the most attractive due to them returning limited quantities of material for processing onshore. Whilst this limits the amount of useful material, such as steel, being returned for recycling, it also results in the least amount of material being returned that will be directed to landfill, such as the polymer coating of the pipelines.

Option 6 was assessed as being the least attractive option as it returns the entire 80 km of pipeline and the most quantity of polymer which takes up limited landfill capacity.

## Appendix G.4.17 Societal – Overall

When combining the assessments conducted at sub-criterion level, the partial removal and leave insitu options were considered the equal most attractive options as they were assessed as being the most attractive options against both the Fishing Industry and Communities / Amenities criteria.

Option 6 was less preferred as the impact from the disturbance to the fishing industry and the additional polymer to landfill from the full removal option, being assessed as less attractive.

## Appendix G.4.18 Economic – Short-term Costs

Option 1a, Option 2a and Option 4 were assessed as the equal most attractive options from a short-term costs perspective. This is due to their costs being similar and the lowest cost options at  $\pounds$ 2.9 million,  $\pounds$ 2.9 million and  $\pounds$ 3.4 million respectively.

The costs for the full removal option was significantly higher with Option 6 being £211 million.

## Appendix G.4.19 Economic – Long-term Costs

The impact of the decommissioning options in terms of long-term costs i.e. any on-going survey and monitoring costs and Fishing Legacy Trust-fund Company (FLTC) payments, are considered in this criterion.

Option 6 is considered the most attractive option against this criterion. This is due to there being no long-term costs associated with this full removal option.

All other options are considered equally less attractive as the long-term costs associated with them is largely similar being between  $\pounds400$  k and  $\pounds700$  k.



## Appendix G.4.20 Economic – Overall

Overall, the assessment is dominated by the short-term costs as the differentials are much greater than for the long-term costs.

The partial removal and leave in-situ options are all considered equal most attractive options from an Economic perspective. These are followed by Option 6 which is significantly less attractive.

## APPENDIX H GROUP 7 – DETAILED EVALUATION RESULTS

Appendix H.1 Group 7 Attributes Table

# Group 7: Trenched & Buried Umbilical

- 13.9 km umbilical from Ganymede to Callisto with 11 m of exposure (UM2)

		Opti	on 5a			Option 4		Optic	on 2a	Option 1a	
		Full Removal	(Reverse Reel)		F	Partial Removal (Cut &	Lift)	Leave In-situ (Mi	nor Intervention)	Do Nothing (Minimum Intervention)	
	- Unbury umbilical with MFE   Recover mattresses and grout bags     - Install recovery rigging for reverse reel   Reverse reel onto reel vessel     - Backfill trench   Post decommissioning survey   Seabed trawl sweep			onto reel vessel	<ul> <li>Dredge to uncover umbilical ends</li> <li>Cut 10 m section with hydraulic shears (at each end) and recover (2 x 10 m)</li> <li>Cut exposed section out (single 11 m length) with hydraulic shears &amp; recover</li> </ul>			<ul> <li>Dredge to uncover umbilical ends</li> <li>Cut 10 m section with hydraulic shears</li> <li>Place rock to remediate snag risk at ex</li> </ul>		<ul> <li>Dredge to uncover umbilical ends</li> <li>Cut 10m section with hydraulic shears (at each end) and recover (2 x 10 m</li> <li>Place rock to remediate snag risk at exposed ends</li> </ul>	
					Place rock to remediate snag risk at exposed ends     Post decommissioning survey   Seabed trawl sweep			<ul> <li>Place rock across all remaining exposit</li> <li>Post decommissioning survey   Seaber</li> <li>Note: all areas of exposure will be rock</li> </ul>	ed sections (one run of 11 m) d trawl sweep	<ul> <li>Post decommissioning survey   Seabed trawl sweep</li> <li>Note: areas of exposure at pipeline ends will be removed with ends, other areas of exposure (11 m) will remain</li> </ul>	
	Vessel Type: Po	B / Dave / Hours / Pl	11		Vessel Type: PoB / Days	/ Hours / PLI		Vessel Type: PoB / Days / Hours / PLL		Vessel Type: PoB / Days / Hours / PLL	
e	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 4.7 / 6.164 / 4.62E-04		DSV: 110 / 6.0 / 7.933 / 5			DSV: 110 / 5.5 / 7.273 / 5.45E-04		DSV: 110 / 5.3 / 6.943 / 5.21E-04			
ly Offshor	Divers: 18 / 4.7 /				Divers: 18 / 6.0 / 2,596 / 2			Divers: 18 / 5.5 / 2,380 / 2.31E-03		Divers: 18 / 5.3 / 2,272 / 2.20E-03	
ffs.					-					,	
	Trawler: 5 / 8.0 /		=		Trawler: 5 / 8.0 / 480 / 3.6			Trawler: 5 / 8.0 / 480 / 3.60E-05		Trawler: 5 / 8.0 / 480 / 3.60E-05	
afe		4 / 9.2 / 4,879 / 3.66	6E-04		Survey Vessel: 44 / 9.2 /	4,879 / 3.66E-04		Survey Vessel: 44 / 9.2 / 4,879 / 3.66E-	)4	Survey Vessel: 44 / 9.2 / 4,879 / 3.66E-04	
1. Safe sonnel		17,383 / 1.30E-03									
	Reel Vessel: 76	/ 10.3 / 9,384 / 7.04E	E-04		Total offshore hours: 15,8	88 hrs		Total offshore hours: 15,012 hrs		Total offshore hours: 14,574 hrs	
Pel					Total offshore PLL: 3.52E	-03		Total offshore PLL: 3.26E-03		Total offshore PLL: 3.13E-03	
5	Total offshore ho	urs: 40,308 hrs									
· ·	Total offshore PL	L: 4.83E-03									
	N	N	N		N	N		N			
	The assessment	of the Personnel Off		n is as follows:							
Summar					ure for offebore personnel is	largely similar for all onti	ons Despite reverse real rea	uiring additional vessel usage, the operati	ons along the 11 km nineline length do	not materially change the offshore risk profile.	
Juinnai					rsonnel perspective.	largery similar for all opti-	ons. Despite reverse reer req	unnig additional vessel usage, the operation	ons along the 14 km pipeline length do	not materially change the districte lisk prolife.	
	overall, all opt	ons are equally pre	eleffed from a fi	Isk to offshore rei	isonner perspective.						
	Resource Type:	Days / Hours / PLL			Resource Type: Days / H	ours / PLL		Resource Type: Days / Hours / PLL		Resource Type: Days / Hours / PLL	
re le	Onshore Operatio	ons (Cleaning & Disp	oosal): 9.0 / 576 /	7 08E-05	Onshore Operations (Clea		4 / 7 87E-06	Onshore Operations (Cleaning & Dispos	al): 1.0 / 64 / 7.87E-06	Onshore Operations (Cleaning & Disposal): 1.0 / 64 / 7.87E-06	
afe on is		one (eleaning a biop						eneriere eperanene (ereaning a Diepee			
- S	Total onshore ho	urs: 576 brs			Total onshore hours: 64 hrs		Total onshore hours: 64 hrs		Total onshore hours: 64 hrs		
- <u>~</u> 0	Total onshore Pl				Total onshore PLL: 7.87E-06		Total onshore PLL: 7.87E-06		Total onshore PLL: 7.87E-06		
		L. 7.00L-00	MW		N	N					
	Resource Type: I Onshore Operation Total onshore PL MW	MW			N	N		N			
	The assessment	of the Personnel On									
Summar								the full pipeline length being recovered to	shore for handling compared to less th	an 50 m of umbilical in the other options.	
	Option 4, Option			U		0	the quantities of returned um	bilical are largely similar.			
	Overall, Option	4, Option 2a and C	Option 1a are eq	ual most preferred	d from a risk to Onshore P	ersonnel perspective.					
	Magaal Davia				Vere el Deve			Vessel Dave		Vessel Payer	
	Vessel Days:				Vessel Days:			Vessel Days:		Vessel Days:	
	DSV: 4.7				DSV: 6.0			DSV: 5.5		DSV: 5.3	
ers	Divers: 4.7				Divers: 6.0			Divers: 5.5		Divers: 5.3	
C S	Trawler: 8.0				Trawler: 8.0			Trawler: 8.0		Trawler: 8.0	
1. Safe Other	Survey Vessel: 9	.2			Survey Vessel: 9.2			Survey Vessel: 9.2		Survey Vessel: 9.2	
S =	CSV: 19.1										
	Reel Vessel: 10.3 Total vessel days: 23.3 days			Total vessel days: 22.8 days		Total vessel days: 22.5 days					
÷	T T		Total Number of Transits:	8		Total Number of Transits: 8		Total Number of Transits: 8			
	Total vessel days: 51.3 days										
	Total Number of	Transits: 14									
	N	N	N		N	N		N			
	The assessment	of the Other Users s	sub-criterion is as	follows:							
Summar					re differences between the ve	essel days and number o	f transits between the options	, these are insufficient to result in a mate	rial difference in the safety impact on o	ther users.	
		ons are equally pre				,	·····		, ,		
		Ulis ale equally big	eleneu nom a n		perspective.						



