Esso Australia Resources Pty Ltd

Gippsland Basin Decommissioning
Campaign #1 Steel Piled Jackets
End State Environment Plan Summary

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Abbreviations

Abbreviation	Definition
AHO	Australian Hydrographic Office
AIMS	Australian Institute of Marine Science
ALARP	As Low As Reasonably Practicable
AMC	Australian Maritime College
AMSA	Australian Maritime Safety Authority
APPEA	Australian Petroleum Production and Exploration Association Ltd
ATBA	Area To Be Avoided
BKA	Blackback
BMA	Bream A
BMB	Bream B
CBA	Cobia

Abbreviation	Definition
CGS	Concrete Gravity Structure
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPA	Dolphin
EOBO	Equal or Better Outcome
EP	Environment Plan
Esso	Esso Australia Resources Pty Ltd
FLA	Flounder
FTA	Fortescue
HLA	Halibut
IMO	International Maritime Organisation
KFA	Kingfish A
KFB	Kingfish B
MKA	Mackerel
MSL	Mean sea level
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
ORC	Onshore reception centre
PCA	Perch
PSZ	Petroleum Safety Zone
ROV	Remotely operated vehicle
SETFIA	South East Trawl Fishing Industry Association
SPJ	Steel Piled Jacket
WKF	West Kingfish
WTA	Whiting

1 Introduction

Esso Australia Resources Pty Ltd (Esso) is the operator of joint ventures for the exploration, development and production of oil and gas from Bass Strait, Victoria. Esso has been producing oil and gas in Bass Strait since 1969 and in this time has supplied over 50 percent of Australia's cumulative crude oil and liquids and currently supplies over 40 percent of all of Eastern Australia's natural gas, hence contributing significantly to the national economy and supporting growth in industry and employment.

Many of the Bass Strait fields have now reached the end of their productive life and Esso is well underway with the planning and preparation for decommissioning. While work is currently underway for the decommissioning of the non-producing (and soon to be non-producing) parts of the Bass Strait production network (Campaign #1), there will be further decommissioning required in the future of the remaining infrastructure which is continuing to deliver gas to Australia.

This summary has been prepared based on information contained within the *Gippsland Basin Decommissioning Campaign #1 Steel Piled Jackets End State Environment Plan* (DC1-EM-ALL-RPPLN-0003). The Environment Plan (EP) will be submitted to NOPSEMA for assessment in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS (Environment) Regulations) once the voluntary public consultation period has concluded and comments have been considered by Esso.

The activities described in this EP relate to the proposed decommissioning 'end states' for the Campaign #1 Steel Piled Jacket (SPJ) platforms in Bass Strait, where an end state is proposed that is different to the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cmth) (OPGGS Act) Section 572(3) requirement for complete removal of all property. The execution activities required to achieve these end states (i.e. cutting, lifting and removal of sections of the SPJs) are not within the scope of this EP and are subject to future EP submissions.

The scope of the EP includes the SPJs associated with the following offshore platforms:

- Halibut (HLA)
- Fortescue (FTA)
- Cobia (CBA)
- Mackerel (MKA)
- Kingfish A (KFA)
- Kingfish B (KFB)
- West Kingfish (WKF)
- Flounder (FLA)
- Bream A (BMA)
- Whiting (WTA).

The location of these SPJ platforms is provided in Figure 1-1.

