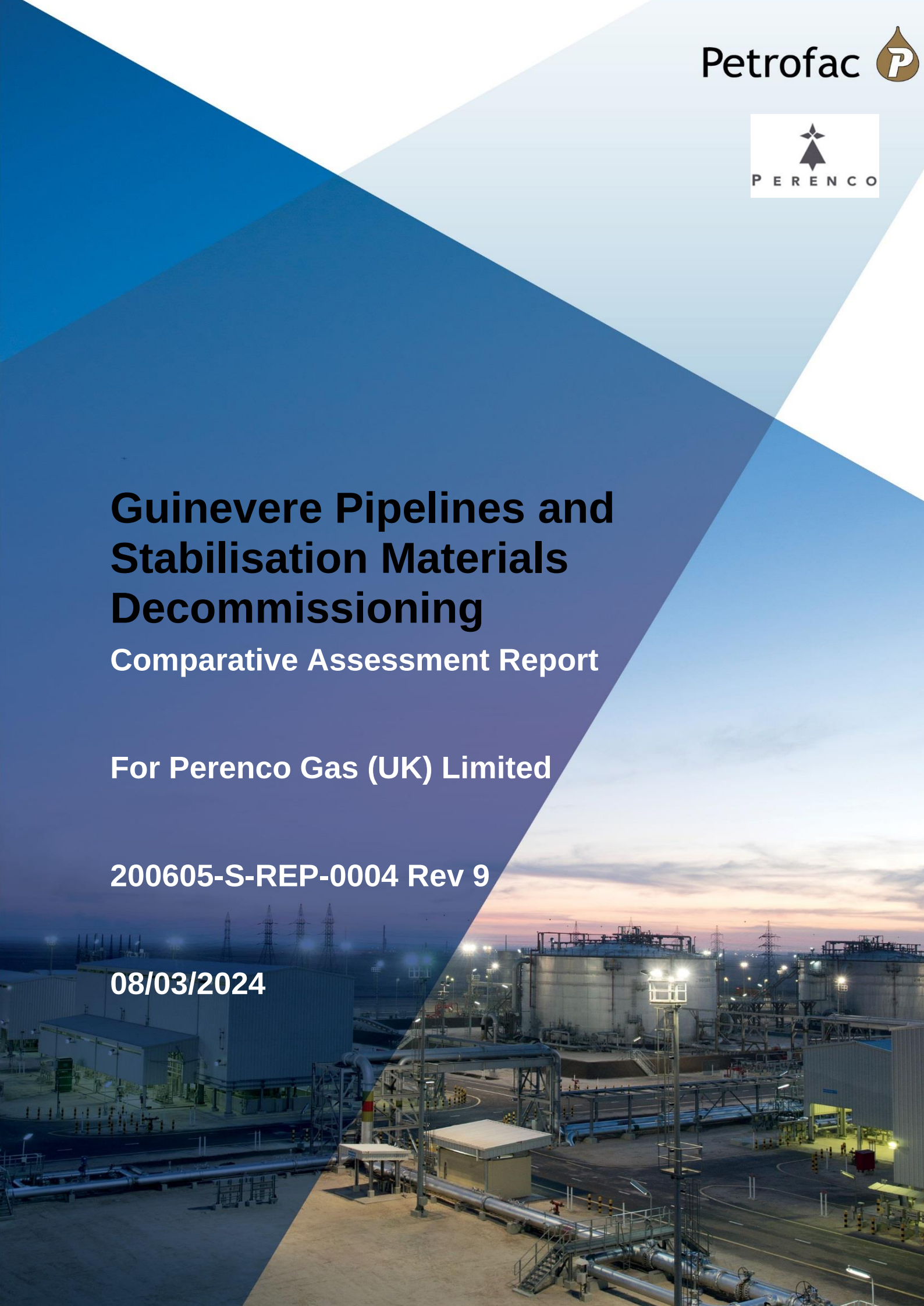
Guinevere Pipelines and Stabilisation Materials Decommissioning

Comparative Assessment Report

For Perenco Gas (UK) Limited

200605-S-REP-0004 Rev 9

08/03/2024



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ABBREVIATIONS

Abbreviation	Description
BEIS	Department for Business, Energy, and Industrial Strategy (Formerly Department for Environment and Climate Change (DECC))
CA	Comparative Assessment
CO_2	Carbon Dioxide
DepCon	Deposit Consent
DOB	Depth of burial
DP	Decommissioning Programme
EA	Environmental Appraisal
e.g.	Exempli Gratia (For example)
EMT	Environmental Management Team
EMODNET	European Marine Observation and Data Network
EUNIS	European Union Nature Information system
FAR	Fatal Accident Rate
FBE	Fusion Bonded Epoxy
HCS	Hydrocarbon Safe
HIRA	Hazard Identification and Risk Assessment
HSEx	Health and Safety Executive
ICES	International Council for the Exploration of the Sea
JNCC	Joint Nature Conservation Council
kg/m^3	Kilograms per cubic metre
km	Kilometre
km^2	Square kilometre
m	Metre
MEG	Mono Ethylene Glycol
mm	Millimetre
MoD	Ministry of Defence
MS	Microsoft
ND	No data
NSTA	North Sea Transition Authority (Formerly Oil and Gas Authority (OGA))
N/A	Not applicable
ODU	Offshore Decommissioning Unit
OEUK	Offshore Energies UK (Formerly Oil and Gas UK (OGUK))
OPRED	Offshore Petroleum Regulator for the Environment and Decommissioning
OSPAR	Oslo Paris Agreement
PL	Pipeline

Abbreviation	Description
PLL	Potential Loss of Life
PUK	Perenco Gas (UK) Limited
PWA	Pipeline Works Authorisation
Q	Quarter
RAG	Red Amber Green
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SNS	Southern North Sea
SPA	Special Protection Area
te	Tonnes (UK)
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
%	Percentage
£	Pound Sterling
"	Inch
>	Greater than
<	Less than

HOLDS

Section	Hold

1 EXECUTIVE SUMMARY

Perenco Gas (UK) Limited (PUK) have conducted a Comparative Assessment (CA) for the decommissioning of Pipeline (PL)874, PL875 and associated stabilisation materials. The CA was completed with reference to published guidance from the Department for Business, Energy, and Industrial Strategy (BEIS) [1] and Offshore Energies UK (OEUK) guidance [2] and included the following steps:

Figure 1-1: Overview of the CA process, adapted from the OEUK

This CA report presents the methodology, decision context and preparation works carried out as well as the assessment analysis and outcomes resulting in the preferred option for the decommissioning of PL874 and PL875 of leave in situ (Option 4a).

The potential impacts associated with the preferred option are presented in the Guinevere pipelines Environmental Appraisal (EA) which will be submitted alongside this CA with the Decommissioning Programme (DP) to Offshore Petroleum Regulator for the Environment and Decommissioning (OPRED) for review.

2 PURPOSE

In accordance with BEIS [1] and OEUK guidance [2], the objective of this report is to detail the CA of the available decommissioning options for the Guinevere pipelines (PL874 and PL875) and associated stabilisation materials.

3 PROJECT OVERVIEW

3.1 Introduction

There are currently an estimated 45,000km of pipeline, cable and umbilical and a significant amount of stabilisation materials in the North Sea. To date approximately 2% of this infrastructure has been decommissioned. With such a large volume of material currently in situ, the decommissioning of this infrastructure represents a significant challenge to both operators and the United Kingdom (UK) government.

Any decision to either remove, remediate, or leave pipeline infrastructure in place requires detailed assessment to be made considering the variables involved with an inevitable balance being made between competing priorities. For example, while a decision to remove infrastructure may appear to bring reduced liability concerns, this must be balanced against the potential environmental impacts of removing such materials.

This review of sometimes competing priorities is carried out as part of a CA process, where a decision on a preferred option is derived based on a balanced assessment comparing various decommissioning options against key criteria.

The following report details the CA process that has been carried out for the Guinevere pipelines and stabilisation materials situated within the Southern North Sea (SNS). The report details the decisions that have been made from early scoping through to selection of the preferred option with details of the technical reviews and assessments that have been carried out to arrive at that option. It has been produced in line with government advice and industry best practice with the purpose of supporting the Guinevere pipelines DP and EA. A full assessment of the environmental and societal impacts associated with the preferred option is presented within the EA document.

3.2 Regulatory Context and Published Guidance

The decommissioning of offshore oil and gas installations and pipelines on the United Kingdom Continental Shelf (UKCS) is principally governed through the Petroleum Act 1998 and is amended by the Energy Act 2008.

The UK's international obligations in relation to offshore decommissioning is principally governed by the 1992 Convention for the protection of the Marine Environment of the Northeast Atlantic (Oslo-Paris Agreement (OSPAR) convention). Agreement in relation to the offshore decommissioning regime was reached at a meeting of the OSPAR commission in 1998 (OSPAR Decision 98/3). As a result, OPRED guidance in relation to offshore decommissioning is aligned.

The primary objective of OSPAR decision 98/3 remains to prevent the dumping of offshore installations at sea, with the default position of full removal. The decision however allows the granting of derogations to leave all or part of a structure in place, subject to a CA process and regulatory approval.

The decision does not apply to pipelines or stabilisation materials, however in line with a pre-cautionary approach, OPRED requires operators this apply the same framework to pipeline decommissioning projects **"A comparative assessment is a mandatory requirement for any potential OSPAR derogation candidate or for all pipeline decommissioning."** [1].

Further, guidance published by the OEUK provides details on regulatory expectations regarding the decommissioning of pipelines and stabilisation materials.

"Any removal or partial removal of a pipeline should be performed in such a way as to cause no significant adverse effects upon the marine environment and any decision that a pipeline may be left in place should have regard to the likely deterioration of the material involved and its present and possible future effect on the marine environment.

While each case will be considered on its merits and in the light of a comparative assessment of the alternative options the following have been identified as possible candidates for in situ decommissioning:

- **Those [pipelines] which are adequately buried or trenched, and which are not subject to development of spans and are expected to remain so.**
- **Those which were not buried or trenched at installation, but which are expected to self-bury over a sufficient length within a reasonable time and remain so buried.**
- **Those where burial or trenching of the exposed sections is undertaken to a sufficient depth and it is expected to be permanent.**
- **Those which are not trenched or buried but which nevertheless are candidates for leaving in place if the comparative assessment shows that to be the preferred option (for example (e.g.) trunk lines).**
- **Those where exceptional and unforeseen circumstances due to structural damage or deterioration or other cause means they cannot be recovered safely and efficiently"** [2].

3.3 Field and Infrastructure Description

The Guinevere pipelines and stabilisation materials fall entirely within UKCS block 48/17 (Figure 3-1, Figure 3-2). Table 3-1 provides details of the Guinevere pipelines that will be subject to the DP.

The Guinevere pipeline system (PL874/PL875) was made Hydrocarbon Safe (HCS) in December 2017, flooded with seawater, and left in-situ (Table 3-1). The Guinevere platform was decommissioned and removed from the seabed in January 2020 with the pipeline ends at the base of the Guinevere jacket cut subsea and removed under Pipeline Works Authorisation (PWA) (PA2548). Approximately, 12.9m of PL874 and 13.3m of PL875 were cut and removed at the Guinevere platform location. The pipelines remain connected to the Lancelot riser.

Recent geotechnical surveys indicate that the western extent of the pipelines, on approach to the former Guinevere jacket, are covered by historical rock placement. Additionally, in quarter (Q) 1 of 2022, the North Sea Transition Authority (NSTA) authorised additional rock placement to cover and secure the exposed cut end of the pipelines at the western end. This involved the deposition of 942te of additional rock at that location (Deposit Consent (DepCon): 15/D/22) (Figure 3-3).
The PL874/PL875 pipeline mattresses were installed in 1993 and in total consist of four concrete mattresses within the Guinevere 500m safety zone and four concrete mattresses within the Lancelot 500m safety zone (Table 3-1).

There is no evidence of the presence of grout bags from as built drawings or surveys, therefore if these were historically used, they are assumed to be completely buried below the seabed.

Approximately 50 grout bags were used to stabilise Guinevere pipelines. Recent surveys have not recorded the presence of grout bags; therefore, they are assumed to be completely buried below the seabed.

Figure 3-1: Guinevere and surrounding fields in SNS

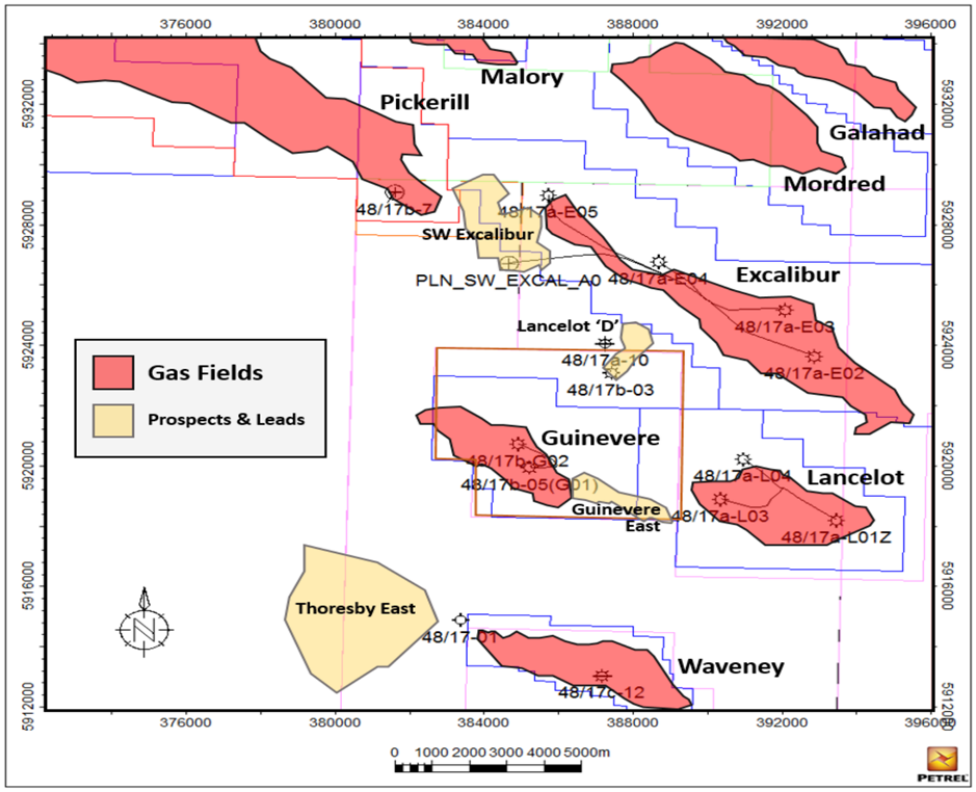


Figure 3-2: Guinevere Pipelines and surrounding PUK assets

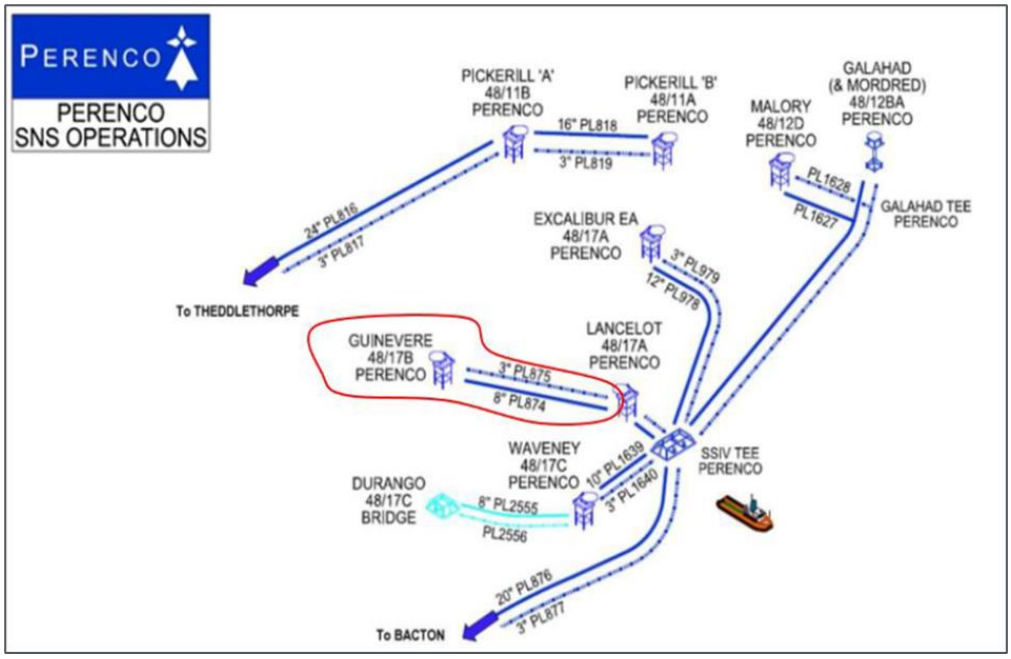


Table 3-1: Details of Guinevere Pipelines and stabilisation material subject to DP