		Optic Full Removal (			P	Option 4 Partial Removal (Cut & Li	ift)	Optio Leave In-situ (Mir		Option 1a Do Nothing (Minimum Intervention)
	- Unbury umbilical \ - Install recovery rig - Backfill trench   P	vith MFE   Recover ging for reverse ree	mattresses and I   Reverse reel o	nto reel vessel	<ul> <li>Dredge to uncover umbili</li> <li>Cut 10 m section with hy</li> <li>Cut exposed section out</li> <li>Place rock to remediate</li> </ul>	ical ends ydraulic shears (at each en (single 11 m length) with I snag risk at exposed ends uney   Seabed trawl swee	nd) and recover (2 x 10 m) hydraulic shears & recover s	Dredge to uncover umbilical ends     Cut 10 m section with hydraulic shears     Place rock to remediate snag risk at ex     Place rock across all remaining expose     Post decommissioning survey   Seabed     Note: all areas of exposure will be rock	(at each end) and recover (2 x 10 m) (posed ends ed sections (one run of 11 m) d trawl sweep	<ul> <li>Dredge to uncover umbilical ends</li> <li>Cut 10m section with hydraulic shears (at each end) and recover (2 x 10</li> <li>Place rock to remediate snag risk at exposed ends</li> <li>Post decommissioning survey   Seabed trawl sweep</li> <li>Note: areas of exposure at pipeline ends will be removed with ends, oth areas of exposure (11 m) will remain</li> </ul>
Consequence Events	The potential for High Consequence Events is assessed as Medium for this option. This relates to the on-deck cutting (for umbilical that is longer than reel capacity), lifting (for umbilical recovery for reeling) and integrity (whilst reverse reeling). Number of Lifts: 2			This is based on the number of both cutting and lifting operations that would need to take place to remove the umbilical exposures and ends.			The potential for High Consequence Events is assessed as Low for this option. This is based on the number of both cutting and lifting operations that would need to take place to the umbilical ends only. Number of Lifts: 2		The potential for High Consequence Events is assessed as Low for this option. This is based on the number of both cutting and lifting operations would need to take place to the umbilical ends only. Number of Lifts: 2	
	W	W	W		N	N		N		
	Option 6 is assess Option 4, Option 2a <b>Overall, Option 4</b> ,	ed as being Weake and Option 1a are <b>Option 2a and O</b> uld be fully remove	r than all other op assessed as bei ption 1a are equ d from the seabed	ing Neutral to each o ually preferred fron	ential for a High Conseque ther as the potential for Hig a <b>High Consequence E</b> The majority of the 13.9 ki depth. There is 11 m of e	th Consequence Events is vents perspective. m umbilical is trenched and xposed umbilical which wil	considered similar for thes d buried to an appropriate II be removed with the	The majority of the 13.9 km umbilical is to depth. There is 11 m of exposed umbilical	trenched and buried to an appropriate cal which will be rock dumped to	The majority of the 13.9 km umbilical is trenched and buried to an appropriate depth. There is 11 m of exposed umbilical which will remain
1.5 Residual Risk					placement designed to be overtrawlable. A post-decommissioning trawl sweep will be conducted. As such, the potential snag hazard post-decommissioning activities is adequately mitigated and would be lower than for the umbilical in its current state of exposure.			mitigate the potential snag hazard associated with these exposed areas. The areas of rock placement will be designed to be overtrawlable and a post-decommissioning trawl sweep will be conducted. As such, the potential snag hazard post-decommissioning activities is adequately mitigated and would be lower than for the umbilical in its current state of exposure. The survey & monitoring programme is committed to ensuring that the potential		its current state of exposure. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be mana & mitigated as appropriate.
	S The assessment of	S the Residual Risk	<b>S</b> sub-criterion is as	s follows:	snag hazard from left in-si mitigated as appropriate. N	tu infrastructure continues	to be managed &	snag hazard from left in-situ infrastructur as appropriate. <b>N</b>	e continues to be managed & mitigated	
mmary	mitigated by rock d Option 4, Option 2a	ump. and Option 1a are	all assessed as		n other as the residual risk			a snag hazard in Option 4, Option 2a and a		azards are very short lengths and for Option 4 and Option 2a they are
	Vessel Noise (days	on-site):			Vessel Noise (days on-sit	e):		Vessel Noise (days on-site):		Vessel Noise (days on-site):
	Survey Vessel - 1.2					·	. E davia		val Trawler E dava	
	6.28   Trawler - 5 da		ays   DSV - 0.67	days   Reel Vessel -	Survey Vessel - 1.2 days	DSV - 0.08 days   Trawle	er - 5 days	Survey Vessel - 1.2 days   DSV - 1.5 day	ys   Hawler - 5 days	Survey Vessel - 1.2 days   DSV - 1.25 day   Trawler - 5 days
Impact		iys	ays   DSV - 0.67	days   Reel Vessel -	Tooling Noise:	DSV - 0.08 days   Trawle raulic Shears - 2.34 days		Survey Vessel - 1.2 days   DSV - 1.5 day Tooling Noise: Dredging - 0.5 days   Hydraulic Shears -		Survey Vessel - 1.2 days   DSV - 1.25 day   Trawler - 5 days Tooling Noise: Dredging - 0.5 days   Hydraulic Shears - 0.08 days
Operational Marine Impact	6.28   Trawler - 5 da Tooling Noise:	nys 5.78 days rges: for hydrocarbon rel e has been cleane within acceptable li	eases through cu d successfully. F mits and included	utting operations Planned discharges	Tooling Noise: Dredging - 0.5 days   Hydr Operation Discharges: Negligible potential for hyd because the pipeline has would therefore be within a No cutting swarf as cutting	raulic Shears - 2.34 days   drocarbon releases through been cleaned successfully	Rock Dumping - 5 days n cutting operations /. Planned discharges ided in operational permits.	Tooling Noise:	0.08 days ases through cutting operations successfully. Planned discharges its and included in operational permits.	Tooling Noise: Dredging - 0.5 days   Hydraulic Shears - 0.08 days Operation Discharges: Negligible potential for hydrocarbon releases through cutting operations
2.1 Operational Marine Impact	6.28 Trawler - 5 da Tooling Noise: MFE for Unburial Operational Discha Negligible potential because the pipelin would therefore be	tys 5.78 days for hydrocarbon rel e has been cleane within acceptable li g swarf as no cuttin st, Grey and Black	eases through cu d successfully. F mits and included g performed. Water, this is dri	utting operations Planned discharges d in operational iven by duration of	Tooling Noise: Dredging - 0.5 days   Hydr Operation Discharges: Negligible potential for hyd because the pipeline has would therefore be within a No cutting swarf as cutting Vessel Discharges: This includes Ballast, Gre	raulic Shears - 2.34 days   drocarbon releases through been cleaned successfully acceptable limits and inclu g performed by hydraulic s y and Black Water, this is jely similar for all options e	Rock Dumping - 5 days n cutting operations /. Planned discharges ided in operational permits. shears.	Tooling Noise: Dredging - 0.5 days   Hydraulic Shears - Operation Discharges: Negligible potential for hydrocarbon relea because the pipeline has been cleaned s would therefore be within acceptable limi No cutting swarf as cutting performed by Vessel Discharges:	0.08 days uses through cutting operations successfully. Planned discharges its and included in operational permits. hydraulic shears.	Tooling Noise: Dredging - 0.5 days   Hydraulic Shears - 0.08 days Operation Discharges: Negligible potential for hydrocarbon releases through cutting operations because the pipeline has been cleaned successfully. Planned discharge would therefore be within acceptable limits and included in operational