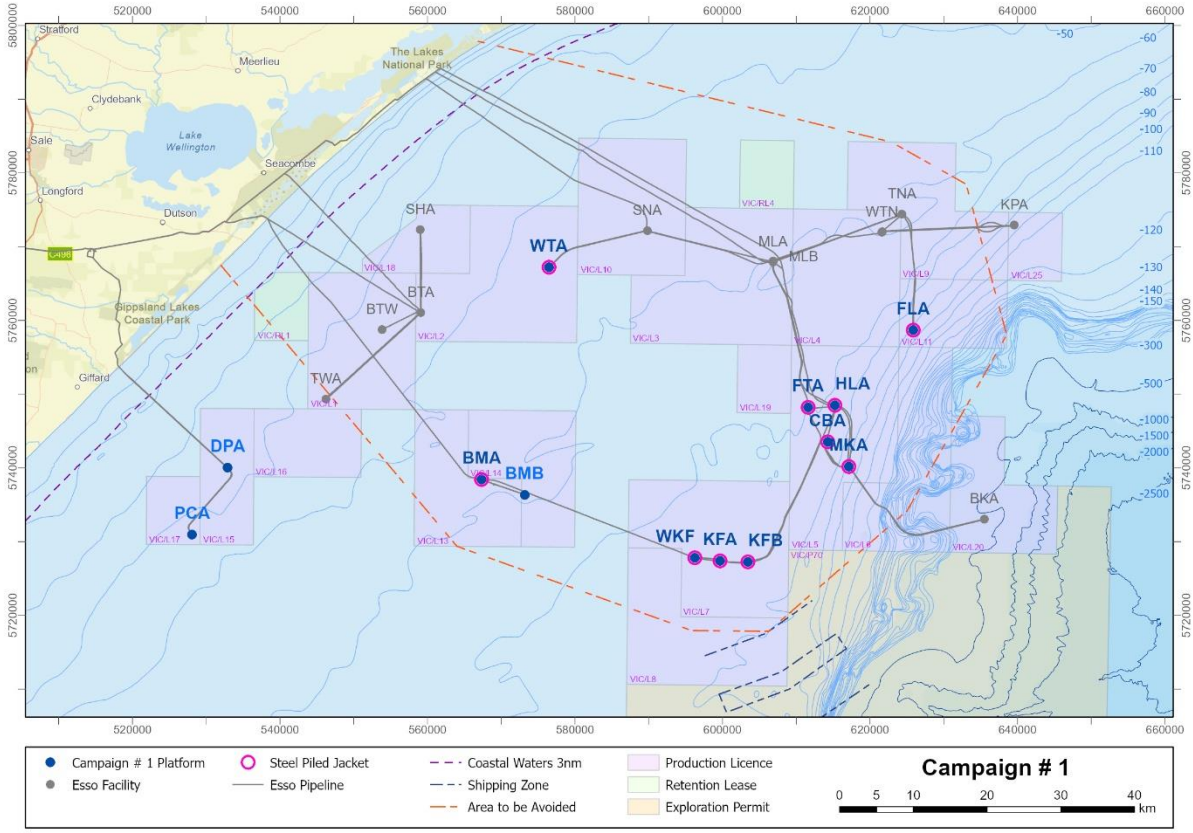


Figure 1-1 Campaign #1 facilities

1.1 Decommissioning Options

Section 572(3) of the OPGGS Act requires Esso to remove all structures, equipment and other property that is neither used nor to be used, in connection with the operations, from the title area. However, under Section 572(7) of the OPGGS Act, the obligation to remove all property (the 'base case' end state) is subject to other provisions of the OPGGS Act, its associated regulations, directions and other applicable laws and allows Esso to propose options other than complete removal where certain criteria are met.

Where a proposed decommissioning end state does not achieve the complete removal of property, Esso is required to prepare an EP describing the option for NOPSEMA's assessment, demonstrating that the option will:

- deliver an Equal or Better Environmental Outcome (EOBO) than the base case
- ensure impacts and risks are reduced to As Low As Reasonably Practicable (ALARP) and acceptable levels (as required by the OPGGS (Environment) Regulations).

Esso has identified a range of feasible decommissioning options for the SPJs which have been evaluated in the EP.

1.2 Steel Piled Jacket overview

SPJ platforms have a substructure (or jacket) as shown in Figure 1-2 that is fastened to the seabed by piles. These jackets support the 'topsides', which contain the production facilities, a helicopter landing pad, and in many cases, living quarters.

The SPJ is composed of a complex array of horizontal, vertical and oblique crossbeams. Figure 1-3 and Figure 1-4 provide historical imagery of the Bass Strait SPJs prior to their installation showing some of this complexity. For a number of SPJ platforms (KFA, KFB and HLA), a supporting 'strut' is also in place to provide additional structural support.