Pipeline no.	Type	Size (inch)	Length (km) note 1	Components	Status
PL874	Hydrocarbon export	8"	6.560	Outside diameter: 219.1mm Wall thickness: 18.3mm Anti-corrosion: Fusion Bonded Epoxy (FBE), 0.55mm, 1400kg/m^3	Flushed and cut subsea at Guinevere. Trenched and buried (Table 3-2). HCS verification December 2017
PL875	Mono Ethylene Glycol (MEG) import	3"	6.537	Outside diameter: 88.9mm Wall thickness: 12.7mm Anti-corrosion: FBE, 0.55mm, 1400kg/m^3	Flushed and cut subsea at Guinevere. Trenched and buried (Table 3-2). HCS verification December 2017

Stabilisation feature	Total no.	Weight (te)	Location	Exposure/condition
Concrete mattresses	4	Unknown	Guinevere 500m safety zone: 4	2 x Articulated (Poly Rope) 2.4m x 5.8m x 0.48m 1 x Flexible (Poly Rope) 2.0m x 10m x 0.30m 1 x Unknown (Poly rope) 2.0m x 10m x 0.30m).
Grout bags	50 (estimated)	Unknown	Unknown	Unknown
Rock placement	2	1 x 942te (C. 22m) 1 x unknown (C.120m)	Guinevere 500m safety zone Guinevere 500m safety zone	N/A

Note 1 – Length represents current pipeline length as per PWA [22] minus 500m section within Lancelot 500m safety zone.

Table 3-2: PL874/ PL875 Depth Of Burial (DOB)

KP	Easting (m)	Northing (m)	DOB (m)	Burial Status
0.144	385429	5919893.9	1.1	Buried
0.169	385454.6	5919891.4	0.4	Buried
0.213	385498.7	5919887.3	1.1	Buried
0.312	385596.5	5919877.7	1.2	Buried
0.366	385649.8	5919874.2	0.7	Buried
0.385	385669.4	5919870.8	1	Buried
0.483	385766.9	5919856.5	1.1	Buried
0.561	385844.2	5919848.5	1.1	Buried
0.571	385853.7	5919849.3	0.6	Buried
0.763	386045.4	5919832.3	0.6	Buried
0.961	386242.4	5919816	0.6	Buried
1.365	386645	5919779.5	0.3	Buried
1.568	386845.5	5919751.7	0.7	Buried
1.961	387238	5919717.9	0.8	Buried
2.157	387433.2	5919702.1	0.3	Buried

KP	Easting (m)	Northing (m)	DOB (m)	Burial Status
2.353	387627.9	5919678.9	0.4	Buried
2.767	388039.9	5919640.3	0.4	Buried
2.957	388229.5	5919619.7	0.5	Buried
3.163	388433.2	5919591.9	0.9	Buried
4.362	389626.6	5919481.3	0.7	Buried
4.742	390005.1	5919436	0.8	Buried
4.955	390215.5	5919411.2	0.4	Buried
5.156	390417.1	5919396.7	0.6	Buried
5.372	390630.8	5919370.5	0.7	Buried
5.76	391017.7	5919334.9	0.7	Buried
5.954	391211	5919316.2	0.7	Buried
6.159	391414.2	5919291	0.6	Buried
6.36	391614.2	5919273.6	0.7	Buried
6.56	391813.1	5919250.1	1.2	Buried

Figure 3-3: Historical rock placement on PL874/PL875 within the Guinevere 500m safety zone.

3.4 Environmental and Social Overview

An environmental baseline assessment will be prepared to support the EA and will be focussed on the selected area. The baseline will focus on key sensitivities such as benthic habitat and commercial fisheries and will rely heavily on environmental data PUK has collected to date via surveys in combination with published sources. A summary of the environmental and societal sensitivities in the vicinity of the infrastructure is presented in Table 3-3.

Table 3-3: Summary of environmental and societal sensitivities in the vicinity of the Guinevere Pipelines.

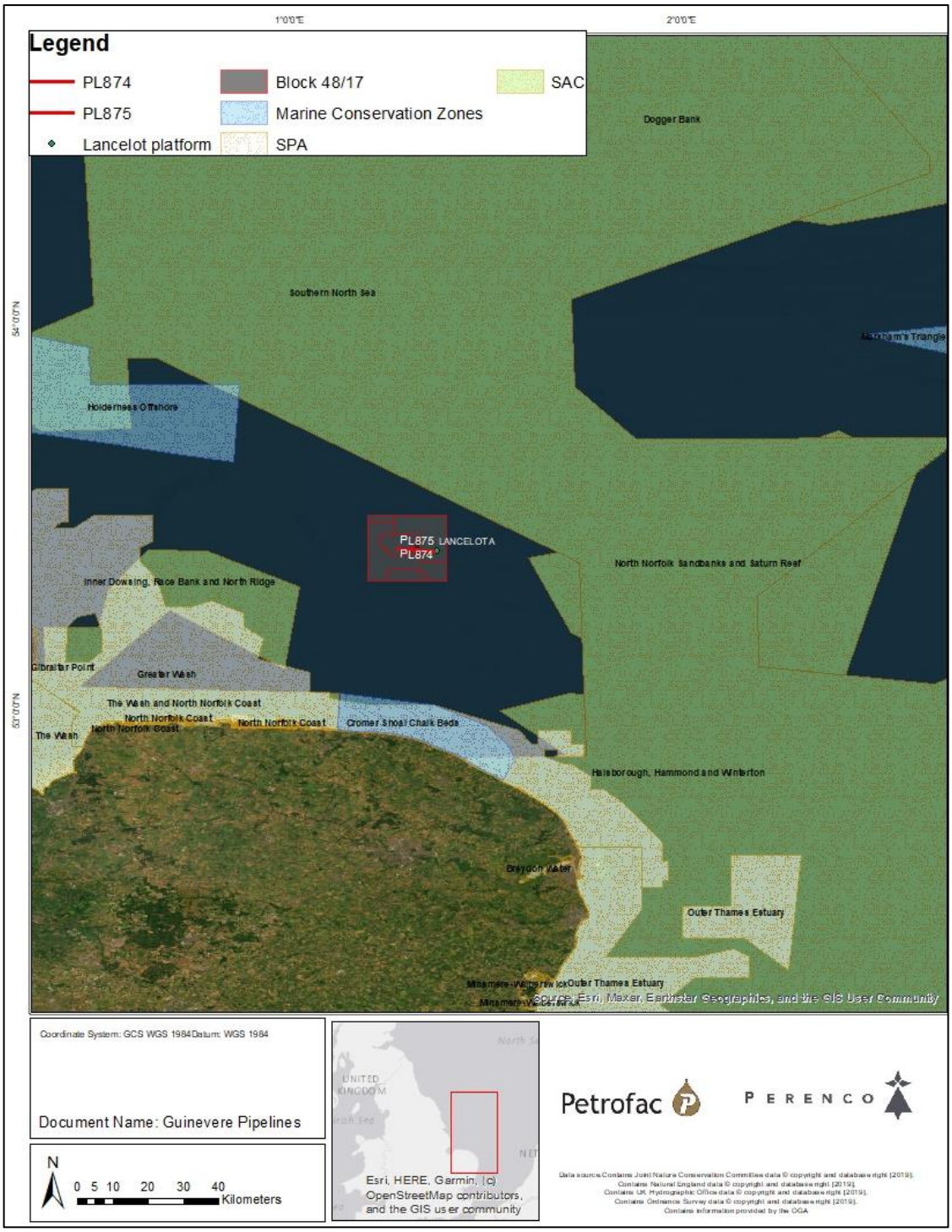
Site Overview		
The Guinevere pipelines are located within Block 48/17 in the SNS. There are two infield pipelines, PL874 and PL875, which connected the recently removed Guinevere installation to the Lancelot installation. The closest landfall is 52km southwest of the western most extent of the pipelines (see Figure 3-4).		
Environmental Receptor	Distance and Direction	Description
Conservation interests		
Offshore Annex I habitats		
North Norfolk Sandbanks and Saturn Reef Special Area of Conservation (SAC)	23km east	Features: Annex I habitats; Sandbanks which are slightly covered by sea water all the time (1110) and Reefs (1170). Description: The North Norfolk Sandbanks are the most extensive example of the offshore linear ridge sandbank type in UK waters. The site encloses a series of 10 main sand banks and associated smaller banks. Invertebrate communities are typical of sandy sediments in the SNS such as polychaete worms, isopods, crabs and starfish. Areas of *Sabellaria spinulosa* biogenic reef are present within the site, consisting of thousands of fragile sand-tubes made by ross worms (polychaetes) which have consolidated together to create solid structures rising above the seabed.
Inner Dowsing, Race Bank and North Ridge SAC	19km southwest	Features: Annex I Habitat: Sandbanks which are slightly covered by sea water all the time and reefs. Description: The tops of the sandbanks are characterised by low diversity communities of polychaete worms and amphipod crustaceans. The trough areas between the sandbank features contain a diverse mosaic of biotopes on mixed and gravelly sands. Biogenic reef created by ross worm (*S. spinulosa*) has been recorded within the site. The complex reef habitats support a variety of bryzoans, hydroids, sponges and anemones as well as the common lobster and the commercially fishery targeted pink shrimp.
Conservation sites		
The Greater Wash Special Protection Area (SPA)	32km southwest	Features: Seabirds and waterbirds. Description: The Greater Wash SPA straddles the 12 nautical mile limit and is proposed to protect different tern species during the breeding season (Sandwich tern, little tern and common tern) as well as a range of seabird species during the non-breeding season (red-throated diver, common scoter and little gull).
Holderness Offshore Marine Conservation Zone	37km northwest	Features: Two broad-scale habitats. Description: The seafloor consists of mixed and coarse sediment interspersed with small cobbles and ross worm reef. This area is significant for crustaceans, including edible crabs and common lobster. Harbour porpoises and grey and harbour seals are regularly seen foraging here. In addition, there are records of basking sharks within the site and it falls within the foraging radii for certain seabird species (e.g., Atlantic puffin and great skua). The site is also in an area that provides spawning and nursery grounds for a number of fish species.
Coastal and Offshore Annex II species		
Southern North Sea SAC	17km northeast	Features: Annex II species; Harbour porpoise (*Phocoena phocoena*) (1351).

		Description: The site has been identified as an area of importance for harbour porpoise and supports 17.5% of the UK North Sea Management Unit population. This site covers an area of 36,951km^2. The majority of this site lies offshore, though it does extend into coastal areas of Norfolk and Suffolk. The northern two thirds of the site are recognised as important for porpoises during the summer season (April – September), whilst the southern part supports persistently higher densities during the winter (October – March).
Plankton		
The SNS is characterised by shallow, well-mixed waters, which undergo large seasonal temperature variations. The region is largely enclosed by land and as a result the marine environment is highly dynamic with considerable tidal mixing and nutrient-rich run-off from land (eutrophication). Under these conditions, nutrient availability is fairly consistent throughout the year, therefore organisms with high nutrient uptake that thrive in dynamic waters, such as diatoms, are particularly successful. The phytoplankton community in the Regional Sea 2 area is dominated by the dinoflagellate genus Tripos (*T. fusus*, *T. furca*, *T. lineatus*), along with higher numbers of the diatom, Chaetoceros (subgenera Hyalochaete and Phaeoceros) than are typically found in the Northern North Sea. From November to May when mixing is at its greatest, diatoms comprise a greater proportion of the phytoplankton community than dinoflagellates [5]. The zooplankton community is dominated by copepods including *Calanus helgolandicus* and *C. finmarchicus* as well as *Paracalanus* spp., *Pseudocalanus* spp., *Acartia* spp., *Temora* spp. And cladocerans such as *Evadne* spp. There has been a marked decrease in copepod abundance in the SNS, which has been linked to changes in global weather phenomena [5]. However, the planktonic assemblage in the vicinity of the proposed deposit operations is not considered unusual.		
Benthic environment		
Seabed sediments	The following European Union Nature Information System (EUNIS) seabed classifications have been identified in the vicinity of the Guinevere [6,7]. A5:15: Infralittoral coarse sediment. A5.14: Circalittoral coarse sediment. A5.23: Infralittoral fine sand. A5.24: Infralittoral muddy sand. A5.25: Circalittoral fine sand. A5.26: Circalittoral muddy sand.	
Benthic fauna	Data from the European Marine Observation and Data Network (EMODnet) broad-scale seabed habitat map for Europe (EUSeaMap2), indicates that the EUNIS habitat classifications predicted to be present at the Guinevere location is 'circalittoral coarse sediment' [8]. This habitat is characterised by robust infaunal polychaetes, mobile crustaceans, and bivalves. Certain species of sea cucumber (*Neopentadactyla* spp.) may also be prevalent in these areas along with lancelet (*Branchiostoma lanceolatum*) [9]. *Sabellaria alveolata* was not conspicuous in 2017 survey data and just 15 individuals were recovered throughout the entire survey. As such, its presence does not require further consideration under the protected 'reef' status [10]. Furthermore, no European Council Habitats Directive Annex I habitats or other protected habitats/species were encountered during the 2017 Guinevere pre-decommissioning environmental survey [10].	
Fish/crustacean – spawning and nursery grounds for the International Council for the Exploration of the Sea (ICES) Rectangle 35F1 around the pipelines [11, 12].		
Spawning grounds	The following species spawn in the vicinity of the project (peak spawning months in brackets): Sandeels (November-February), Herring (August-October), Lemon sole (April-September), Mackerel (May-July), Sole (August), Whiting (February-June).	
Nursery grounds	The following species have nursery grounds in the vicinity of the project: Hake, Herring, Ling, Mackerel, *Nethrops,* Sandeel, Sprat, Spiny Dogfish, Tope shark, Whiting.	
Seabirds for the UKCS Block 48/17 [13]		
Data indicates that Block 48/17 is not within a hotspot area, defined as an important area of high seabird density at sea. The data predicts a density of <4 seabirds per km^2 during the breeding season (March – September) and <6 seabirds per km^2 in winter (November – March) The most abundant species present in the block of interest are kittiwake and lesser black-backed gull in the breeding season, guillemot and razorbill over winter, and guillemot during the post breeding dispersal period.		