Overall, Option 4, Option 2a and Option 1a are equally preferred from an Operational Marine Impact perspective.



			tion 5a II (Reverse Reel)		P	Option 4 Partial Removal (Cut & I	_ift)		on 2a inor Intervention)	Do Not
	- Install recovery ri	with MFE   Recoving ging for reverse r	ver mattresses and reel   Reverse reel o oning survey   Seab	onto reel vessel	<ul> <li>Dredge to uncover umbili</li> <li>Cut 10 m section with hy</li> </ul>	ical ends /draulic shears (at each e (single 11 m length) with snag risk at exposed end survey   Seabed trawl swe	and) and recover (2 x 10 m) hydraulic shears & recover is	- Dredge to uncover umbilical ends	rs (at each end) and recover (2 x 10 m) exposed ends sed sections (one run of 11 m) ed trawl sweep	<ul> <li>Dredge to uncover umbilito</li> <li>Cut 10m section with hyd</li> <li>Place rock to remediate s</li> <li>Post decommissioning su</li> <li>Note: areas of exposure a areas of exposure (11 m) w</li> </ul>
2. Environmental 2.2 Legacy Marine Impact			acts from this full re	moval option.	depth. There is 11 m of e ends rock dumped. The legacy marine impact trenched and buried umbil layers. Given the buried status of been cleaned to a regulate considered low but greate	xposed umbilical which w s relate to the left in-situ ical which has a combina the material being left in- ory acceptable level, the l r than the full removal opt	tion of polymer and steel situ and the umbilical having egacy marine impact is	trenched and buried umbilical which ha layers. Given the buried status of the material been cleaned to a regulatory acceptabl considered low but greater than the full	ical which will be rock dumped. a left in-situ materials, i.e. the remaining s a combination of polymer and steel being left in-situ and the pipeline having e level, the legacy marine impact is	The majority of the 13.9 km appropriate depth. There is is. The legacy marine impacts remaining trenched and bur and steel layers. Given the buried status of th having been cleaned to a re impact is considered low bu
	S	S	S		N	N		N		
		re assessed as N is the most pret	leutral to each othe	er as the quantities a l <b>acy Marine Impact</b>			al impact is expected to be a	Vessel Emissions (in tonnes): Fuel: 522 CO2e: 1,710 NOx: 31.00 SO2: 2.09		Vessel Emissions (in tonne Fuel: 517 CO2e: 1,694 NOx: 30.71 SO2: 2.07
2.3 2.3 A	Vessel Energy Us	e: 49,936 GJ			Vessel Energy Use: 22,85	58 GJ		Vessel Energy Use: 22,438 GJ		Vessel Energy Use: 22,229
	N	N	N		N	N		N		, , , , , , , , , , , , , , , , , , ,
Summary	All options are ass	sessed as Neutral	l to each other as tl		as follows: issions generated are simila neric Emissions perspectiv					
nment ther nption	Material Emission Recovered Materia Remaining Materia Total: 248	al: 248	):		Material Emissions (CO2 Recovered Material: 1 Remaining Material: 397 Total: 398	in tonnes):		Material Emissions (CO2 in tonnes): Recovered Material: 1 Remaining Material: 397 Total: 398		Material Emissions (CO2 ir Recovered Material: 1 Remaining Material: 397 Total: 398
2. En 2 Cor	Rock: N/A				Rock: 200 tonnes			Rock: 160 tonnes		Rock: 50 tonnes
	N	N	N		N	N		N		·
Summary	All options are ass preference for any	sessed as being N of the options. Ins are equally p	preferred from an		ns perspective. There is a small amount o	of short-term disturbance	esulting from removing the	There is limited short-term disturbance	of replacement material left behind, and for this option from the small area of	There is limited short-term
2. Environmenta 2.5 Disturbance					is considered insignificant		umping the cut ends. This	rock dump only.		rock dump only.
	W	W	W		N	N		N		
Summary	Option 5 is assess Option 4, Option 2	sed as being Wea a and Option 1a a	aker than all other o are all assessed as	being Neutral to eac	ea of seabed disturbance fro	urbance is considered ne	km umbilical using a Mass I gligible and similar across the		ery small area impacted in the other opti	ons.



Option 1a Nothing (Minimum Intervention) bilical ends hydraulic shears (at each end) and recover (2 x 10 m) te snag risk at exposed ends g survey   Seabed trawl sweep re at pipeline ends will be removed with ends, other n) will remain
km umbilical is trenched and buried to an
re is 11 m of exposed umbilical which will be left as-
acts relate to the left in-situ materials, i.e. the buried umbilical which has a combination of polymer
of the material being left in-situ and the pipeline a regulatory acceptable level, the legacy marine w but greater than the full removal option.
ons, there is polymer remaining and this is enough to
onnes):
,
,229 GJ
02 in tonnes):
7
, these are considered insufficient to express a
rm disturbance for this option from the small area of