The structure shown in Figure 1-2 illustrates only the portion of the platform installed above the seabed. The supporting foundation piles are driven through the legs and skirts of the SPJ deep into the seabed and then cemented to keep the structure in place. These deep foundation piles can extend more than 150 metres into the seabed (further discussed and illustrated in Section 2.1).

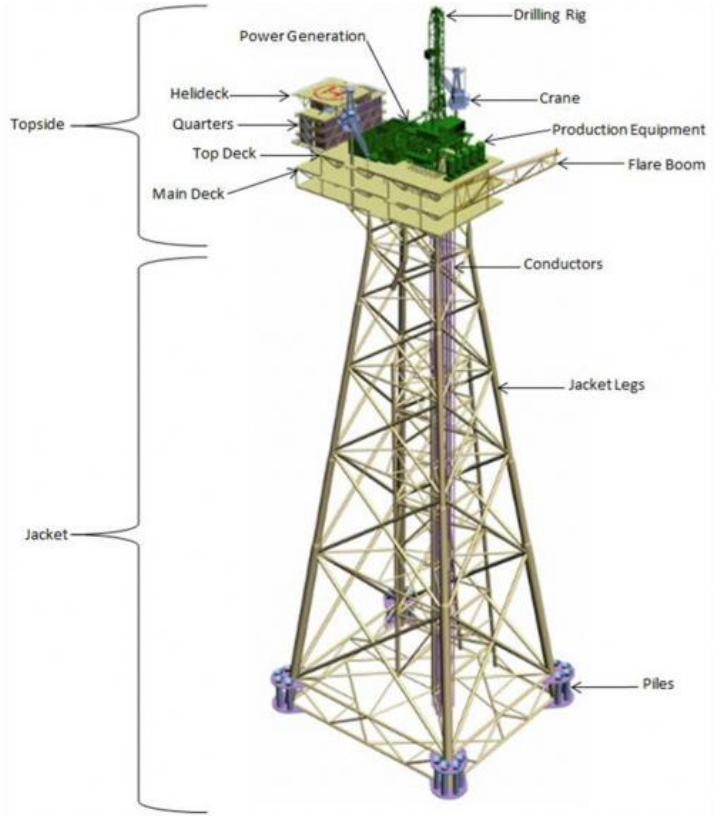


Figure taken from (Bull & Love, 2019)

Figure 1-2 Diagram of a typical Steel Piled Jacket platform

Figure 1-3 One of the Kingfish Steel Piled Jackets being transported to its installation location