Month	January	February	March	April	May	June	July	August	September	October	November	December
Seabird Oil Sensitivity Index [24]	3	3	3	3	5	5	5	3	4	2	1	3
Cetaceans sightings in ICES Rectangle 35F1 [14].												
Harbour porpoise	ND	ND	ND	ND	Low	Low	Low	Low	ND	ND	ND	ND
Key:	5=low		4=medium		3=high		2=very high		1=extremely high		ND= No Data	

Societal Receptor	Description
Commercial fishing	
Guinevere is located within ICES Rectangle 35F1. Annual fishing effort in ICES Rectangle 35F1 is only available for 2012 and 2013, with an average of 726 days [16]. This annual mean is consistent with large areas of the SNS. Monthly fishing effort is generally low but is highest between March and July. The most frequently used gear type is static gears, particularly traps which target shellfish species. This is reflected in the landings data which indicates that shellfish species are the most significant component of the fishery in terms of landed tonnage and value (over 95% for both). The most frequently caught species include the Norway lobster (*Nephrops norvegicus*), crabs, lobsters and scallops [15].	
Other users	
Recreational vessels	Due to the distance between the project area and the nearest landfall, no recreational vessel use is known.
Shipping activity	The density of shipping traffic in the SNS is relatively high due to the presence of fishing vessels, some ferries between the UK and the rest of Europe and cargo and offshore support vessels [5]. However, the waters surrounding the Guinevere location are described as having 'Moderate' shipping activity [17].
Oil and Gas	The Guinevere Field infrastructure lies towards the southwest edge of a collection of gas fields in the SNS and therefore oil and gas activity surrounding the former Guinevere platform location is considered to be moderate to high [18]. The nearest platforms are the PUK operated Excalibur, Lancelot and Waveney Normally Unattended Installations (located 7km to the northeast, east and southeast, respectively). The UKCS Block 48/17 is crossed by 14 pipelines [18].
Telecommunications	No telecommunications cables pass through Block 48/17 [19].
Military activities	Block 48/17 does not lie within a known military practice and exercise area [5]. However, a license condition identified by the Ministry of Defence (MoD) exists for Block 48/17 as it lies within MoD training ranges [20]. The license condition stipulates that the MoD must be consulted 12 months in advance of placement of any installation (fixed or resting on the seabed or floating) related to oil and gas activity within the block.
Aggregate extractions	The licensed aggregate production area Outer Dowsing (License No. 515/2, in operation 01/01/2015 – 31/12/2029), licensed to Westminster Gravels Ltd is located approximately 3km to the west of the proposed Guinevere pipeline (PL874/PL875) deposit area.
Windfarms	There are currently no 'active' or 'under construction' windfarms within UKCS Block 48/17. However, the Dudgeon Extension Area which is in the 'pre-planning' stages extends into the southern portion of Block 48/17 approximately 7km to the south of the proposed Guinevere pipeline (PL874/PL875) deposit area. Dudgeon is the nearest 'active' windfarm to the Guinevere location, approximately 12km south in Block 48/22 [21].
Wrecks	There are no wrecks recorded within block 48/17.

Figure 3-4: Location of Guinevere pipelines (PL874/PL875) in relation to the UK coast and environmentally sensitive areas.



4 OVERVIEW OF CA PROCESS

The CA process was developed in line with OEUK Guidelines [2] and BEIS Guidance notes [1]. Figure 4-1 presents the various stages of the CA process that was followed.

Figure 4-1: Overview of the CA process, adapted from the OEUK

5 CA Scoping

5.1 CA Boundaries, Inclusions and Exclusions

5.1.1 Inclusions

The scope of the Guinevere pipelines DP will cover the pipelines (PL874 and PL875) located within UKCS block 48/17 from the former Guinevere platform location to the edge of the 500m safety zone at Lancelot. The remaining elements of PL874/PL875 and associated stabilisation materials within the Lancelot 500m safety zone will be considered as part of the Lancelot decommissioning scope.

A full list of infrastructure within scope of the CA is presented in Table 5-1.

5.1.2 Exclusions

Lancelot 500m Safety Zone

All infrastructure within the Lancelot 500m safety zone is excluded from the current scope. This includes Pipeline ends, spool pieces and stabilisation material. This infrastructure will be considered within the Lancelot DP when applicable.

Rock Placement and Underlying Materials

Recent geotechnical surveys indicate that the western extent of the pipelines, on approach to the former Guinevere jacket, are covered by historical rock placement [3] Additionally, in Q1 2022 the NSTA authorised additional rock placement to cover and secure the exposed cut end of the pipelines at the western end. This involved the deposition of 942te of additional rock at that location (DepCon: 15/D/22) [3]. This rock placement fully covers 50 grout bags and the 4 concrete mattresses within the Guinevere 500m safety zone with a berm that was designed with a 1:3 slope to make it overtrawlable.

The Guidelines for CA in DP [2] state that ***"Where rock-dump that has been used to protect a pipeline, removal is recognised not to be practicable. It is assumed therefore that such rock-dump shall remain in place, unless there are special circumstances that would warrant consideration of removal".***

Additionally, OPRED's Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidance Notes [1] states ***"Where rock-dump has previously been used to protect a pipeline it is recognised that removal of the pipeline is unlikely to be practicable and it is generally assumed that the rock-dump and the pipeline will remain in place. Where this occurs, it is expected that the rock-dump will remain undisturbed."***

In line with current guidance, the pipeline sections and any associated stabilisation materials which have been covered by rock placement have been excluded from the CA process and will be left in situ.

Pipeline Crossings

There are no known crossings along the entire length of the pipelines from Guinevere to Lancelot.

Fully Buried Stabilisation Materials

Recent surveys have not identified the presence of the approximately 50 grout bags used during pipeline installation; therefore, they are expected to be fully buried below the seabed or covered. by rock placement.

Table 5-1: Guinevere Pipeline details within scope of the CA

Pipeline no.	Type	Size	Length (km) note 1	Components	Status
PL 874	Hydrocarbon export	8"	6.418	Outside diameter: 219.1mm Wall thickness: 18.3mm Anti-corrosion: FBE, 0.55mm, 1400kg/m^3	Flushed and cut subsea at Guinevere. Trenched and buried (Table 3-2). HCS verification December 2017
PL 875	MEG import	3"	6.395	Outside diameter: 88.9mm Wall thickness: 12.7mm Anti-corrosion: FBE, 0.55mm, 1400kg/m^3	Flushed and cut subsea at Guinevere. Trenched and buried (Table 3-2). HCS verification December 2017

Note 1: Pipeline length within scope is original length (as per PWA [22]) minus Guinevere rock berm (142m) and Lancelot 500m safety zone.

5.1.3 Evaluation Method

In line with section 7 of the OEUK guidelines [2], a combination of method A, B and C has been selected as a suitable assessment methodology for the CA. Using a Red/Amber/Green (RAG) system (Table 5-2), this method provides a combination of quantitative and qualitative assessment of the selected methods against the CA criteria and sub-criteria, focussing on key and significant differentiators and allowed further exploration of the outcome by way of sensitivity analysis.

Scores were assigned based on a RAG rating and used for analysis. Sensitivity analysis was performed by adjusting score weighting on each of the five main criteria to assess if any changes in the preferred method appeared.

Table 5-2: RAG performance indicators (Method A)

Performance	Comparative impact
Most preferred	Lower impact
	Moderate impact
Least preferred	Higher impact
No preference	No significant impact across options note 1

Note 1: The preferred option should be selected by focussing on the matters where the impacts of the options are significantly different. As a result, where there is no significant difference between options for a particular sub-criterion, this will be coloured grey.

5.1.4 Assessment Criteria

Table 5-3 provides further details on each of the main and sub criteria used in the assessment. Further details on scoring criteria are presented in Appendix 1.

Table 5-3: CA Assessment main and sub criteria

Main Criteria	Sub criteria	Description
Safety	Project personnel	Qualitative/Semi-Quantitative assessment of safety risk to offshore project personnel. For each decommissioning method, a calculation of Potential Loss of Life (PLL) was made based on the Fatal Accident Rate (FAR) x Hours of Exposure for each of the worker groups and is considered a suitable metric for CA purposes. The FAR is taken from the summary report of the Joint Industry Project investigating the Risk Analysis into Decommissioning Activities issued by Safetec [25]. These figures were used to support the CA workshop during the Hazard Identification and Risk Assessment (HIRA) and scored according to the PUK risk assessment matrix. For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
	Other users of the sea	Qualitative assessment of safety risk to other sea users including risks during operations and residual risks of any material left in situ. For each decommissioning method, a review of localised fishing effort, ship density and collision risk were made. These reviews were used to support the CA workshop during the HIRA and scored according to the PUK risk assessment matrix.

Main Criteria	Sub criteria	Description
		For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
Environmental	Atmospheric emissions	Quantitative assessment of emissions to air during offshore activities. For each decommissioning method, total emissions were calculated. These figures were used to support the CA workshop during an Environmental section of the HIRA and scored according to the PUK risk assessment matrix. For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
	Seabed disturbance/Loss of habitat	Quantitative assessment of seabed impact. For each decommissioning method, total volume of seabed impacted was calculated. These figures were used to support the CA workshop during an Environmental section of the HIRA and scored according to the PUK risk assessment matrix. For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category will be assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
	Waste generation	Quantitative assessment of waste generation. For each decommissioning method, total waste generated was calculated. These figures were used to support the CA workshop during an Environmental section of the HIRA and scored according to the PUK risk assessment matrix.

Main Criteria	Sub criteria	Description
		For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
	Legacy impacts	Qualitative assessment of impacts associated with any materials left in situ. For each decommissioning method, an assessment of legacy impacts was used to support the CA workshop during an Environmental section of the HIRA and scored according to the PUK risk assessment matrix. For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
Technical	Risk of major project failure	Qualitative assessment of risk of major project failure. For each method, an assessment of technical feasibility against defined criteria was completed.
	Technical feasibility	Qualitative assessment of risk of technical feasibility. For each method, an assessment of technical feasibility against defined criteria was completed.
	Track record	Qualitative assessment of risk of methodology/technology track record. For each method, an assessment of technical feasibility against defined criteria was completed.
Societal	Offshore users	Qualitative assessment of impacts on offshore societal use of the area e.g., fishing/tourism. For each decommissioning method, an assessment of impacts of other offshore users was completed during the HIRA and scored according to the PUK risk assessment matrix.

Main Criteria	Sub criteria	Description
		For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
	Onshore communities	Qualitative assessment of impacts on onshore communities. For each decommissioning method, an assessment of impacts to onshore communities was completed during the HIRA and scored according to the PUK risk assessment matrix. For each method, the values of the scores against each hazard were averaged and ranked based on these averages. A RAG category was assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
Economic	Cost of decommissioning method	Quantitative assessment of decommissioning commercial (cost) estimation for each method. Commercial (cost) estimation for each method was calculated by PUK based on values from previous campaigns, this included estimates for vessel usage and equipment costs for both decommissioning work and surveys. For each method a RAG category will be assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).
	Cost of long-term monitoring/remediation	Quantitative assessment of long-term commercial (cost) estimation for each method. Commercial (cost) estimation for each method was calculated by PUK based on costs from previous campaigns, this included estimates for vessel usage and equipment hire for surveys. For each method a RAG category will assigned based on total value ranking across methods (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber).

6 CA Screening

6.1 CA Screening Workshop

A screening workshop was held on 24th February 2023 to review potential options and remove those which were not viable from further assessment. The workshop included Petrofac and PUK Engineers familiar with the project scope and decommissioning methods under review. The output of this workshop is presented in Table 6-1. In line with current guidance at least one option for full removal was carried forward for further assessment within the CA [4].

6.2 Reuse Options

No reuse options including re-use for further hydrocarbon extraction or carbon capture and storage have been identified. Reuse options have been addressed within the Cessation Of Production document approved by the NSTA in December 2016.

Table 6-1: Output from the Guinevere Pipelines CA screening workshop

	Safety	Environment	Technical	Societal	Economic	Comments	Selected for further assessment?
Option 1. Full removal							
a) Cut and lift (subsea cuts) (Combined lines)						Technically feasible. Separation of lines subsea not feasible. Lifting operations can be well managed and controlled. Expensive option due to long campaign.	Yes
b) Reverse reeling (combined lines)						Separation of lines subsea not feasible. Reverse reeling may present greater hazards, but more economic than other full removal options.	Yes
c) Reverse installation (Surface cut) (Combined lines)						Separation of lines subsea not feasible. Potential safety concerns, technically challenging but feasible.	Yes
Option 2. Partial removal							
a) Cut and lift (subsea cuts)						N/A: No exposures	No
Option 3. leave in situ with remediation							
a) Re-burial of exposed sections						N/A: No exposures	No
b) Rock-placement of exposed sections						N/A: No exposures	No
Option 4. Leave in situ without remediation							
a) No exposed sections, leave in situ						Least impact on safety, environment and social receptors. Technically feasible.	Yes

Least preferred
Intermediate
Most preferred

7 CA Preparation

During the preparation phase numerous documents detailing information on the asset were reviewed and several technical assessments were completed including:

- 200605-S-REP-0019 Guinevere Waste Generation technical note
- 200605-S-REP-0020 Guinevere Emissions Generation technical note
- 200605-S-REP-0021 Guinevere Seabed disturbance technical note
- 200605-S-REP-0022 Guinevere Project personnel safety technical note
- Schedule, costings and durations for Guin CA issued to Petrofac 03.03.23
- 15-D-22 consent document
- DepCon Application PA3804
- PA2278 PWA
- 2017-001_Vol6_rev01 Guinevere Pre-Decommissioning Environmental Survey
- OEL_NSEPER0422_GUI_TCR Guinevere Platform Post Decommissioning Seabed environment Survey
- SN-PG-BX-RP-FD-000003 Pre-Decommissioning Environmental Baseline and Debris Survey Campaign
- J/5/48/22 Post-decommissioning Surveys: Environmental Assessment Justification
- Perenco UK Ltd Guinevere Installation Decommissioning Programme
- P1297 - Guinevere Pipeline Deposits MAT Environmental Appraisal Justification Document - Rev R03
- NSO-PJ00292-RR-DC-SUR-003 Post Decommissioning MBES and Environmental survey

8 CA Evaluation

Confirmation of main criteria and sub criteria as detailed in section 5.1.4 was completed internally within PUK prior to the full CA workshop.

Criteria were assessed by a combination of quantitative and qualitative means, with scores converted to a RAG categorisation to allow an assessment to be made across all sub-criteria in line with method A of the OEUK guidelines [2].

Sensitivity analysis was performed by adjusting score weighting on each criterion (see section 11.2).

9 CA Report and Recommendations

The assessment of feasible options and emerging recommendations of the CA workshop are detailed in section 11 of this report.

The outcome and recommendations of the CA are reflected in the decommissioning option presented in the DP and supporting EA where a detailed assessment of any impacts (both positive and negative) has been carried out drawing on a substantial amount published scientific literature and survey data collected by PUK.