			Opt	on 5a			Option 4		Optic	n 2a	Option 1a
				(Reverse Reel)			Partial Removal (Cut & Li	ft)	Leave In-situ (Mi	nor Intervention)	Do Nothing (Minimum Intervention)
	- Unbu	ury umbilical	with MFE   Recov	er mattresses and g	rout bags	- Dredge to uncover umbil	ical ends		- Dredge to uncover umbilical ends		- Dredge to uncover umbilical ends
				el   Reverse reel on			/draulic shears (at each en		<ul> <li>Cut 10 m section with hydraulic shears</li> </ul>	(at each end) and recover (2 x 10 m)	- Cut 10m section with hydraulic shears (at each end) and recover (2 x 10 m)
	- Back	kfill trench   F	Post decommissio	ning survey   Seabed	d trawl sweep	- Cut exposed section out	(single 11 m length) with I	nydraulic shears & recover	<ul> <li>Place rock to remediate snag risk at ex</li> </ul>	posed ends	<ul> <li>Place rock to remediate snag risk at exposed ends</li> </ul>
						- Place rock to remediate	snag risk at exposed ends		- Place rock across all remaining expose	ed sections (one run of 11 m)	<ul> <li>Post decommissioning survey   Seabed trawl sweep</li> </ul>
						- Post decommissioning s	survey   Seabed trawl swee	р	- Post decommissioning survey   Seaber	I trawl sweep	- Note: areas of exposure at pipeline ends will be removed with ends, other
						- Note: all areas of exposu	ure will be removed		- Note: all areas of exposure will be rock	dumped	areas of exposure (11 m) will remain
a	Habitat	at Loss (Rocl	(dump): N/A			Habitat Loss (Rockdump)	: 160 m2		Habitat Loss (Rockdump): 150 m2		Habitat Loss (Rockdump): 40 m2
Environment 2.6 Loss of Hahitat			.,			,			,		
a s	g										
jo și i	0										
Ξο̈́́Ξ	Ĕ										
2. Environmental 2.6 Loss of Habitat											
~											
		S	S	S		N	W		W		
	The as	ssessment o	f the Loss of Habit	at (legacy / long-ter	m impact) sub-crite	erion is as follows:	•				
	Option	n 5 is assess	ed as being Stron	ger than Option 4, C	Option 2a and Option	on 1a as the rock placed for	each of these options cha	nges the current seabed ha	bitat and thus results in an area of habita	loss whereas there is no habitat loss i	n Option 5.
Summa	Option	n 4 is assess	ed as being Neutr	al to Option 2a as th	he area of habitat le	oss in these options is simi	lar. Option 4 is assessed	as being Weaker than Optio	on 1a as area of habitat loss in Option 1a	is smaller than Option 4.	
Summa	Option	n 2a is asses	sed as being Wea	ker than Option 1a	as the area of habi	itat loss in Option 2a is grea	ater than Option 1a.				
	Note: H	Habitat loss	is from the replace	ement of the sandba	ink features with ha	ard substrate (rock).					
	Overa	all, Option 5	is the most pref	erred from a Loss	of Habitat perspe	ctive.					
	0		B	funchilia da ia anna	i dana dana dina a	O	n undeilie ele suitte burdensulie	a har and an all adversarian	Or a second Martanitan Or this a successful second		Or work Material Continue work lister to with business is a barrier of a set of marrier
= = .	Conce		: Reverse reeling of	f umbilicals is cons	idered routine.		g umbilicals with hydraulic	shears and rock dumping	Concept Maturity: Cutting umbilicals w	th hydraulic shears and rock dumping	Concept Maturity: Cutting umbilicals with hydraulic shears and rock dumping
<ol> <li>Technical</li> <li>Technical</li> <li>Technical</li> <li>Feasibility</li> </ol>	(Score	e 3)				considered routine. (Score	e 3)		considered routine. (Score 3)		considered routine. (Score 3)
hr chr ihi	<u> </u>		- · · ·	<b>6</b> H							
Te	lecnn			successfully reverse	0		technical risks due to the	limited cutting required.	Technical Risks: Limited technical risk	•	Technical Risks: Limited technical risks due to the limited cutting required
3.1 				grity failure during re		Rock dump routine. (Sco	re 3)		and no requirement for unburial. Rock d	imp routine. (Score 3)	and no requirement for unburial. Rock dump routine. (Score 3)
9	cutting	g required for	a reel swap on th	e reel vessel (deck o	ops). (Score 2)						
		W	W	W		N	N		N		
	The as	ssessment o	f the Technical Ris	k sub-criterion is as	s follows:			-			
~	Option	n 5 is assess	ed as being Weal	er than all other opt	tions as there are t	echnical risks associated w	ith the reverse reeling oper	ations such as potential int	egrity failure and deck operations.		
Summa	All othe	her options a	re assessed as be	ing Neutral to each	other as the techn	ical risk profiles are largely	similar, i.e. short duration,	routine operations.			
	Overa	all, Option 4	, Option 2a and	Option 1a are equa	ally preferred from	m a Technical Risk persp	ective.				
	14/1-11-1										
_ D	vvniist					g Short term disturbance in			Short term disturbance in localised areas	-	Short term disturbance in localised areas. Relatively small volume of rock
eta hin	the um		· · ·	and restricted acces	, 0	v			covering installed over exposures, profile		covering installed over cut ends, profiled to be overtrawlable. Left in-situ
Societal Fishing	operati		•	the relatively short	•	,	me. Fishing operations an	e conducted in the area of	infrastructure may lead to snagging in tir	ne. Fishing operations are conducted	infrastructure may lead to snagging in time. Fishing operations are
4. Societal 4.1 Fishing	Fishing	ng operations	are conducted in	he area of this umb	ilical. (Score 2)	this umbilical. (Score 2)			in the area of this umbilical. (Score 2)		conducted in the area of this umbilical. (Score 2)
4 4											
		W	W	W		N	N		N		
	_					N	N		N		
		ssessment o			riterion is as tollow						
	Option			ect on Fishing sub-c							
Summa	A 11 11	n 5 is assess	ed as being Weal	er than all other opt	tions due to the dis	sruption caused to fishing op			inimal disruption due to shorter operationa	I durations with the other options.	
		n 5 is assess her options a	ed as being Weal re assessed as be	er than all other opt ing Neutral to each	tions due to the dis other as the disrup	sruption caused to fishing op otion associated with exposi	ure removal and / or rock d	ump is largely similar, as is	the left in-situ infrastructure.	I durations with the other options.	
	Note: g	n 5 is assess her options a given that fis	ed as being Weak re assessed as be hing operations ar	er than all other opt ing Neutral to each e conducted extens	tions due to the dis other as the disrup ively in this area, n	sruption caused to fishing op otion associated with exposi- to benefit is given for full rem	ure removal and / or rock d noval of the pipeline in term	ump is largely similar, as is	the left in-situ infrastructure.	I durations with the other options.	
	Note: g	n 5 is assess her options a given that fis	ed as being Weak re assessed as be hing operations ar	er than all other opt ing Neutral to each e conducted extens	tions due to the dis other as the disrup ively in this area, n	sruption caused to fishing op otion associated with exposi	ure removal and / or rock d noval of the pipeline in term	ump is largely similar, as is	the left in-situ infrastructure.	I durations with the other options.	
	Note: g Overa	n 5 is assess her options al given that fis <b>aII, Option 4</b>	ed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b>	er than all other opt ing Neutral to each e conducted extens	tions due to the dis other as the disrup ively in this area, n	sruption caused to fishing op otion associated with expose to benefit is given for full rem I from a Societal impact o	ure removal and / or rock d noval of the pipeline in term	ump is largely similar, as is	the left in-situ infrastructure. try.	I durations with the other options.	Materials Returned:
1	Note: g Overa Materia	n 5 is assess her options al given that fis <b>all, Option 4</b> rials Returned	ed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b>	er than all other opt ing Neutral to each e conducted extens	tions due to the dis other as the disrup ively in this area, n	sruption caused to fishing op otion associated with expose to benefit is given for full rem from a Societal impact of Materials Returned:	ure removal and / or rock d noval of the pipeline in term on Fishing perspective.	ump is largely similar, as is	the left in-situ infrastructure. try. Materials Returned:	I durations with the other options.	Materials Returned: Steel: 1 tonnes (recyclable)
ties /	Note: g Overa Materia	n 5 is assess her options a given that fis all, Option 4 rials Returned : 186 tonnes	ed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> I: (recyclable)	er than all other opt ing Neutral to each e conducted extens	tions due to the dis other as the disrup ively in this area, n	suption caused to fishing op otion associated with exposi- to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e)	ump is largely similar, as is	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable)	I durations with the other options.	Steel: 1 tonnes (recyclable)
etal unities / iries	Note: g Overa Materia	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> I: (recyclable) s (landfill)	er than all other opt ing Neutral to each e conducted extens Option 1a are the e	tions due to the dis other as the disrup ively in this area, n	sruption caused to fishing op otion associated with expose to benefit is given for full rem from a Societal impact of Materials Returned:	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e)	ump is largely similar, as is	the left in-situ infrastructure. try. Materials Returned:	I durations with the other options.	
ocietal munities /	Note: g Overa Materia	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne	ed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> I: (recyclable)	er than all other opt ing Neutral to each e conducted extens Option 1a are the e	tions due to the dis other as the disrup ively in this area, n	suption caused to fishing op otion associated with exposi- to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e)	ump is largely similar, as is	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable)	I durations with the other options.	Steel: 1 tonnes (recyclable)
Societal ommunities /	Note: g Overa Materia	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba	eed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land	er than all other opt ing Neutral to each e conducted extens <b>Option 1a are the e</b>	tions due to the dis other as the disrup ively in this area, n equally preferred	suption caused to fishing op otion associated with exposi- to benefit is given for full rem I from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfil	ure removal and / or rock d noval of the pipeline in term <b>on Fishing perspective.</b> e)	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Retumed: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill)		Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill)
<ol> <li>Societal</li> <li>Communities / Ammenties</li> </ol>	Note: g Overa Materia	n 5 is assess her options a given that fis all, Option 4 rials Returner : 186 tonnes ner: 80 tonne ess/Grout Ba	eed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> ( (recyclable) s (landfill) g: 54 tonnes (land ome societal bene	er than all other opt ing Neutral to each e conducted extens <b>Option 1a are the o</b> fill)	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel,	suption caused to fishing op otion associated with exposi- to benefit is given for full rem I from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabi Polymer: 1 tonnes (landfil There are minimal societa	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imp		Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the
<ul> <li>4. Societal</li> <li>4.2 Communities / Ammenities</li> </ul>	Note: g Overa Materia Steel: Polymo Mattree Whilst this is	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba t there are so s more than c	eed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ome societal bene ffset by the polym	er than all other opt ing Neutral to each e conducted extens <b>Option 1a are the o</b> fill) its from the returnin er and mattress / gr	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel,	suption caused to fishing op otion associated with exposi- to benefit is given for full rem I from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfil	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Retumed: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill)		Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill)