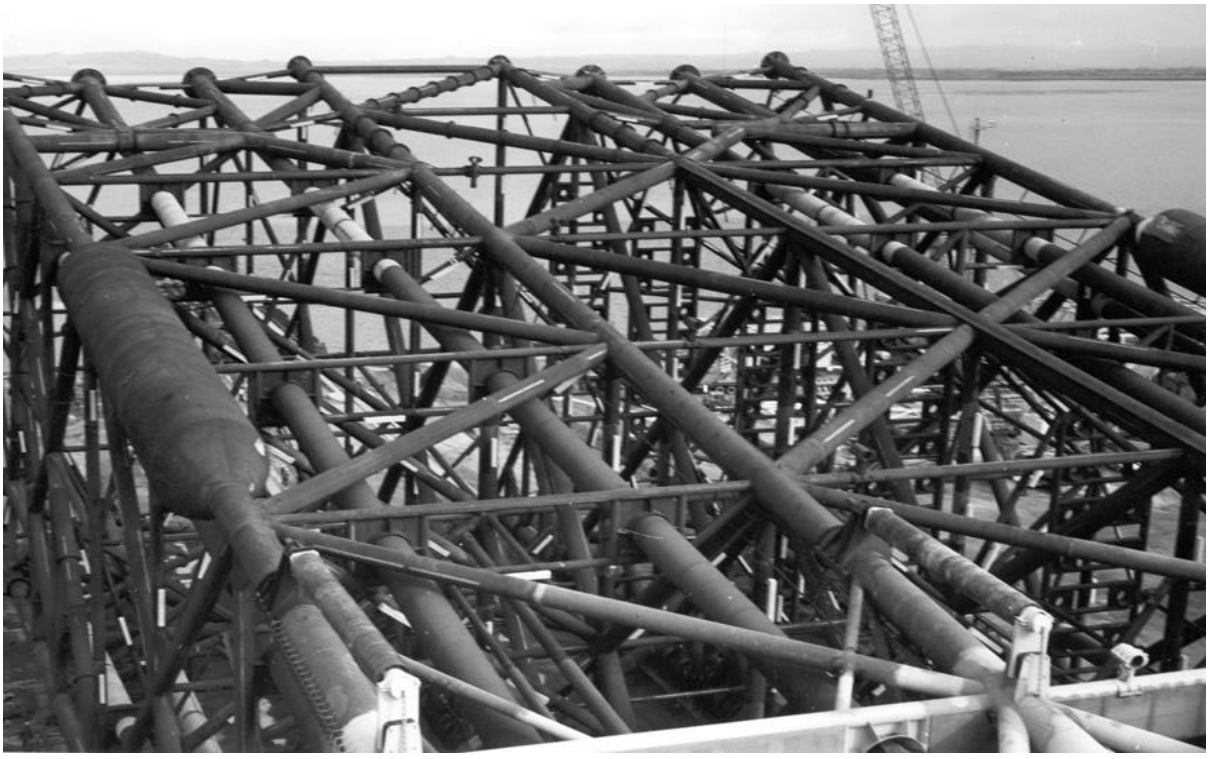


Figure 1-4 Historical image of the Mackerel Steel Piled Jacket prior to installation, showing the complexity of the structure

2 Decommissioning Options Assessment

Esso has undertaken a Decommissioning Options Assessment to evaluate a range of SPJ decommissioning options including the base case of complete removal required by the OPGGS Act. Table 2-1 provides a list of the decommissioning options assessed.

Table 2-1 Decommissioning options

Option	Description
A	Re-purpose the SPJ (topsides removed with SPJ remaining above mean sea level (MSL)) for an alternative use.
B	Complete removal of SPJ, including foundation piles up to 156m below the seabed.
C	SPJ foundation piles left in place, with cut line below the seabed (large scale dredging assumed to be required).
D	Lower section (including strut footings where present) left in place, with cut line as close as practicable to the seabed (without large scale dredging of the seabed).
E	Lower section left in place with cut line to achieve a minimum clearance of 55m below MSL. Strut footings at HLA, KFA and KFB will be cut at a practical location within the minimum clearance of 55m[1].
E plus placement	Lower section left in place with cut line to achieve a minimum clearance of 55m below MSL. Strut footings at HLA, KFA and KFB will be cut at a practical location within the minimum clearance of 55m. Selected removed upper sections (excluding any with splash zone coatings or storage tanks) placed adjacent to the lower section remaining in place.
F	Lower section left in place with cut line to achieve a minimum clearance of 26m below MSL. Strut footings at HLA, KFA and KFB will be cut at a practical location within the minimum clearance of 26m[2].
G	Complete SPJ left in place with topsides removed and SPJ remaining above MSL.

Under all options the facility topsides (the section of the facility containing production and service facilities) will be removed and transported to an onshore facility for dismantling and recycling/disposal. Illustrative examples of Option C, D, E and F end states as they apply to the WKF platform are included in Figure 2-1.

[1] IMO Standard 3.6 (IMO Res. A.672(16), 1989) states that a clear water column of at least 55 metres should be provided in the case of partial removal to ensure safety of navigation.

[2] The 26-metre clearance was assessed based on consideration of precedents from the decommissioning of SPJs to this depth in the Gulf of Mexico.

Note Option B (complete removal) is not shown in Figure 2-1 because the extent of seabed disturbance required is not able to be determined. Option E plus placement is also not shown.