10 CA Workshop

A CA workshop was held at the PUK Office in Norwich with remote connection via Microsoft (MS) Teams on 14th March 2023. Table 10-1 presents a list of attendees.

The CA workshop included a HIRA of the safety, environmental and social elements by reviewing a set of guidewords against each decommissioning option. After discussion and review of supporting information, each guideword was scored based on the modified PUK risk matrix (Risk matrix was updated to include positive impacts). Some items could not be fully assessed during the workshop and were later scored after further assessment. The final HIRA scores are presented in Appendix 2.

Table 10-1: CA workshop attendees

Name	Role	Company	Location
Gareth MacGlennon	Principal Environmental Engineer - Chair	Petrofac	Meeting Room
Martin Russell	Technical Safety Consultant	Petrofac	Meeting Room
Muhammad Faizan Ullah	Environmental Engineer -Scribe	Petrofac	Meeting Room
Joanne Turner	Decommissioning Compliance Advisor	PUK	Meeting Room
Wayne Smith	Sub-sea Decommissioning Engineer	PUK	Meeting Room
Samuel Onaiwi	Pipeline Decommissioning Engineer	PUK	Meeting Room
Guillaume Monsegu	Decommissioning Manager	PUK	MS Teams
Doug Stewart	Offshore Industrial Advisor Manager	Joint Nature Conservation Committee (JNCC)	MS Teams
Offshore Decommissioning Unit (ODU)	Senior Decommissioning Manager	OPRED	MS Teams
ODU	Offshore Decommissioning Assistant Manager	OPRED	MS Teams
ODU	Decommissioning Manager	OPRED	MS Teams
Arnaldo Latas	Safety Inspector Vessels	Health and Safety Executive (HSEx)	MS Teams
Jillian Whyte	Offshore Advisor	JNCC	MS Teams
Environmental Management Team (EMT)	EMT representative	OPRED	MS Teams
EMT	Senior Environmental Manager	OPRED	MS Teams

11 CA Results

This section presents the outcomes of the CA evaluation process, describes how scores were achieved, and details the sensitivity analysis applied to the CA results.

A quantitative assessment using values derived from the HIRA was used to score three of the five main criteria (Safety, Environmental, Societal) with technical and economic criteria assessed separately (See Appendix 1). The HIRA was designed in a way that could be applied across all decommissioning options to allow balanced comparative scoring.

In order to allow comparison of decommissioning options across all criteria for each method, the value of the scores against each hazard in the HIRA were averaged and assigned a RAG category (if within 20% lowest rank Green, if within 20% of highest rank Red, otherwise Amber). The same RAG categorisation was applied to the Technical and Economic criteria assessment resulting in a consistent scoring approach across all criteria that could be used in the CA process.

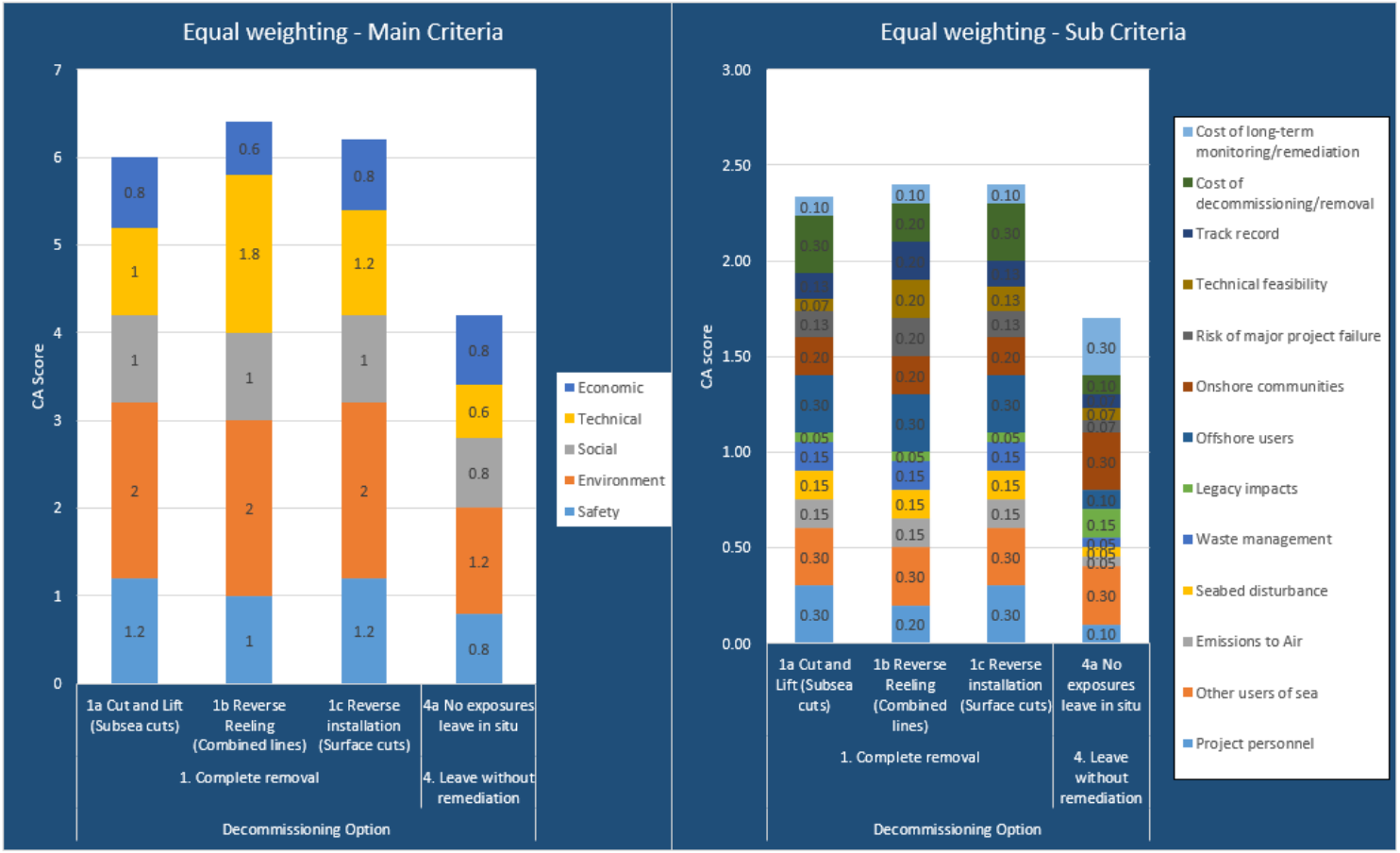
In order to determine overall scores, an overall rating was determined by applying a score of 1 to low impact, 2 to medium impact and 3 to high impact ratings. These scores were summed and rated with ranking being inversely proportional to rating (the lowest overall rating score represents the preferred option) (Table 11-1). This method was chosen in order to allow comparison across all 5 main criteria where safety, environmental, social and economic underwent a quantitative assessment and technical underwent a qualitative assessment.

Full details of the HIRA scoring, and technical/economic assessment are presented in Appendices 2 and 3 respectively.

Table 11-1: CA results

Criterion	Sub-criterion	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Risk to Project personnel	High impact (3)	Moderate impact (2)	High impact (3)	Low impact (1)
	Risk to Other users	High impact (3)	High impact (3)	High impact (3)	High impact (3)
	Criterion total	6	5	6	4
Environmental	Emissions to air	High impact (3)	High impact (3)	High impact (3)	Low impact (1)
	Seabed disturbance	High impact (3)	High impact (3)	High impact (3)	Low impact (1)
	Waste management	High impact (3)	High impact (3)	High impact (3)	Low impact (1)
	Legacy impacts	Low impact (1)	Low impact (1)	Low impact (1)	High impact (3)
	Criterion total	10	10	10	6
Societal	Offshore users	High impact (3)	High impact (3)	High impact (3)	Low impact (1)
	Onshore communities	Moderate impact (2)	Moderate impact (2)	Moderate impact (2)	High impact (3)
	Criterion total	5	5	5	4
Technical	Risk of major project failure	Moderate impact (2)	High impact (3)	Moderate impact (2)	Low impact (1)
	Technical feasibility	Low impact (1)	High impact (3)	Moderate impact (2)	Low impact (1)
	Track record	Moderate impact (2)	High impact (3)	Moderate impact (2)	Low impact (1)
	Criterion total	5	9	6	3
Economic	Cost of decommissioning/removal	High impact (3)	Moderate impact (2)	High impact (3)	Low impact (1)
	Cost of long-term monitoring/remediation	Low impact (1)	Low impact (1)	Low impact (1)	High impact (3)
	Criterion total	4	3	4	4
Overall rating		**30**	**32**	**31**	**21**
Overall ranking		**2**	**4**	**3**	**1**

Figure 11-1: CA output under equal weighting



11.1 Conclusions and the Preferred Method

The results of the CA indicate that the preferred decommissioning option for pipelines PL874 and PL875 is 4a - leave in situ (Table 11-1, Figure 11-1) .

Scores across all criteria were lower for option 4a (Leave in situ) compared to other options, with the exception of the economic criterion which was lowest for option 1b Reverse Reeling (Combined lines). This is due to the costs involved with pipeline removal being balanced against the costs associated with long term legacy surveys as a result of the leave in situ scenario. Whilst there are small differences in values across sub criteria for the three full removal options overall values are consistent with the greatest difference being between full removal options (Options 1a, 1b, 1c) and leave in situ (Option 4a).

Scores according to individual criteria as discussed further below.

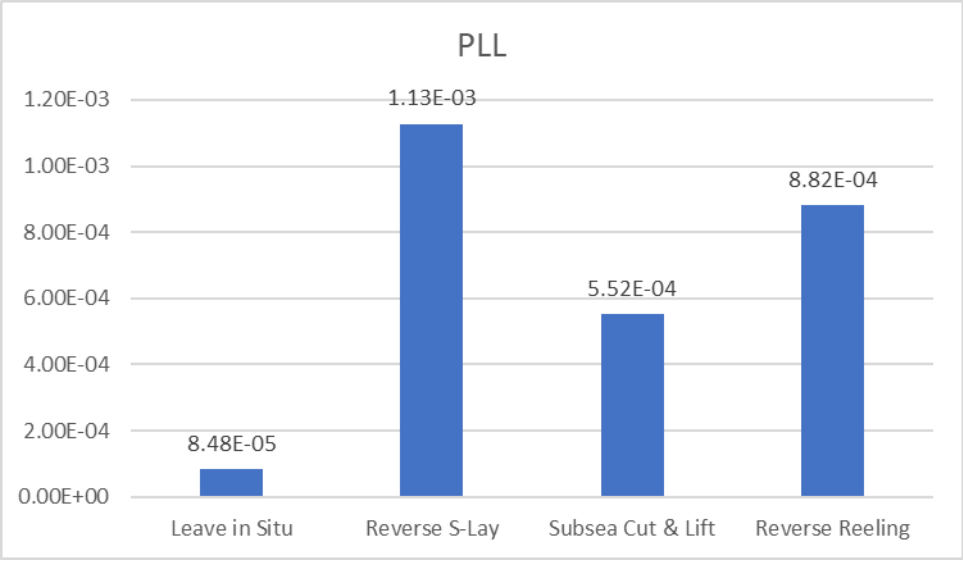
11.1.1 Safety

Option 4a was the lowest score for Safety with the result being predominantly driven by a greatly reduced risk to project personnel during offshore operations. Offshore operations for option 4a are limited to legacy surveys which require significantly reduced offshore days and reduced vessel crew sizes to complete with an associated PLL of 8.48E-05. This result is significantly lower than that for all three removal options (1a, 1b and 1c) (Figure 11-2).

This pattern was still observed after greater weighting was applied to Safety scores. Risk to other offshore sea users was consistent across options.

Overall, there is a preference for Option 4a from a Safety perspective.

Figure 11-2: PLL calculations across options



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11.1.2 Environmental

Option 4a was the lowest score for Environmental with the result being predominantly driven by reduced emissions to air (315te for option 4a, 1,605-5,157te for options 1a, 1b and 1c), impacts on the seabed (zero for option 4a, 12,836m^2 for options 1a, 1b and 1c) and generation of operational waste. Conversely option 4a scored highest while considering legacy impacts as full removal options scored zero. This pattern was still observed after greater weighting was applied to Environmental scores. A detailed assessment of all potentially significant environmental impacts is presented in the Guinevere pipelines and stabilisation materials EA [23].

Overall, there is a preference for Option 4a from an Environmental perspective.

11.1.3 Societal

Option 4a was the lowest score for Societal with the result being predominantly driven by a lower impact on other offshore users of the area, particularly impacts on fishing activity and shipping in the area, where exclusion would be limited to a single smaller vessel operating over a period of days. Option 4a scored higher under consideration of onshore communities with the score being driven by a loss in employment and recycling opportunities due to the pipeline remaining in situ, although it should be noted that the exact amount of employment generation and recycling opportunity for pipelines recovered to shore may be overestimated. This pattern was still observed after greater weighting was applied to Societal scores.

Overall, there is a preference for Option 4a from a Societal perspective.

11.1.4 Technical

Option 4a was the lowest score for Technical with the overall result being driven by lower scores across all three sub criteria. This pattern was still observed after greater weighting was applied to Technical scores.

Overall, there is a preference for Option 4a from a Technical perspective.

11.1.5 Economic

Option 1b was the lowest score for Economic with the result being driven by intermediate scores for project operational costs and zero legacy survey costs. However, after applying a greater weighting to Economic scores, option 4a emerged as the preferred option due to lower operational costs.

Overall, there is a preference for Option 4a from an Economic perspective.

11.2 Sensitivity Analysis

In order to determine if any particular criteria are responsible for driving the preferred outcome, sensitivity analysis was performed and compared with the initial outcome.

Sensitivity analysis was carried out by converting the rating score from each criterion into a percentage and multiplying by the weighted value. An initial assessment with equal ratings across all criteria was completed (Figure 11-1) followed by subsequent comparisons with greater weighting allocated to individual criteria in turn (Figure 11-3 - Figure 11-7).

The equal weighting assessment applied an equal value of 20% across the five main criteria with values assigned to sub-criteria on a pro-rata basis. Later comparisons against weighted criteria applied a greater value of 60 to that criterion (again with values for sub criteria allocated on a pro-rata basis) as detailed in Table 11-2 below.

The results were then assessed to determine which criteria had the greatest impact on the original scoring and if any change in the preferred method was observed.

Table 11-2: Weightings applied across each criterion to assess sensitivity of the results.