<ul> <li>4. Societal</li> <li>4.2 Communities /</li> </ul>	Note: g Overa Materia Steel: Polymo Mattree Whilst this is	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba t there are so s more than c	eed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> ( (recyclable) s (landfill) g: 54 tonnes (land ome societal bene	er than all other opt ing Neutral to each e conducted extens <b>Option 1a are the o</b> fill) its from the returnin er and mattress / gr	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel,	suption caused to fishing op otion associated with exposi- to benefit is given for full rem I from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabi Polymer: 1 tonnes (landfil There are minimal societa	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imp		Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the
4. Societal 4.2 Communities / Ammenities	Note: g Overa Materia Steel: Polymo Mattree Whilst this is	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba at there are so s more than c ike up landfill	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ome societal bene ffset by the polym capacity. (Score	er than all other opt ing Neutral to each e conducted extens <b>Option 1a are the e</b> fill) its from the returnin er and mattress / gr 2)	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel,	suption caused to fishing op otion associated with exposi- to benefit is given for full rem <b>1 from a Societal impact o</b> Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns &	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th k disposal. (Score 3)	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imp		Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the
<ul> <li>4. Societal</li> <li>4.2 Communities / Ammenities</li> </ul>	Materia Steel: Polyme Whilst this is will tak	n 5 is assess her options a given that fis all, Option 4 rials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba t there are so s more than c ike up landfill	eed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> ( (recyclable) s (landfill) g: 54 tonnes (land ome societal bene ffset by the polym capacity. (Score	er than all other opting Neutral to each e conducted extens <b>Option 1a are the o</b> ffill) fill) its from the returniner and mattress / gr 2)	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which	suption caused to fishing op otion associated with exposi- to benefit is given for full rem I from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfil There are minimal societa minimal onshore returns & N	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imp onshore returns & disposal. (Score 3)		Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the
4. Societal 4.2 Communities / Ammentities	Materia Steel: Polyme Whilst this is will tak	n 5 is assess her options a given that fis <b>all, Option 4</b> rials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba it there are so s more than c ike up landfill <b>W</b> ssessment o	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ome societal bene ffset by the polym capacity. (Score <b>W</b> f the Societal impa	er than all other opting Neutral to each e conducted extens option 1a are the end of the extension of the ex	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which	suption caused to fishing op otion associated with exposi- to benefit is given for full rem <b>1 from a Societal impact of</b> Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns & N follows:	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) e) l) I benefits / impacts with th a disposal. (Score 3)	ump is largely similar, as is s of impact to fishing indust	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imp onshore returns & disposal. (Score 3)	acts with this option due to the minimal	Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the minimal onshore returns & disposal. (Score 3)
4.5	Materia Steel: Polyme Whilst this is will tak	n 5 is assess her options a given that fis <b>all, Option 4</b> ials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba it there are so is more than c ike up landfill <b>W</b> ssesssment o Assessment	eed as being Weak re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ome societal bene ffset by the polym capacity. (Score <b>W</b> f the Societal imp of the societal imp	er than all other opting Neutral to each e conducted extens <b>Option 1a are the e</b> fill) its from the returniner and mattress / gr 2) <b>W</b> act on Other Users spact of options is do	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which sub-criterion is as forminated by any ne	suption caused to fishing op otion associated with exposi- to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns & N follows: egative impacts from materia	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) l) l benefits / impacts with th & disposal. (Score 3) N al returned as the positive i	ump is largely similar, as is s of impact to fishing indust is option due to the mpacts, such as recyclable	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imp onshore returns & disposal. (Score 3)	acts with this option due to the minimal fered by an option is considered less si	Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the
4. Societal 4. Societal 4.2 Communities / Ammonifies	Materia Steel: Polyme Mattree Whilst this is will tak	n 5 is assess her options a given that fis all, Option 4 ials Returned : 186 tonnes ner: 80 tonne ess/Grout Ba it there are so s more than c ike up landfill W ssesssment o Assessment n 5 is assess	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land gree societal bene ffset by the polym capacity. (Score <b>W</b> f the Societal impact of the societal impact e d as being Weal	er than all other opting Neutral to each e conducted extens <b>Option 1a are the e</b> fill) its from the returniner and mattress / gr 2) <b>W</b> act on Other Users s pact of options is do er than all other opti	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which sub-criterion is as to prinated by any ne tions due to the po	suption caused to fishing op otion associated with exposi- to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns & N follows: egative impacts from materia	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with the k disposal. (Score 3) N al returned as the positive in bags that are likely to end	ump is largely similar, as is s of impact to fishing indust is option due to the mpacts, such as recyclable	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imponshore returns & disposal. (Score 3) <b>N</b> e material or any job creation / retention o	acts with this option due to the minimal fered by an option is considered less si	Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the minimal onshore returns & disposal. (Score 3)
4.5	Mote: Q Overal Materia Steel: Polyme Mattree Whilst this is will tak The as Note: A Option All other	n 5 is assess her options a given that fis all, Option 4 ials Returned: : 186 tonnes ner: 80 tonne ess/Grout Ba at there are so a more than c ake up landfill W ssessment o Assessment n 5 is assess her options a	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ffset by the polym capacity. (Score <b>W</b> f the Societal impa- of the societal impa- to f the societal impa- re assessed as be	er than all other opting Neutral to each e conducted extens Dption 1a are the offill) its from the returniner and mattress / gr 2) W act on Other Users of pact of options is do er than all other opting Neutral to each	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which sub-criterion is as f ominated by any ne tions due to the po other as the positi	suption caused to fishing op otion associated with exposi- to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabl Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns & N follows: egative impacts from material lymer and mattress / grout l	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th & disposal. (Score 3) N al returned as the positive i bags that are likely to end uefits are largely similar.	ump is largely similar, as is s of impact to fishing indust is option due to the mpacts, such as recyclable	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imponshore returns & disposal. (Score 3) <b>N</b> e material or any job creation / retention o	acts with this option due to the minimal fered by an option is considered less si	Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the minimal onshore returns & disposal. (Score 3)
4.5	Mote: Q Overal Materia Steel: Polyme Mattree Whilst this is will tak The as Note: A Option All other	n 5 is assess her options a given that fis all, Option 4 ials Returned: : 186 tonnes ner: 80 tonne ess/Grout Ba at there are so a more than c ake up landfill W ssessment o Assessment n 5 is assess her options a	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ffset by the polym capacity. (Score <b>W</b> f the Societal impa- of the societal impa- to f the societal impa- re assessed as be	er than all other opting Neutral to each e conducted extens Dption 1a are the offill) its from the returniner and mattress / gr 2) W act on Other Users of pact of options is do er than all other opting Neutral to each	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which sub-criterion is as f ominated by any ne tions due to the po other as the positi	suption caused to fishing op otion associated with expose to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabi Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns & N follows: egative impacts from materia lymer and mattress / grout live and negative societal ber	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th & disposal. (Score 3) N al returned as the positive i bags that are likely to end uefits are largely similar.	ump is largely similar, as is s of impact to fishing indust is option due to the mpacts, such as recyclable	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imponshore returns & disposal. (Score 3) <b>N</b> e material or any job creation / retention o	acts with this option due to the minimal fered by an option is considered less si	Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the minimal onshore returns & disposal. (Score 3)
4.5	Mote: Q Overal Materia Steel: Polyme Mattree Whilst this is will tak The as Note: A Option All other	n 5 is assess her options a given that fis all, Option 4 ials Returned: : 186 tonnes ner: 80 tonne ess/Grout Ba at there are so a more than c ake up landfill W ssessment o Assessment n 5 is assess her options a	eed as being Weal re assessed as be hing operations ar , <b>Option 2a and</b> (recyclable) s (landfill) g: 54 tonnes (land ffset by the polym capacity. (Score <b>W</b> f the Societal impa- of the societal impa- to f the societal impa- re assessed as be	er than all other opting Neutral to each e conducted extens Dption 1a are the offill) its from the returniner and mattress / gr 2) W act on Other Users of pact of options is do er than all other opting Neutral to each	tions due to the dis other as the disrup ively in this area, n equally preferred g recyclable steel, out bags, which sub-criterion is as f ominated by any ne tions due to the po other as the positi	suption caused to fishing op otion associated with expose to benefit is given for full rem i from a Societal impact of Materials Returned: Steel: 1 tonnes (recyclabi Polymer: 1 tonnes (landfill There are minimal societa minimal onshore returns & N follows: egative impacts from materia lymer and mattress / grout live and negative societal ber	ure removal and / or rock d noval of the pipeline in term on Fishing perspective. e) )) I benefits / impacts with th & disposal. (Score 3) N al returned as the positive i bags that are likely to end uefits are largely similar.	ump is largely similar, as is s of impact to fishing indust is option due to the mpacts, such as recyclable	the left in-situ infrastructure. try. Materials Returned: Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / imponshore returns & disposal. (Score 3) <b>N</b> e material or any job creation / retention o	acts with this option due to the minimal fered by an option is considered less si	Steel: 1 tonnes (recyclable) Polymer: 1 tonnes (landfill) There are minimal societal benefits / impacts with this option due to the minimal onshore returns & disposal. (Score 3)