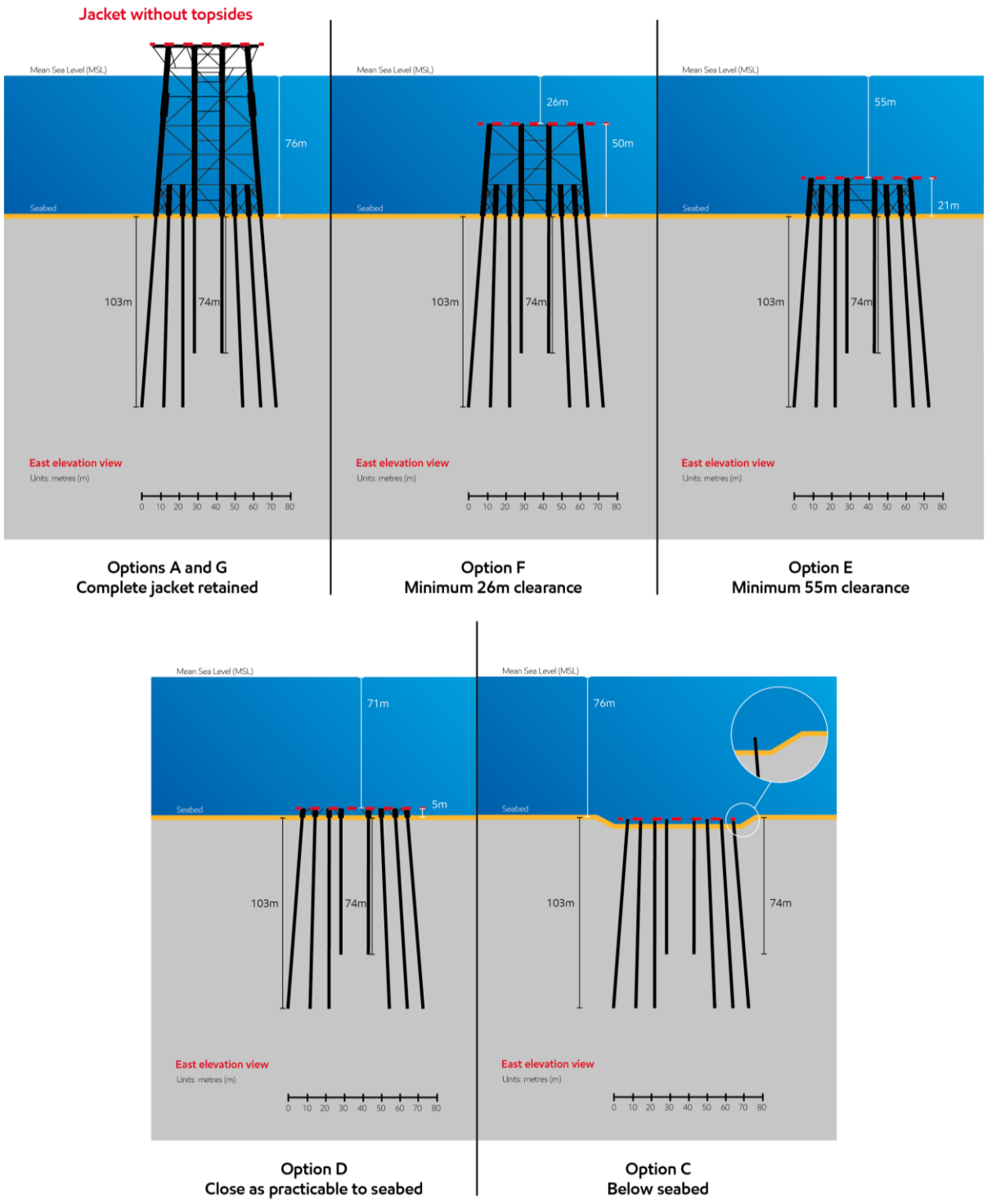


Figure 2-1 Example End States for West Kingfish Platform

2.1 Options Feasibility Assessment

An Options Feasibility Assessment was conducted to evaluate each of the decommissioning options against a set of screening criteria to determine which options were considered feasible. The screening criteria is shown in Table 2-2.