	Safety	Environmental	Technical	Societal	Economic
Criteria with greater weighting	%				
Safety	60	10	10	10	10
Environmental	10	60	10	10	10
Technical	10	10	60	10	10
Societal	10	10	10	60	10
Economic	10	10	10	10	60

Figure 11-3: Safety Weighting

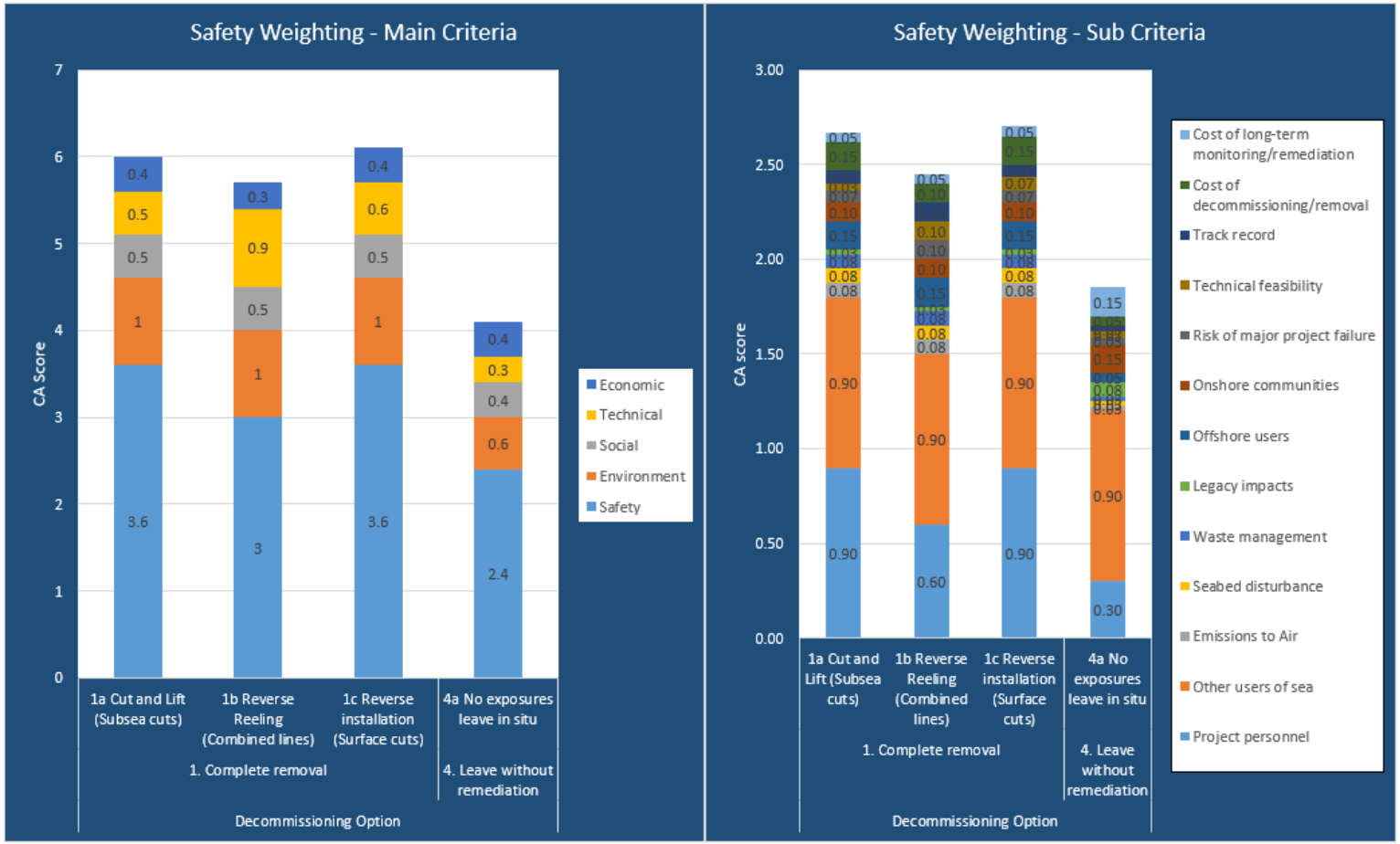


Figure 11-4: Environmental Weighting

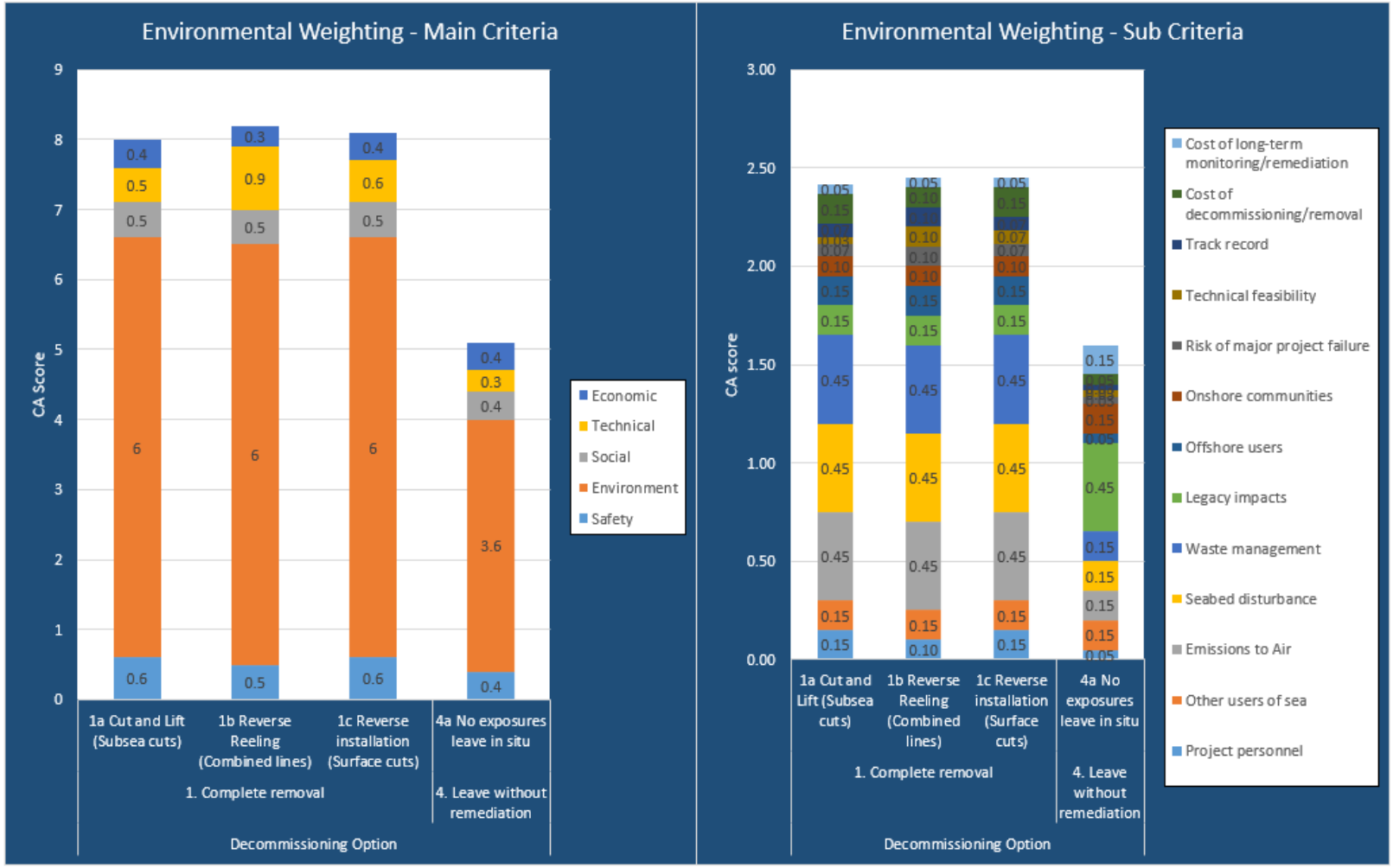


Figure 11-5: Societal Weighting

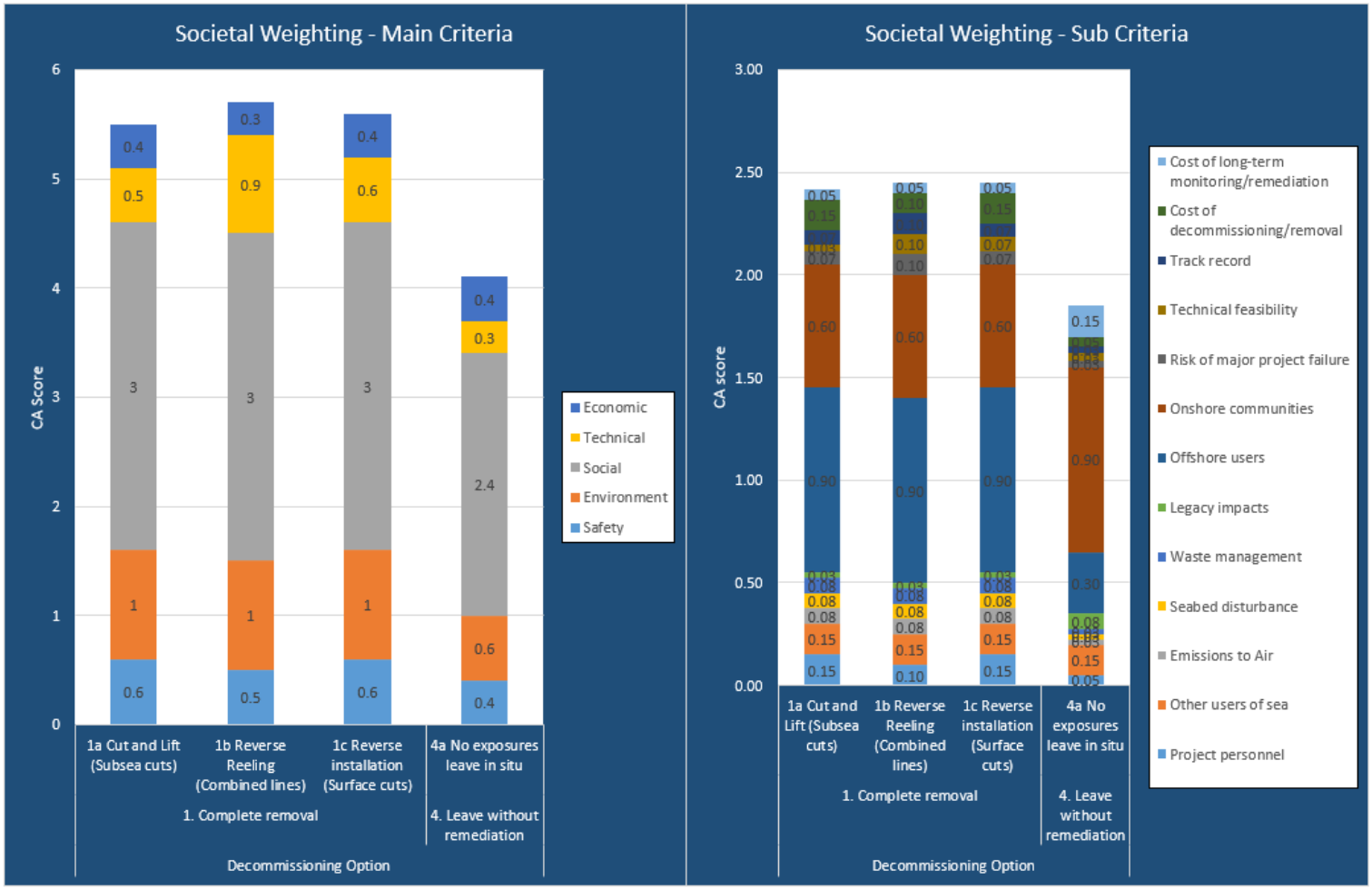
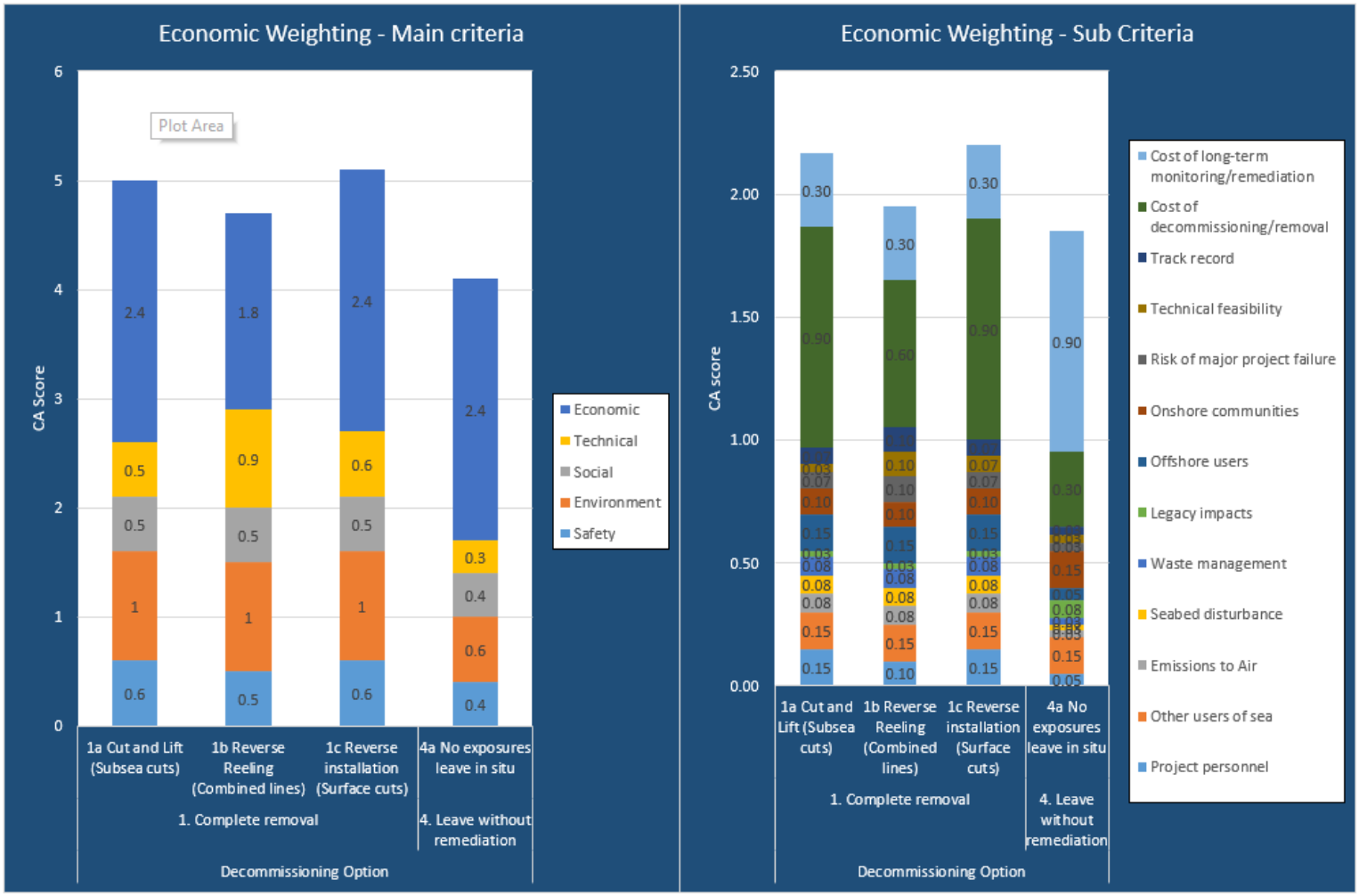


Figure 11-6: Technical Weighting

Figure 11-7: Economic Weighting



12 CA Conclusions and Recommendations

The results of the CA indicate that the preferred decommissioning option for both pipelines is to leave in situ (Option 4a). Sensitivity analysis has been carried out on the assessment outcomes where greater weighting was allocated to individual criteria and compared against a standard equal weighting version (see section 11), this provides an opportunity to assess which, if any, of the criteria are responsible for driving the CA result.

While some small changes in scores and order of the methods was observed throughout the sensitivity analysis, the preferred method of leave in situ remained consistent for all scenarios. This indicates that the preferred option is not being driven by any single criteria and is as a result of a combination of all criteria with all contributing to the outcome.