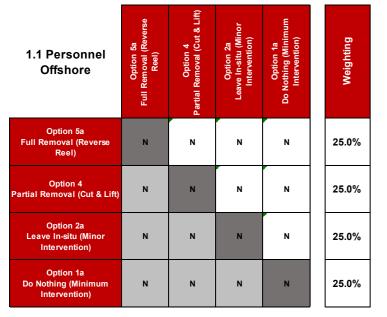
			on 5a (Reverse Reel)		F	Option 4 Partial Removal (Cut & L	ift)		on 2a inor Intervention)	Do Not
	- Install recovery rig	gging for reverse re	er mattresses and g eel   Reverse reel ont ning survey   Seabec	to reel vessel	<ul> <li>Cut exposed section out</li> <li>Place rock to remediate</li> </ul>	ydraulic shears (at each er t (single 11 m length) with snag risk at exposed ends survey   Seabed trawl swee	hýdraulic shears & recover	<ul> <li>Dredge to uncover umbilical ends</li> <li>Cut 10 m section with hydraulic shear</li> <li>Place rock to remediate snag risk at e</li> <li>Place rock across all remaining expos</li> <li>Post decommissioning survey   Seabe</li> <li>Note: all areas of exposure will be rocl</li> </ul>	xposed ends ed sections (one run of 11 m) d trawl sweep	<ul> <li>Dredge to uncover umbility</li> <li>Cut 10m section with hydromy</li> <li>Place rock to remediate signal commissioning signal commissioning signal commission communication of the section of the s</li></ul>
<ol> <li>Economic</li> <li>Short- term Costs</li> </ol>	£5.736 Million				£2.255 Million			£1.885 Million		£1.743 Million
	W	W	W		N	N		N		
Summary	Option 5 is assess All other options ar	ed as being Weak e assessed as bei	ing Neutral to each	ions as the costs a other as the costs	are around double in all cas are similar. n a Short-term Cost pers					
conomic : Long- m Costs	Surveys: N/A FLTC: N/A				Surveys: £0.277 Million FLTC: N/A			Surveys: £0.277 Million FLTC: N/A		Surveys: £0.277 Million FLTC: £0.042 Million
5. Eco 5.2 L term	Total Legacy Cost:	£0 Million			Total Legacy Cost: £0.27	7 Million		Total Legacy Cost: £0.277 Million		Total Legacy Cost: £0.319
	S	e	S		N	N		N		