Table 2-2 Screening criteria used to assess the feasibility of potential Steel Piled Jacket decommissioning options

Screening criteria	Considerations
Precedents	Has the option been executed successfully on comparable projects – either internationally or within Commonwealth or State waters off Victoria or elsewhere in Australia?
Technical feasibility	Is the technology/execution process to achieve the option well understood/developed?
Execution complexity	Can the execution risks associated with the method to achieve the option be managed/mitigated?
Safety, environmental and societal acceptability	Will the option potentially result in safety, environmental or societal impacts or risks that are considered acceptable?
Timing	Can the option be achieved in the timeframe required i.e. are there any engineering/supply chain constraints/lack of regulatory framework or policy that would preclude execution of the option?
Cost and liability	Will the option result in unreasonable or excessive cost or ongoing liability aspects?
Legislation and pertinent guidance	Does the option comply with applicable legislation and is consistent with relevant guidance?

At the conclusion of the screening process, Options A, B and G were not considered to be feasible and were not taken forward for further assessment.

Options C, D, E and F were assessed as 'feasible' and taken forward for further evaluation of:

- environmental impacts and risks
- whether the option would provide an EOBO relative to complete removal
- whether the impacts and risks associated with the option can be reduced to levels that are acceptable and ALARP.

2.1.1 Option A – Repurposement

Esso is continuing to investigate re-purposement options (Option A) for the Bass Strait SPJ facilities. However, until such time as a viable re-use option is identified and plans approved, planning for the removal of all Campaign #1 SPJ's will continue.

2.1.2 Option B – Complete Removal ('Base Case')

Option B requires the complete removal of the deep foundation piles that have been driven and cement grouted (that is, concreted) up to approximately 156 metres into the seabed. These deep foundation piles were engineered to provide a strong, secure, and enduring bond with the soil. Future removal was not a consideration of the design standards of the day and no feasible method of complete removal at depth has been identified. Figure 2-2 illustrates the extent of the foundation piles beneath the seabed for KFA as an example.