As a result of the CA, the decommissioning option presented within the Guinevere pipelines DP and EA is that of a leave in situ. This outcome does carry within it several obligations that will be discussed and agreed with OPRED including the requirement to carry out an overtrawl survey (or other agreed non-intrusive method) of the Guinevere 500m safety zones when relevant to confirm a lack of snagging hazard. Additionally, periodic post decommissioning surveys will be completed to confirm that the pipelines remain buried under the seabed and do not present a snagging hazard.

A detailed assessment of impacts, both positive and negative, on the environment and society is presented within the Guinevere pipelines and stabilisation materials EA which has been submitted alongside this CA to support the DP.

Table 12-1: Selected Decommissioning options

Infrastructure	Decommissioning option
142m of PL874 within Guinevere 500m safety zone	Leave in situ under existing rock placement
142m of PL875 within Guinevere 500m safety zone	Leave in situ under existing rock placement
PL874 within Lancelot 500m safety zone	To be considered in Lancelot DP
PL875 within Lancelot 500m safety zone	To be considered in Lancelot DP
PL874 Remaining section	Leave in situ
PL875 Remaining section	Leave in situ
Concrete Mattress	Leave in situ under existing rock placement
Rock placement	Leave in situ

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Appendix 1 - CA Scoring Criteria

	Sub-criteria	Low (1)	Moderate (2)	High (3)
Safety	Project personnel	Results from HIRA		
	Other users of sea	Results from HIRA		
Environmental	Atmospheric Emissions	Results from HIRA		
	Seabed disturbance/Loss of habitat			
	Waste generation			
	Legacy impacts			
Technical	Risk of major project failure	Offshore Execution Phase unlikely to slip beyond planned schedule (including contingencies).	Potential for extended Offshore Execution Phase duration > 1month but < 3months beyond planned schedule (including contingencies) but within same campaign/season. Some minor uncertainties.	Potential for unplanned and unforeseen activity delaying project end by > 4 months, and potential to cause a 2nd unplanned campaign in a separate season. Major uncertainties exist
	Technical feasibility	Scope is straightforward and well understood.	Scope is understood but presents some technical challenges to overcome.	Scope is poorly understood and presents significant technical challenges to overcome.
	Track record	No new technology or working practices to be introduced. Option has good industry track record in the basin and can be executed by contractors with significant previous experience of all activities involved.	No new technology or working practices to be introduced. Option has limited industry track record in the basin and can be executed by contractors with some previous experience of most activities involved.	New technology/untried working practice to be introduced. Option has no industry track record in the basin.
Societal	Offshore users	Results from HIRA		
	Onshore communities			
Economic	Cost of decommissioning/removal	Lowest cost	Costs between lowest and highest to be ranked accordingly, if within 20% lowest also rank Green, if within 20% of highest also rank Red	Highest cost
	Cost of long-term monitoring/remediation	Lowest cost	Costs between lowest and highest to be ranked accordingly, if within 20% lowest also rank Green, if within 20% of highest also rank Red	Highest cost

Appendix 2 - HIRA Results

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
			C	L	1a Cut and Lift (Subsea cuts)	C	L	1b Reverse Reeling (Combined lines)	C	L	1c Reverse installation (Surface cuts)	C	L	4a No exposures leave in situ	
Safety	Risk to project personnel	Offshore Vessel use	4	2	8	4	2	8	4	2	8	3	2	6	Potential for multiple fatalities associated with extended vessel operation. Option 4a limited to post decom survey.
		Remotely Operated Vehicle (ROV) operation	2	2	4	2	2	4	2	2	4	0	0	0	ROV operation during trenching and unburial activities for removal options. No ROV use for option 4a.

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
		Lifting ops (offshore)	4	2	8	0	0	0	3	2	6	0	0	0	Greater frequency of offshore lifting ops for option 1a due to removal of 10m sections from seabed to barge vessel. Option 1c is limited to moving smaller cut sections around vessel. No offshore lifting ops for options 1b and 4a.
		Lifting ops (Quayside)	4	2	8	0	0	0	4	2	8	0	0	0	Quayside lifting ops required for options 1a and 1c. Not required for 1b as pipeline will be on reel and 4a as pipeline left in situ
		Subsea pipeline cuts	3	2	6	3	1	3	3	1	3	0	0	0	High frequency of subsea cuts for option 1a. Options 1b and 1c limited to Lancelot 500m safety zone. N/A for 4a.
		Surface pipeline cuts	0	0	0	0	0	0	4	2	8	0	0	0	Only applicable to option 1c.
		Pipeline Reverse reeling	0	0	0	4	2	8	0	0	0	0	0	0	Only applicable to option 1b.

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
		Vessel collision (With platforms or project vessels)	5	3	15	5	2	10	5	2	10	5	1	5	Very major health incident if collision with operational asset (e.g. Lancelot) Option 1a uses multiple vessels and longest duration of activity. Option 4a single vessel with short duration.
		Average			6			4			6			1	
	Risk to other users	Third party vessel collision with Project infrastructure/vessels	3	3	9	3	2	6	3	2	6	3	2	6	Potential for high impact health and safety incident. Risk is greater for option 1a due to greater vessel days.

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
		Snagging risk of items left in situ	3	1	3	3	1	3	3	1	3	3	1	3	Pipeline is trenched and buried and expected to remain so. Only snagging hazard present would be cut end at Lancelot 500m safety zone which is consistent across. This could be zero if the Lancelot 500m safety zone section is also left in situ buried, however this is currently out of CA scope.
		Average			6			5			5			5	
Environmental	Emissions to air	Emissions to air	5	5	25	5	5	25	5	5	25	3	5	15	Based on Guinevere CA Emissions assessment 200605-S-REP-0020
		Average			25			25			25			15	

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
	Seabed disturbance	Seabed disturbance / Loss of Habitat	1	5	5	1	5	5	1	5	5	0	0	0	Based on Guinevere CA seabed impact assessment 200605-S-REP-0021
		Average			5			5			5			0	
	Waste management	Vessel waste generation	1	5	5	1	5	5	1	5	5	1	5	5	Based on Waste calculations Guinevere CA Waste assessment 200605-S-REP-0019
		Operational waste generation	4	5	20	4	5	20	4	5	20	0	0	0	Based on Waste calculations Guinevere CA Waste assessment 200605-S-REP-0019
		Average			13			13			13			3	
	Legacy Impacts	Deterioration of materials left in situ	0	0	0	0	0	0	0	0	0	2	5	10	No impact for removal options. Low impact for leave in situ. Pipeline is flushed and cleaned. Impact limited to FBE pipeline coating.

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
		Average			0			0			0			10	
Societal	Offshore users	Exclusion of third parties	1	5	5	1	5	5	1	5	5	0	0	0	Removal options create limited loss of 3rd party access <1km^2 during project activities. Predominantly fishing vessels/shipping.
		Short term impacts on fishing (Operations)	1	5	5	1	5	5	1	5	5	0	0	0	Scored in line with exclusion of third parties. Accounts for exclusion of fishing vessels during project activities.
		Long term impacts on fishing (legacy)	2	5	10	2	5	10	2	5	10	0	0	0	Pipeline removal options will have impact on local seabed affecting fishing success.
		Total			7			7			7			0	

Criterion	Sub-criterion	Guideword/Hazard	1. Complete removal									4. Leave without remediation			Notes
	Onshore communities	Provision of employment	0	0	0	0	0	0	0	0	0	1	5	5	Removal options provide onshore work for processing and Recycling. Leave in situ scored as 5 due to loss of this opportunity
		Loss of recycling options (resource extraction)	0	0	0	0	0	0	0	0	0	1	3	3	
		Use of Landfill	2	5	10	2	5	10	2	5	10	1	5	5	Based on Waste calculations Guinevere CA Waste assessment 200605-S-REP-0019
		Average			3			3			3			4	
		Total			**65.13**			**61.13**			**62.88**			**37.71**	

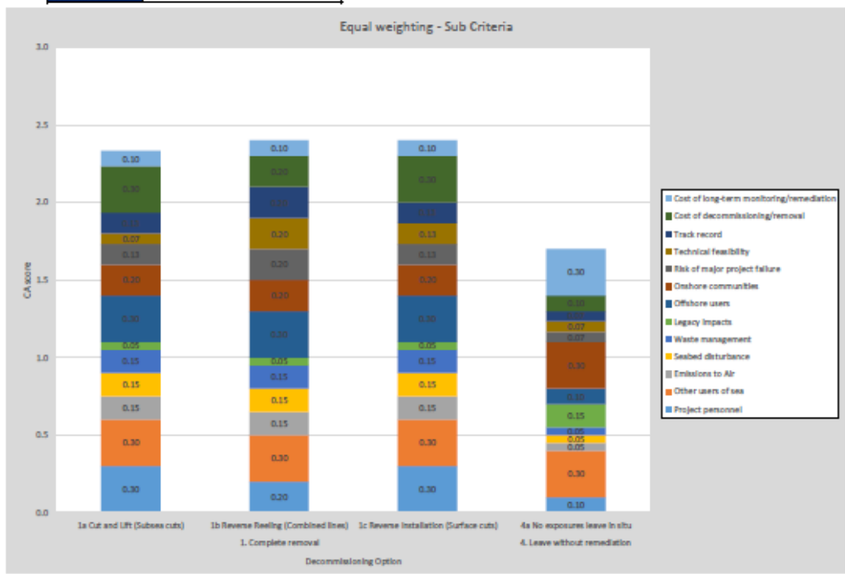
Appendix 3 - Technical and Economic Assessment Results

Criterion	Sub-Criterion	Decommissioning Option			
		1a Cut and Lift (Subsea cuts)	**1b Reverse Reeling (Combined lines)**	**1c Reverse installation (Surface cuts)**	**4a No exposures leave in situ**
Technical	Risk of major project failure	2	3	2	1
	Technical feasibility	1	3	2	1
	Track record	2	3	2	1
Economic	Cost for operations	3	2	3	1
	Cost of long-term monitoring/remediation	1	1	1	3
	Total	**9**	**12**	**10**	**7**

Appendix 4 - Detailed CA Analysis Results

Criterion	Sub-criterion	Weighting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	10.0	3	2	3	1
	Other users of sea	10.0	3	3	3	3
Environmental	Emissions to Air	5.0	3	3	3	1
	Seabed disturbance	5.0	3	3	3	1
	Waste management	5.0	3	3	3	1
	Legacy impacts	5.0	1	1	1	3
Societal	Offshore users	10.0	3	3	3	1
	Onshore communities	10.0	2	2	2	3
Technical	Risk of major project failure	6.7	2	3	2	1
	Technical feasibility	6.7	1	3	2	1
	Track record	6.7	2	3	2	1
Economic	Cost of decommissioning/removal	10.0	3	2	3	1
	Cost of long-term monitoring/remediation	10.0	1	1	1	3
Total		100.0	30	32	31	21

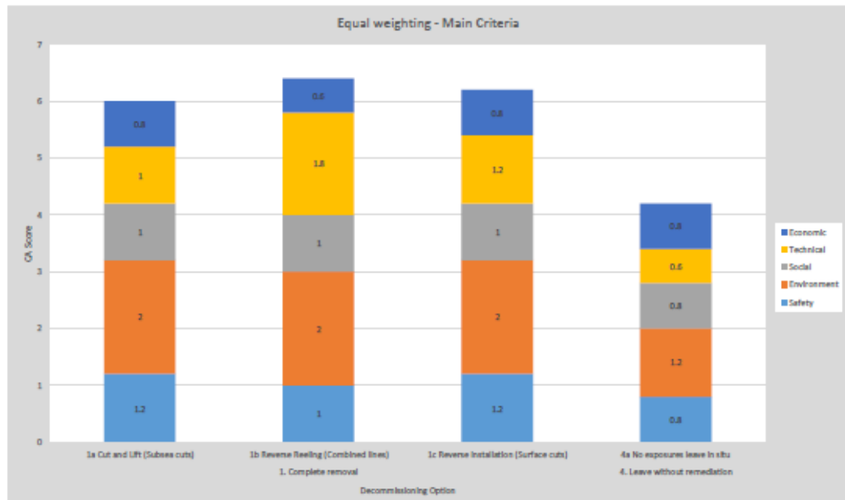
Criteria with greater weighting	Weighting Percentage
Safety	20
Environmental	20
Societal	20
Technical	20
Economic	20



Criterion	Sub-criterion	Weighting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	10.0	0.30	0.20	0.30	0.10
	Other users of sea	10.0	0.30	0.30	0.30	0.30
Environmental	Emissions to Air	5.0	0.15	0.15	0.15	0.05
	Seabed disturbance	5.0	0.15	0.15	0.15	0.05
	Waste management	5.0	0.15	0.15	0.15	0.05
	Legacy impacts	5.0	0.05	0.05	0.05	0.15
Societal	Offshore users	10.0	0.30	0.30	0.30	0.10
	Onshore communities	10.0	0.20	0.20	0.20	0.30
Technical	Risk of major project failure	6.7	0.13	0.20	0.13	0.07
	Technical feasibility	6.7	0.07	0.20	0.13	0.07
	Track record	6.7	0.13	0.20	0.13	0.07
Economic	Cost of decommissioning/removal	10.0	0.30	0.20	0.30	0.10
	Cost of long-term monitoring/remediation	10.0	0.10	0.10	0.10	0.30
Total		100.0	2.33	2.40	2.40	1.70

Criterion	Weighting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	20	6	5	6	4
Environment	20	10	10	10	6
Social	20	5	5	5	4
Technical	20	5	9	6	3
Economic	20	4	3	4	4
Total	100	30	32	31	21

Criterion	Weighting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	20	1.2	1	1.2	0.8
Environment	20	2	2	2	1.2
Social	20	1	1	1	0.8
Technical	20	1	1.8	1.2	0.6
Economic	20	0.8	0.6	0.8	0.8
Total	100	6	6.4	6.2	4.2



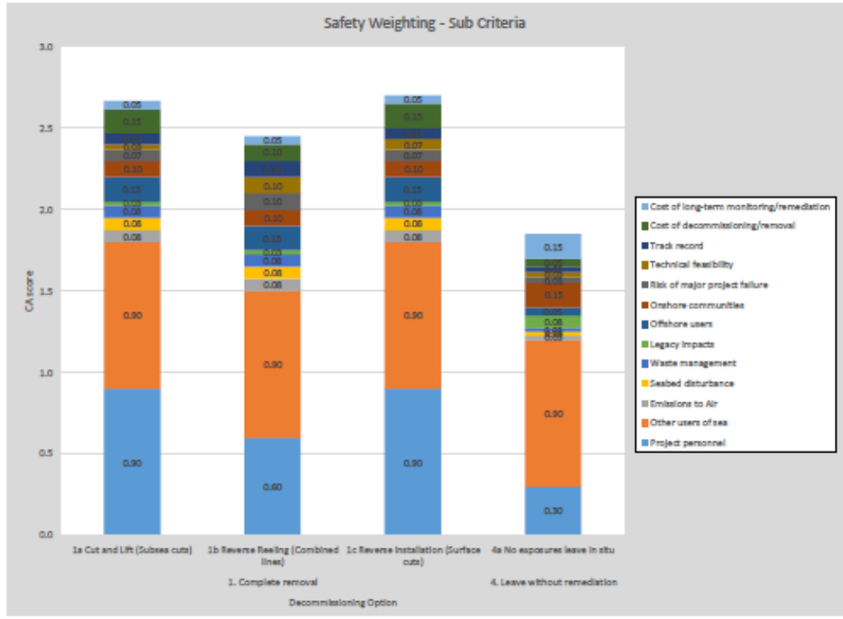
Criterion	Sub-criterion	Weigting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	30.0	3	2	3	1
	Other users of sea	30.0	3	3	3	3
Environmental	Emissions to Air	2.5	3	3	3	1
	Seabed disturbance	2.5	3	3	3	1
	Waste management	2.5	3	3	3	1
	Legacy impacts	2.5	1	1	1	3
Societal	Offshore users	5.0	3	3	3	1
	Onshore communities	5.0	2	2	2	3
Technical	Risk of major project failure	3.3	2	3	2	1
	Technical feasibility	3.3	1	3	2	1
	Track record	3.3	2	3	2	1
Economic	Cost of decommissioning/removal	5.0	3	2	3	1
	Cost of long-term monitoring/remediation	5.0	1	1	1	3
Total		100.0	30	32	31	21