Overall, Option 5 is most preferred from a Long-term Cost perspective.



# Option 1a Do Nothing (Minimum Intervention) umbilical ends ith hydraulic shears (at each end) and recover (2 x 10 m) diate snag risk at exposed ends ning survey | Seabed trawl sweep ssure at pipeline ends will be removed with ends, other 1 m) will remain





1.2 Personnel Onshore	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	мw	мw	MW	10.0%
Option 4 Partial Removal (Cut & Lift)	MS	N	N	N	30.0%
Option 2a Leave In-situ (Minor Intervention)	MS	N	N	N	30.0%
Option 1a Do Nothing (Minimum Intervention)	MS	N	N	N	30.0%

1.3 Other Users	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	N	N	N	25.0%
Option 4 Partial Removal (Cut & Lift)	N	N	N	N	25.0%
Option 2a Leave In-situ (Minor Intervention)	N	N	N	N	25.0%
Option 1a Do Nothing (Minimum Intervention)	N	N	N	N	25.0%

1.4 High Consequence Events	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Rever <del>se</del> Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

1.5 Residual Risk	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	w	N	N	N	22.2%

2.1 Operational Marine Impact	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	s	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	s	N	N	N	27.3%



2.2 Legacy Marine Impact	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	W	N	N	N	22.2%

2.3 Fuel Use & Atmospheric Emissions	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	N	N	N	25.0%
Option 4 Partial Removal (Cut & Lift)	N	N	N	и	25.0%
Option 2a Leave In-situ (Minor Intervention)	N	N	N	N	25.0%
Option 1a Do Nothing (Minimum Intervention)	N	N	N	N	25.0%

2.4 Other Consumptions	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	N	N	N	25.0%
Option 4 Partial Removal (Cut & Lift)	N	N	N	N	25.0%
Option 2a Leave In-situ (Minor Intervention)	N	N	N	N	25.0%
Option 1a Do Nothing (Minimum Intervention)	N	N	N	N	25.0%

2.5 Disturbance	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Rever <del>se</del> Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

2.6 Loss of Habitat	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	s	s	s	33.1%
Option 4 Partial Removal (Cut & Lift)	w	N	N	w	19.9%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	w	19.9%
Option 1a Do Nothing (Minimum Intervention)	w	S	S	N	27.0%

3.1 Technical Feasibility	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	s	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	s	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%



4.1 Fishing	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

4.2 Communities / Ammenities	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	S	N	N	N	27.3%

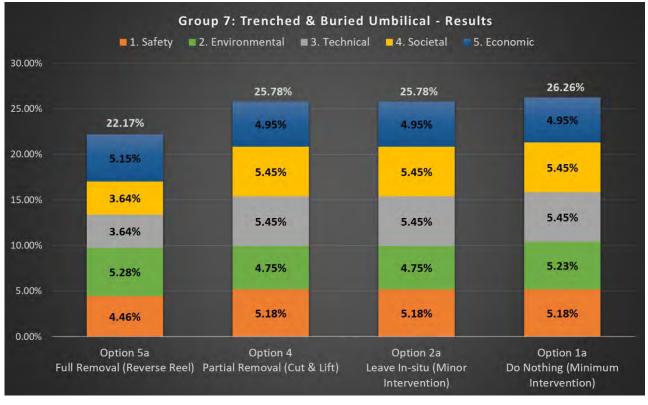
5.1 Short-term Costs	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	w	w	w	18.2%
Option 4 Partial Removal (Cut & Lift)	S	N	N	N	27.3%
Option 2a Leave In-situ (Minor Intervention)	S	N	N	N	27.3%
Option 1a Do Nothing (Minimum Intervention)	s	N	N	N	27.3%

5.2 Long-term Costs	Option 5a Full Removal (Reverse Reel)	Option 4 Partial Removal (Cut & Lift)	Option 2a Leave In-situ (Minor Intervention)	Option 1a Do Nothing (Minimum Intervention)	Weighting
Option 5a Full Removal (Reverse Reel)	N	s	s	s	33.3%
Option 4 Partial Removal (Cut & Lift)	w	N	N	N	22.2%
Option 2a Leave In-situ (Minor Intervention)	w	N	N	N	22.2%
Option 1a Do Nothing (Minimum Intervention)	W	N	N	N	22.2%











## Appendix H.4 Group 7 Detailed Evaluation Discussion

## Appendix H.4.1 Safety – Personnel Offshore

The assessment of the options indicated that all options were equally preferred from a Personnel Offshore perspective. Whilst the full removal option is greater in scope as it removes the entire umbilical, with it being only 14 km in length, the differential in scope between the full and partial removal / leave in-situ options is smaller. This means the difference in safety risk exposure to offshore personnel is also smaller, and insufficient to express a preference in this case.

## Appendix H.4.2 Safety – Personnel Onshore

As with previous assessments, the safety risk associated with the onshore personnel is related to the quantity of material being returned to shore for onshore handling, transportation and processing. The leave in-situ options (Option 1a and 2a) were considered equally preferred as the quantity of material from removing the umbilical ends is the same in both options.

The partial removal option (Option 4) returns slightly more material for onshore handling, transportation and processing from the removed exposures (11 m) but this was insufficient to express a preference.

The full removal by reverse reeling (Option 5a) returns more material for onshore handling, transportation and processing, than the leave in-situ or partial removal options as the full 14 km umbilical is retuned. As such, the full removal option is assessed as being less attractive than the leave in-situ or partial removal options.

## Appendix H.4.3 Safety – Other Users

The assessment of the decommissioning options against this criterion has indicated that all options are equally preferred as they have a similar, low impact on the safety of other users as the vessel days and transits to and from port is similar in these options.

## Appendix H.4.4 Safety – High Consequence Events

The assessment during the workshop indicated that the partial removal and leave in-situ options would have the least exposure to potential for High Consequence Events and would therefore, be the most attractive against this criterion. This is due to the limited cut and lift operations to recover the umbilical end sections in Option 1a and Option 2a with the small additional number of cut and lift operations to remove the exposures in Option 4 being insufficient to differentiate from a potential for High Consequence Events perspective.

Option 5a would be exposed to a greater potential for High Consequence Events from the back of deck handling and potential for integrity failure of the umbilical.

## Appendix H.4.5 Safety – Residual Risk

The residual risk relates to the potential for any safety impact from the decommissioning options. Option 5a is assessed as the most attractive option from a residual safety risk perspective as it is a full removal option and therefore removes all residual risk.

The partial removal and leave in-situ options were assessed as being equally attractive from a residual risk perspective as the removal of the exposures in Option 4 or the rock placement over the exposures in Option 2a were considered to provide similar mitigation of any potential residual risk.



These were also considered similar to Option 1a as the 11 m of exposure left in this option was insufficient to express a preference.

It should be noted that, as part of any partial removal or leave in-situ solution being selected, any potential hazards along the umbilical would be risk assessed and remediated and / or monitored to ensure that any emerging hazards do not develop into an unacceptable snagging risk to fishing operations.

## Appendix H.4.6 Safety – Overall

When combining the assessments conducted at sub-criterion level, the partial removal and leave insitu options were all considered equal most attractive from a safety perspective. This reflects the similar work scopes associated with these options from addressing the 11 m of exposure along a 14 km umbilical.

Option 5a was assessed as significantly less attractive than the other options overall with it being the most attractive for residual risk being insufficient to offset the other contributions.

## Appendix H.4.7 Environment – Operational Marine Impact

The environmental impact on the marine environment from performing the decommissioning options was considered low across all options. However, there were sufficient, cumulative differences, to indicate preferences across the decommissioning options.

The assessment performed during the workshop indicated that the leave in-situ and partial removal options are the most attractive from an operational marine impact perspective. This is due to these options having the least impact in terms of marine noise as they have the lowest number of vessel days and the lowest amount of subsea cutting operations with the increases for partial removal by cut & lift over the leave in-situ options being insufficient to express a preference.

All options have similar impacts in terms of discharges that occur from the umbilical whilst performing the decommissioning option as they will have been cleaned successfully for all options.

The discharges from vessels relates to the number of vessels and the number of vessel days. Option 5a is less attractive than the options due to the additional number of vessel days associated with the full removal option.

## Appendix H.4.8 Environment – Legacy Marine Impact

The assessment indicated that Option 5a, full removal of the umbilical, is the most attractive decommissioning option from a legacy marine environmental impact perspective. This is due to the umbilical being fully removed and thus eliminating any legacy impact from degradation products or polymers.

The partial removal and leave in-situ options were assessed as less attractive than the full removal option as the majority of the umbilical is left in-situ in these options. The additional removal of 11 m of exposure was not considered sufficient to differentiate between Option 4 and the leave in-situ options. No distinction was made between the impact of exposed umbilical versus buried or rock covered umbilical.



## Appendix H.4.9 Environment – Fuel Use & Atmospheric Emissions

The assessment indicated that the all options are equally the most attractive against the fuel use and atmospheric emissions criterion. This is due to the differences in terms of work scope being insufficient to express a preference from a fuel use and emissions perspective.

## Appendix H.4.10 Environment – Other Consumptions

All options were assessed as equally preferred from an Other Consumptions perspective. This is due to the differences in terms of material returned, material left in-situ and rock cover required being insufficient to express a preference.

## Appendix H.4.11 Environment – Seabed Disturbance

The leave in-situ and partial removal options are assessed as the most attractive decommissioning options here as the seabed impact is limited to the area relating to the umbilical end section removal.

Option 5a is less attractive than the leave in-situ or partial removal options as a large area of seabed is impacted by the de-burial along the umbilical using an MFE prior to it being reverse reeled.

## Appendix H.4.12 Environment – Loss of Habitat

Option 5a, the full removal option was assessed as being the most attractive option against this criterion as there is no loss of, or material change to the marine habitat as it currently stands.

Option 1a is assessed as less attractive due to the small quantity of rock placed at the cut umbilical ends. Option 4 and Option 2a are assessed as less attractive again, as they involve the introduction of rock to mitigate the snag hazard associated with the cut ends of the umbilical left after the exposures are removed or to cover the exposures. The introduction of this rock is a material change to around 160 m<sup>2</sup> or 150 m<sup>2</sup> of habitat for Option 4 and Option 2a respectively, where the existing sandbank is replaced with a hard substrate.

## Appendix H.4.13 Environment – Overall

When combining the assessments conducted at sub-criterion level, the most attractive option, from an environmental perspective is Option 5a, followed closely by Option 1a which is followed closely by Option 4 and Option 2a. It is noted that, reflecting the relatively minor environmental impacts across all options, the differences between the options are small.

The full removal by reverse reeling option was assessed as being the most attractive or equal most attractive option against four of the six environmental sub-criteria. Key contributions were provided in the legacy and loss of habitat criteria.

Option 1a was also most attractive or equal most attractive in four of the six sub-criteria with the impact from leaving the umbilical in-situ and the small amount of rock cover at the cut umbilical ends being sufficient to express a preference for Option 5a.

Option 4 and Option 2a were also assessed as being equal most attractive in four of the six subcriteria. They were less preferred from legacy and a habitat loss perspective as the umbilical is left in-situ and a small quantity rock is required at the locations where there are exposures or where they are removed.



## Appendix H.4.14 Technical – Technical Feasibility

The leave in-situ and partial removal options were assessed as being the most attractive from a Technical Feasibility perspective due to the scope of removing the umbilical end sections, removing the exposures, placing rock cover over exposures and over the cut ends associated with these options being considered routine subsea operations.

Option 5a was less attractive as the technical risks associated with successfully performing the deburial operations to allow the reverse reeling of the umbilical to be performed being the main concern.

Overall, Option 4, Option 2a and Option 1a are the most attractive from a Technical perspective, followed by Option 5a.

## Appendix H.4.15 Societal – Fishing Industry

Prior to discussing the assessment, some context is provided from the Fishing Baseline Characterisation ref. [7]. Fishing activity in the LOGGS south area, where the pipelines are installed, is moderate to high in terms of value and effort (up to 100 days of effort) and predominantly undertaken by Dutch beam trawl fleet with a minor amount of fishing undertaken by UK demersal fishing (generally beam trawling).

Given the above, the partial removal and leave in-situ options are assessed as being the most attractive options due to them presenting the least disruption and disturbance to the fishing industry from having the smallest offshore work scopes.

Option 5a is assessed as the least attractive option due to the added disruption to the fishing industry from the removal of the entire 14 km of umbilical.

It was noted that, given that fishing operations are already conducted in the area along and around this umbilical, and any infrastructure remaining on the seabed will be subject to an appropriate post-decommissioning monitoring regime, the residual presence of the umbilical was not considered a limitation to fishing activity.

## Appendix H.4.16 Societal – Communities / Amenities

The impact of the decommissioning options on communities and amenities are considered in this criterion.

The leave in-situ and partial removal options are assessed as being the most attractive due to them returning limited quantities of material for processing onshore. Whilst this limits the amount of useful material, such as copper and steel, being returned for recycling, it also results in the least amount of material being returned that will be directed to landfill, such as the polymer coating and high-pressure tubes of the umbilical.

Option 5a was assessed as being the least attractive option as it returns the entire 14 km of umbilical and the most quantity of polymer which takes up limited landfill capacity.

## Appendix H.4.17 Societal – Overall

When combining the assessments conducted at sub-criterion level, the partial removal and leave insitu options were considered the equal most attractive options as they were assessed as being the most attractive options against both the Fishing Industry and Communities / Amenities criteria.



Option 5a was less preferred as the impact from the disturbance to the fishing industry and the additional polymer to landfill from the full removal option, being assessed as less attractive.

## Appendix H.4.18 Economic – Short-term Costs

Option 1a, Option 2a and Option 4 were assessed as the equal most attractive options from a short-term costs perspective. This is due to their costs being similar and the lowest cost options at  $\pounds$ 1.7 million,  $\pounds$ 1.9 million and  $\pounds$ 2.3 million respectively.

The costs for the full removal option was higher with Option 5a being £5.7 million.

## Appendix H.4.19 Economic – Long-term Costs

The impact of the decommissioning options in terms of long-term costs i.e. any on-going survey and monitoring costs and Fishing Legacy Trust-fund Company (FLTC) payments, are considered in this criterion.

Option 5a is considered the most attractive option against this criterion. This is due to there being no long-term costs associated with this full removal option.

All other options are considered equally less attractive as the long-term costs associated with them is largely similar being between  $\pounds 270$  k and  $\pounds 320$  k.

## Appendix H.4.20 Economic – Overall

Overall, the assessment is dominated by the short-term costs as the differentials are much greater than for the long-term costs.

The partial removal and leave in-situ options are all considered equal most attractive options from an Economic perspective. These are followed by Option 5a which is significantly less attractive.