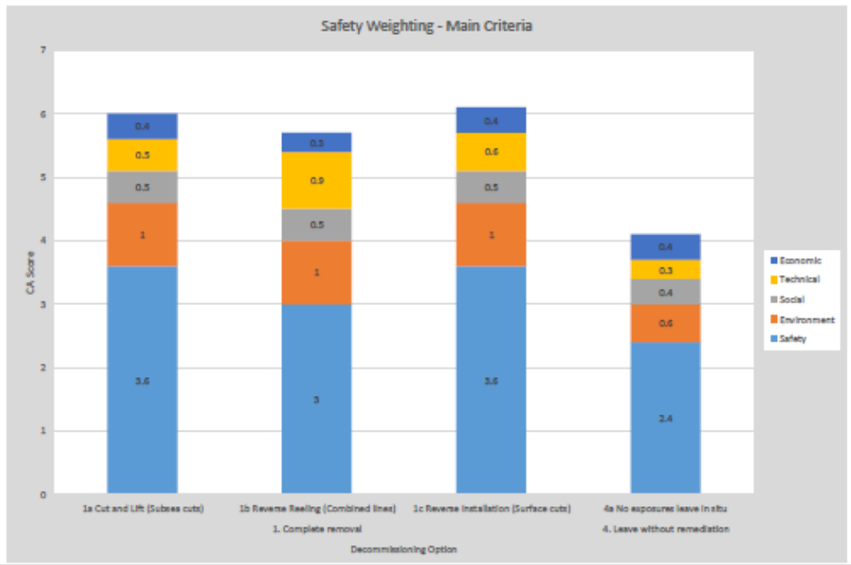
Criterion	Sub-criterion	Weigting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	30.0	0.90	0.60	0.90	0.30
	Other users of sea	30.0	0.90	0.90	0.90	0.90
Environmental	Emissions to Air	2.5	0.08	0.08	0.08	0.03
	Seabed disturbance	2.5	0.08	0.08	0.08	0.03
	Waste management	2.5	0.08	0.08	0.08	0.03
	Legacy impacts	2.5	0.03	0.03	0.03	0.08
Societal	Offshore users	5.0	0.15	0.15	0.15	0.05
	Onshore communities	5.0	0.10	0.10	0.10	0.15
Technical	Risk of major project failure	3.3	0.07	0.10	0.07	0.03
	Technical feasibility	3.3	0.03	0.10	0.07	0.03
	Track record	3.3	0.07	0.10	0.07	0.03
Economic	Cost of decommissioning/removal	5.0	0.15	0.10	0.15	0.05
	Cost of long-term monitoring/remediation	5.0	0.05	0.05	0.05	0.15
Total		100.0	2.67	2.45	2.70	1.85

Criterion	Weigting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	60	6	5	6	4
Environment	10	10	10	10	6
Social	10	5	5	5	4
Technical	10	5	9	6	3
Economic	10	4	3	4	4
Total	100	30	32	31	21

Criterion	Weigting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	60	3.6	3	3.6	2.4
Environment	10	1	1	1	0.6
Social	10	0.5	0.5	0.5	0.4
Technical	10	0.5	0.9	0.6	0.3
Economic	10	0.4	0.3	0.4	0.4
Total	100	6	5.7	6.1	4.1

Weighting	Safety	Environmental	Societal	Technical	Economic
	Percentage				
Safety	60	10	10	10	10
Environmental	10	60	10	10	10
Societal	10	10	60	10	10
Technical	10	10	10	60	10
Economic	10	10	10	10	60





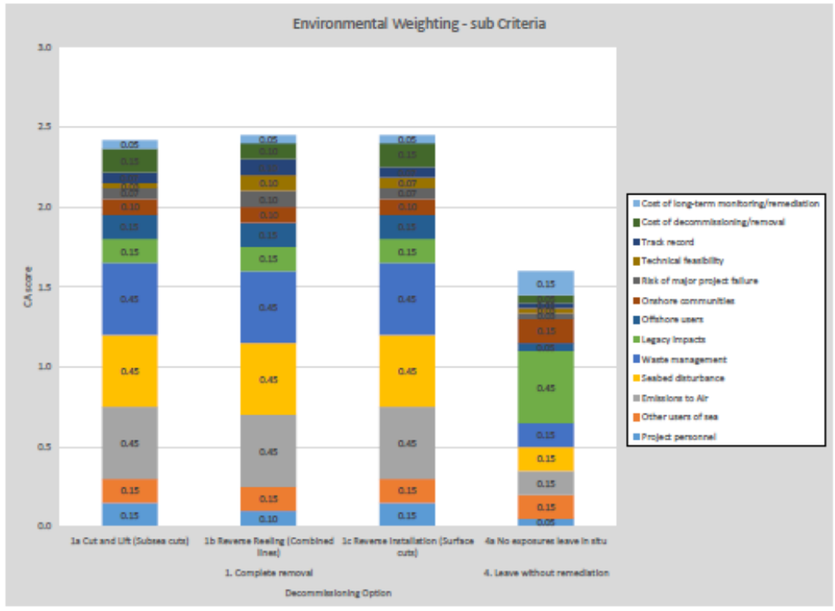
Criterion	Sub-criterion	Weighting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	3	2	3	1
	Other users of sea	5.0	3	3	3	3
Environmental	Emissions to Air	15.0	3	3	3	1
	Seabed disturbance	15.0	3	3	3	1
	Waste management	15.0	3	3	3	1
	Legacy impacts	15.0	1	1	1	3
Societal	Offshore users	5.0	3	3	3	1
	Onshore communities	5.0	2	2	2	3
Technical	Risk of major project failure	3.3	2	3	2	1
	Technical feasibility	3.3	1	3	2	1
	Track record	3.3	2	3	2	1
Economic	Cost of decommissioning/removal	5.0	3	2	3	1
	Cost of long-term monitoring/remediation	5.0	1	1	1	3
Total		100.0	30	32	31	21

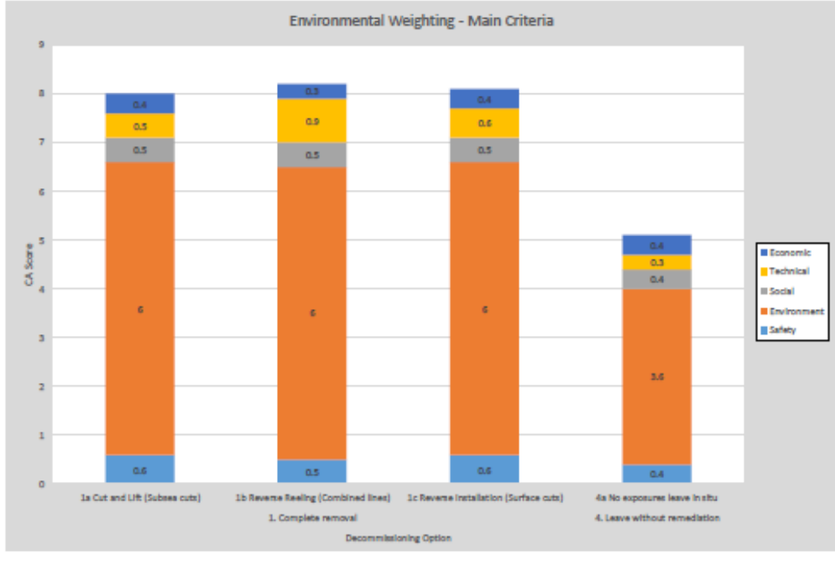
Criterion	Sub-criterion	Weighting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	0.15	0.10	0.15	0.05
	Other users of sea	5.0	0.15	0.15	0.15	0.15
Environmental	Emissions to Air	15.0	0.45	0.45	0.45	0.15
	Seabed disturbance	15.0	0.45	0.45	0.45	0.15
	Waste management	15.0	0.45	0.45	0.45	0.15
	Legacy impacts	15.0	0.15	0.15	0.15	0.45
Societal	Offshore users	5.0	0.15	0.15	0.15	0.05
	Onshore communities	5.0	0.10	0.10	0.10	0.15
Technical	Risk of major project failure	3.3	0.07	0.10	0.07	0.03
	Technical feasibility	3.3	0.03	0.10	0.07	0.03
	Track record	3.3	0.07	0.10	0.07	0.03
Economic	Cost of decommissioning/removal	5.0	0.15	0.10	0.15	0.05
	Cost of long-term monitoring/remediation	5.0	0.05	0.05	0.05	0.15
Total		100.0	2.42	2.45	2.45	1.60

Criterion	Weighting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	6	5	6	4
Environment	60	10	10	10	6
Social	10	5	5	5	4
Technical	10	5	9	6	3
Economic	10	4	3	4	4
Total	100	30	32	31	21

Criterion	Weighting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	0.6	0.5	0.6	0.4
Environment	60	6	6	6	3.6
Social	10	0.5	0.5	0.5	0.4
Technical	10	0.5	0.9	0.6	0.3
Economic	10	0.4	0.3	0.4	0.4
Total	100	8	8.2	8.1	5.1

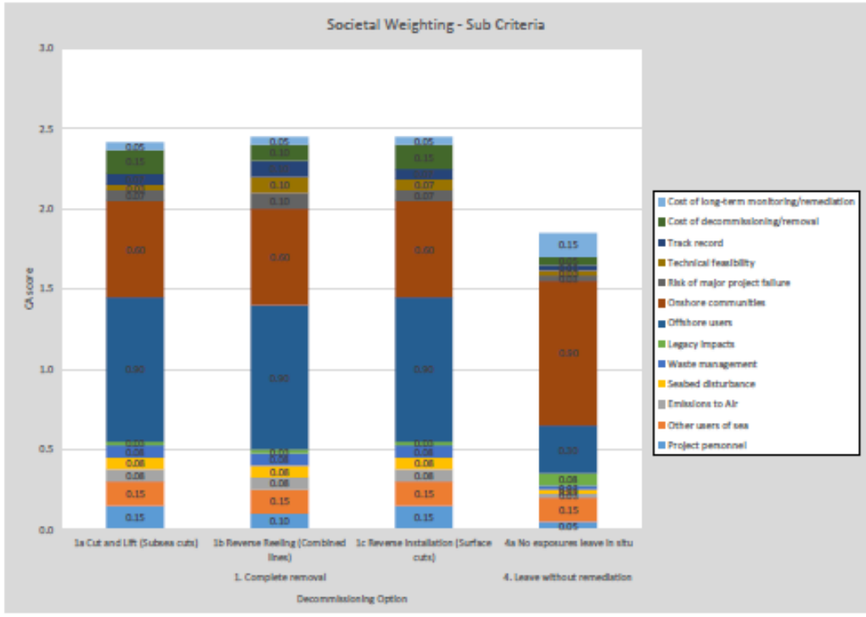
Weighting	Safety	Environmental	Societal	Technical	Economic
	Percentage				
Safety	60	10	10	10	10
Environmental	10	60	10	10	10
Societal	10	10	60	10	10
Technical	10	10	10	60	10
Economic	10	10	10	10	60





Criterion	Sub-criterion	Weighting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	3	2	3	1
	Other users of sea	5.0	3	3	3	3
Environmental	Emissions to Air	2.5	3	3	3	1
	Seabed disturbance	2.5	3	3	3	1
	Waste management	2.5	3	3	3	1
	Legacy impacts	2.5	1	1	1	3
Societal	Offshore users	30.0	3	3	3	1
	Onshore communities	30.0	2	2	2	3
Technical	Risk of major project failure	3.3	2	3	2	1
	Technical feasibility	3.3	1	3	2	1
	Track record	3.3	2	3	2	1
Economic	Cost of decommissioning/removal	5.0	3	2	3	1
	Cost of long-term monitoring/remediation	5.0	1	1	1	3
Total		100.0	30	32	31	21

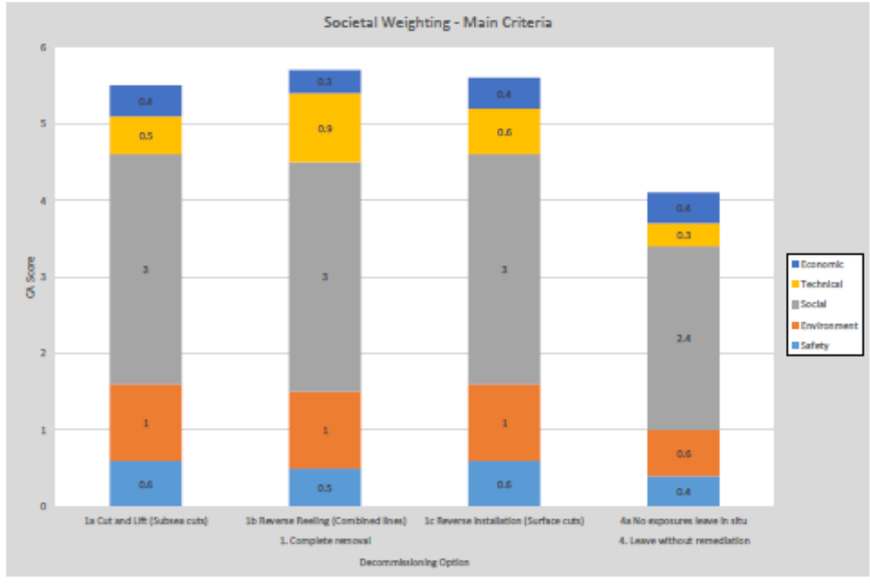
Weighting	Safety	Environmental	Societal	Technical	Economic
	Percentage				
Safety	60	10	10	10	10
Environmental	10	60	10	10	10
Societal	10	10	60	10	10
Technical	10	10	10	60	10
Economic	10	10	10	10	60



Criterion	Sub-criterion	Weighting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	0.15	0.10	0.15	0.05
	Other users of sea	5.0	0.15	0.15	0.15	0.15
Environmental	Emissions to Air	2.5	0.08	0.08	0.08	0.03
	Seabed disturbance	2.5	0.08	0.08	0.08	0.03
	Waste management	2.5	0.08	0.08	0.08	0.03
	Legacy impacts	2.5	0.03	0.03	0.03	0.08
Societal	Offshore users	30.0	0.90	0.90	0.90	0.30
	Onshore communities	30.0	0.60	0.60	0.60	0.90
Technical	Risk of major project failure	3.3	0.07	0.10	0.07	0.03
	Technical feasibility	3.3	0.03	0.10	0.07	0.03
	Track record	3.3	0.07	0.10	0.07	0.03
Economic	Cost of decommissioning/removal	5.0	0.15	0.10	0.15	0.05
	Cost of long-term monitoring/remediation	5.0	0.05	0.05	0.05	0.15
Total		100.0	2.42	2.45	2.45	1.85

Criterion	Weighting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	6	5	6	4
Environment	10	10	10	10	6
Social	60	5	5	5	4
Technical	10	5	9	6	3
Economic	10	4	3	4	4
Total	100	30	32	31	21

Criterion	Weighting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	0.6	0.5	0.6	0.4
Environment	10	1	1	1	0.6
Social	60	3	3	3	2.4
Technical	10	0.5	0.9	0.6	0.3
Economic	10	0.4	0.3	0.4	0.4
Total	100	5.5	5.7	5.6	4.1



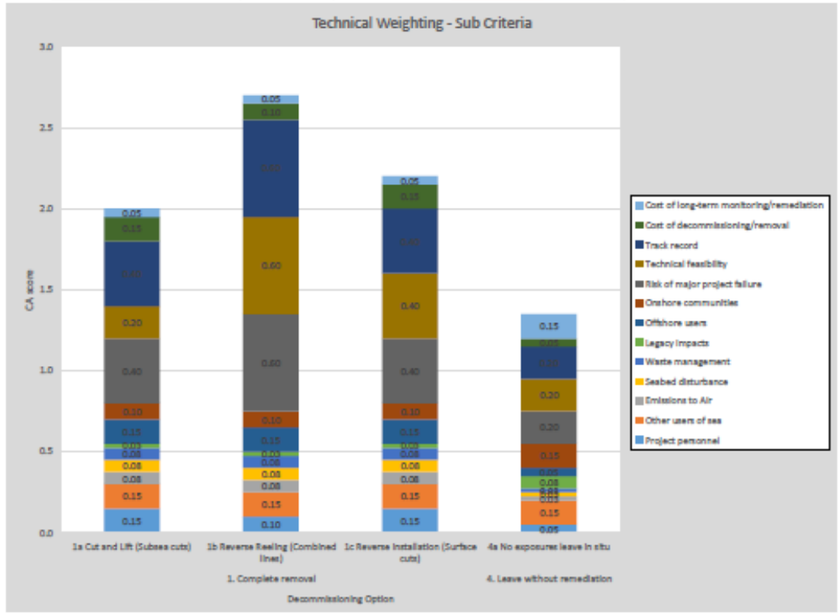
Criterion	Sub-criterion	Weigting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	3	2	3	1
	Other users of sea	5.0	3	3	3	3
Environmental	Emissions to Air	2.5	3	3	3	1
	Seabed disturbance	2.5	3	3	3	1
	Waste management	2.5	3	3	3	1
	Legacy impacts	2.5	1	1	1	3
Societal	Offshore users	5.0	3	3	3	1
	Onshore communities	5.0	2	2	2	3
Technical	Risk of major project failure	20.0	2	3	2	1
	Technical feasibility	20.0	1	3	2	1
	Track record	20.0	2	3	2	1
Economic	Cost of decommissioning/removal	5.0	3	2	3	1
	Cost of long-term monitoring/remediation	5.0	1	1	1	3
Total		100.0	30	32	31	21

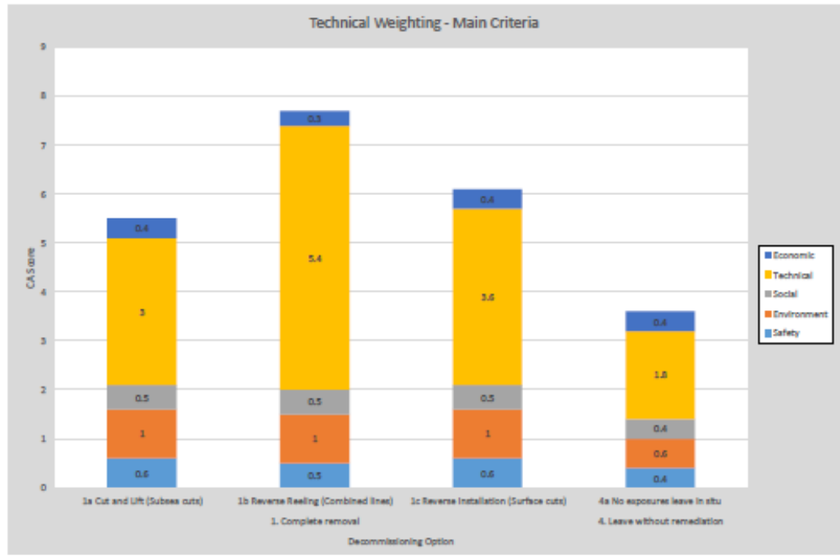
Criterion	Sub-criterion	Weigting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	0.15	0.10	0.15	0.05
	Other users of sea	5.0	0.15	0.15	0.15	0.15
Environmental	Emissions to Air	2.5	0.08	0.08	0.08	0.03
	Seabed disturbance	2.5	0.08	0.08	0.08	0.03
	Waste management	2.5	0.08	0.08	0.08	0.03
	Legacy impacts	2.5	0.03	0.03	0.03	0.08
Societal	Offshore users	5.0	0.15	0.15	0.15	0.05
	Onshore communities	5.0	0.10	0.10	0.10	0.15
Technical	Risk of major project failure	20.0	0.40	0.60	0.40	0.20
	Technical feasibility	20.0	0.20	0.60	0.40	0.20
	Track record	20.0	0.40	0.60	0.40	0.20
Economic	Cost of decommissioning/removal	5.0	0.15	0.10	0.15	0.05
	Cost of long-term monitoring/remediation	5.0	0.05	0.05	0.05	0.15
Total		100.0	2.00	2.70	2.20	1.35

Criterion	Weigting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	6	5	6	4
Environment	10	10	10	10	6
Social	10	5	5	5	4
Technical	60	5	9	6	3
Economic	10	4	3	4	4
Total	100	30	32	31	21

Criterion	Weigting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	0.6	0.5	0.6	0.4
Environment	10	1	1	1	0.6
Social	10	0.5	0.5	0.5	0.4
Technical	60	3	5.4	3.6	1.8
Economic	10	0.4	0.3	0.4	0.4
Total	100	5.5	7.7	6.1	3.6

Weighting	Safety	Environmental	Societal	Technical	Economic
	Percentage				
Safety	60	10	10	10	10
Environmental	10	60	10	10	10
Societal	10	10	60	10	10
Technical	10	10	10	60	10
Economic	10	10	10	10	60





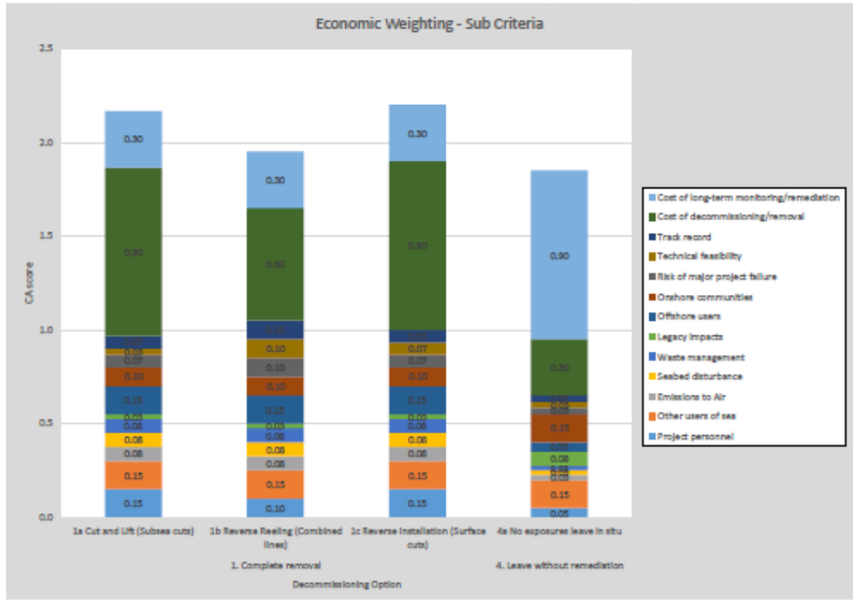
Criterion	Sub-criterion	Weigting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	3	2	3	1
	Other users of sea	5.0	3	3	3	3
Environmental	Emissions to Air	2.5	3	3	3	1
	Seabed disturbance	2.5	3	3	3	1
	Waste management	2.5	3	3	3	1
	Legacy impacts	2.5	1	1	1	3
Societal	Offshore users	5.0	3	3	3	1
	Onshore communities	5.0	2	2	2	3
Technical	Risk of major project failure	3.3	2	3	2	1
	Technical feasibility	3.3	1	3	2	1
	Track record	3.3	2	3	2	1
Economic	Cost of decommissioning/removal	30.0	3	2	3	1
	Cost of long-term monitoring/remediation	30.0	1	1	1	3
Total		100.0	30	32	31	21

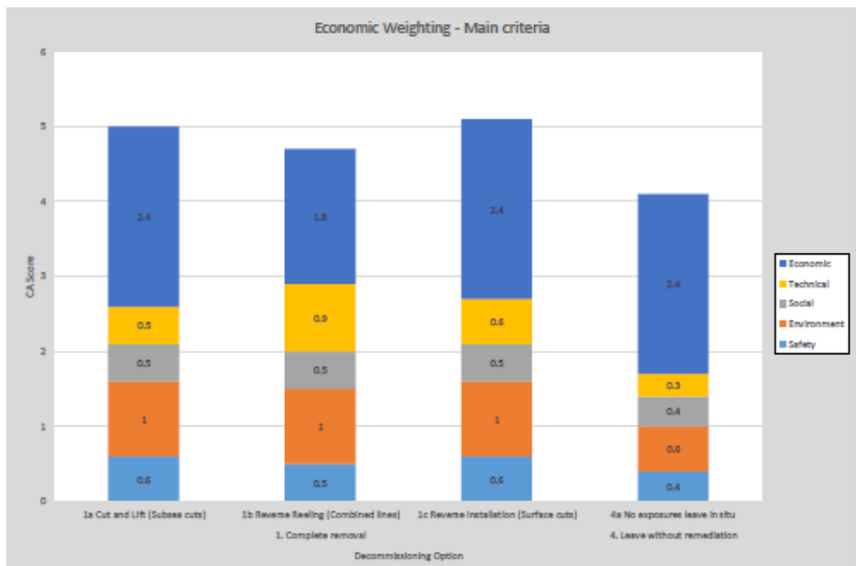
Criterion	Sub-criterion	Weigting	Decommissioning Option			
			1. Complete removal			4. Leave without remediation
			1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	Project personnel	5.0	0.15	0.10	0.15	0.05
	Other users of sea	5.0	0.15	0.15	0.15	0.15
Environmental	Emissions to Air	2.5	0.08	0.08	0.08	0.03
	Seabed disturbance	2.5	0.08	0.08	0.08	0.03
	Waste management	2.5	0.08	0.08	0.08	0.03
	Legacy impacts	2.5	0.03	0.03	0.03	0.08
Societal	Offshore users	5.0	0.15	0.15	0.15	0.05
	Onshore communities	5.0	0.10	0.10	0.10	0.15
Technical	Risk of major project failure	3.3	0.07	0.10	0.07	0.03
	Technical feasibility	3.3	0.03	0.10	0.07	0.03
	Track record	3.3	0.07	0.10	0.07	0.03
Economic	Cost of decommissioning/removal	30.0	0.90	0.60	0.90	0.30
	Cost of long-term monitoring/remediation	30.0	0.30	0.30	0.30	0.90
Total		100.0	2.17	1.95	2.20	1.85

Criterion	Weigting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	6	5	6	4
Environment	10	10	10	10	6
Social	10	5	5	5	4
Technical	10	5	9	6	3
Economic	60	4	3	4	4
Total	100	30	32	31	21

Criterion	Weigting	Decommissioning Option			
		1. Complete removal			4. Leave without remediation
		1a Cut and Lift (Subsea cuts)	1b Reverse Reeling (Combined lines)	1c Reverse installation (Surface cuts)	4a No exposures leave in situ
Safety	10	0.6	0.5	0.6	0.4
Environment	10	1	1	1	0.6
Social	10	0.5	0.5	0.5	0.4
Technical	10	0.5	0.9	0.6	0.3
Economic	60	2.4	1.8	2.4	2.4
Total	100	5	4.7	5.1	4.1

Weighting	Safety	Environmental	Societal	Technical	Economic
	Percentage				
Safety	60	10	10	10	10
Environmental	10	60	10	10	10
Societal	10	10	60	10	10
Technical	10	10	10	60	10
Economic	10	10	10	10	60





Appendix 5 - PUK Risk Matrix

		Severity	Safety	Environmental	Societal	Financial	Likelihood of Occurrence				
							Frequency	Negligible (N) < 1 in 1000 chance of occurring	Low (L) 1 in 100 to 1 in 1000 chance of occurring	Medium (M) 1 in 10 to 1 in 100 chance of occurring	High (H) 1 in 2 to 1 in 10 chance of occurring	Very High (VH) > 1 in 2 chance of occurring
								1	**2**	**3**	**4**	**5**
Potential consequence of Risk	**5**	**Very High (VH**	**Very Major Health Incident** Potential for 5 of more fatalities	**Very major impact** Large scale impact on seabed/water column (>50km^2) and/or persistent impact (Recovery >5 years). Emissions >1000 tonnes (CO_2)	**Very major impact** Onshore waste >1000 tonnes and/or loss of 3rd party access >20km^2	**>£5m** gross project costs		5	10	15	20	25
	4	**High (H)**	**Major Health / Safety incident** 1 or more fatalities, acute or chronic, actual or alleged	**Significant impact** Large scale impact on seabed/water column (25-50km^2) and/or persistent impact (Recovery 2-5 years). Emissions 500-1000 tonne (CO_2)	**Significant impact** Onshore waste 500-1000 tonnes and/or loss of 3rd party access 10-20km^2	**£1m-£5m** gross project costs		4	8	12	16	20
	3	**Medium (M)**	**High impact Health / Safety incident** Single or multiple reportable (HSEx) injuries Permanent partial disability(ies)	**Moderate Impact** Moderate scale impact on seabed/water column (5-25km^2) and/or persistent impact (Recovery 1-2 years) Emissions 15-0-500 tonnes (CO_2)	**Moderate impact** Onshore waste 150-500 tonnes and/or loss of 3rd party access 5-10km^2	**£500k to £1m** gross project costs		3	6	9	12	15
	2	**Low (L)**	**Medium Impact Health / Safety incident** Lost Time Incident	**Low impact** Low scale impact on seabed/water column (1-5km^2) and/or short-term impact (Recovery < 1 year). Emissions 10-150 tonne (CO_2)	**Low impact** Onshore waste 10-150 tonnes and/or loss of 3rd party access 1-5km^2	**£100k-£500k** gross project costs		2	4	6	8	10
	1	**Negligible**	**Low Impact Health / Safety Incident** First Aid Case	**Negligible Impact** Negligible impact on seabed/Water column (<1km^2) and or limited recovery (Recovery weeks to months) Emissions <10 tonnes (CO_2)	**Negligible impact** Onshore waste <10 tonnes and/or loss of 3rd party access <1km^2	**<£100k**		1	2	3	4	5
	0	**Positive / N/A**	Positive or zero impact	Positive or zero impact	Positive or zero impact	Positive or zero impact		Positive / 0	Positive / 0	Positive / 0	Positive / 0	Positive / 0