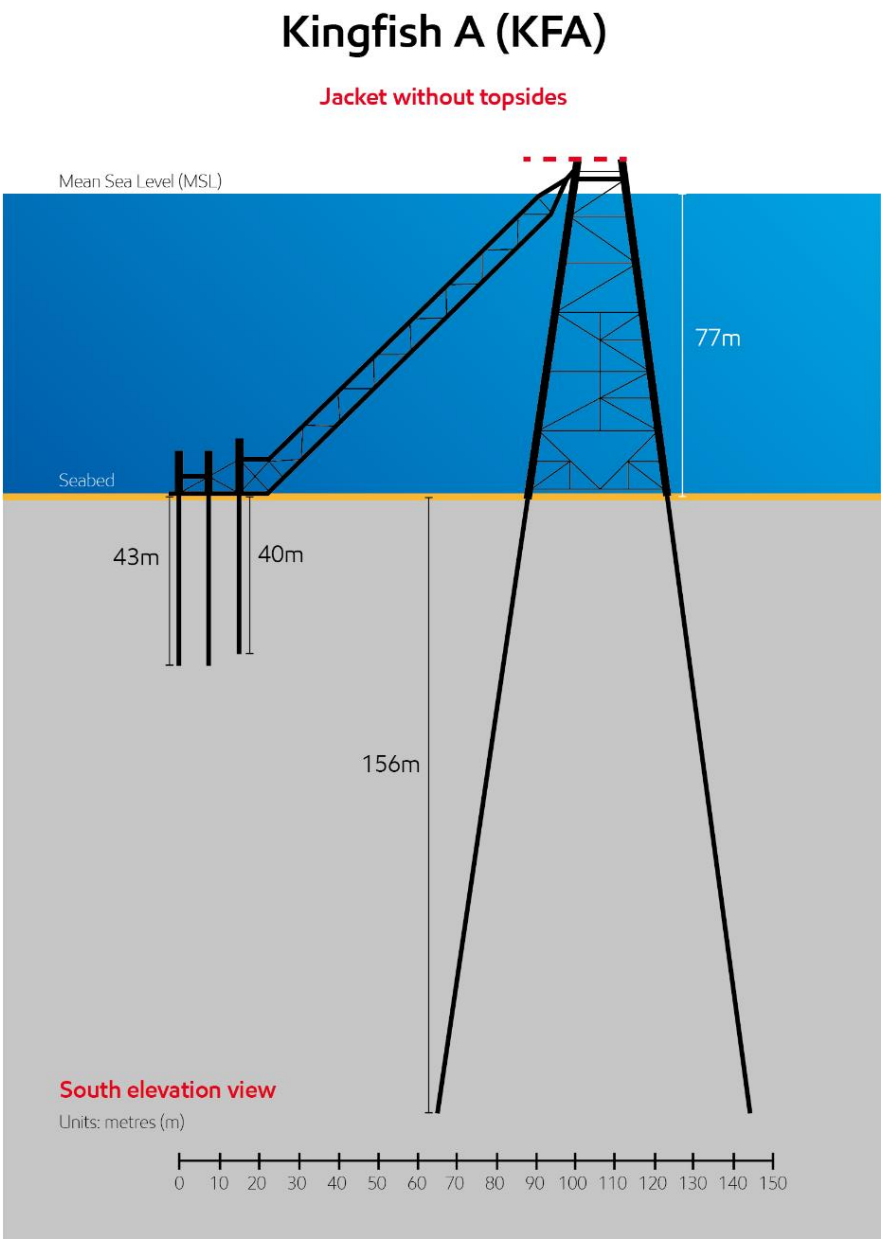


Figure 2-2 Schematic of Kingfish A facility

Option B was assessed as not feasible based on the following:

- no precedent for complete removal of deep foundation piles was found
- a technically feasible method for removal of deep piles was not identified

- safety risks are not able to be adequately assessed, given the lack of a feasible removal method
- the environmental impacts of removal are not considered to be acceptable, given the extent of seabed and ecosystem disturbance that would be required to remove all 176 foundation piles associated with Campaign #1 facilities
- the extensive cost and duration to remove foundation piles would far outweigh any benefit to the environment or other users of the sea that may be realised by removal of the deep foundation piles.

2.1.3 Option G – Full SPJ left in place with topsides removed

Option G was assessed as not feasible due to a lack of Australian and international precedents. Ongoing impacts and risks to other users of the sea are also not considered to be acceptable.

2.2 End fate of removed sections of Steel Piled Jackets

Once the SPJs have been cut, two options are being considered for the end fate of the removed sections:

- Disposal option #1 – All Onshore: removed SPJ sections taken to an onshore reception centre (ORC) for dismantling and recycling/disposal (location is yet to be determined); and
- Disposal option #2 – Partial In place: place selected removed SPJ sections placed on the seabed adjacent to the SPJ lower sections remaining in place.

2.2.1 Disposal option #1 – All Onshore

Any removed sections of the SPJs that contain contaminants are not considered feasible for seabed placement and will be transported to a suitable onshore location for further processing. Those sections will be taken onshore for further processing. Planning is occurring in parallel to identify suitable means and locations for onshore processing to include opportunities for recycling and appropriate disposal where recycling is not possible. The onshore handling and disposal of all SPJ's will be conducted in accordance with applicable laws and standards at the selected onshore location.

2.2.2 Disposal option #2 – Partial In place

The placement of removed sections of the SPJ on the seabed adjacent to the originating structure is only considered feasible where the following criteria are met:

- the cut section of the SPJ must not include any components deemed to be contaminants. These include sections with components used for hydrocarbon or chemical storage, sections of the SPJ in the splash zone which have protective epoxy coatings or monel wraps
- the removed section must be of a height such that placement will ensure a 55-metre clearance below MSL (consistent with SPJ end state Option E) to ensure navigational safety is maintained.

Where removed sections of the SPJ meet these criteria, the location for placement must:

- avoid pipelines and any other seabed infrastructure

- occur within an approximate 200-metre radius of the lower jacket section.

In accordance with these criteria, removed sections at WTA, BMA and FTA were not considered feasible for seabed placement due to insufficient water depth. However, disposal option #2 will be carried forward for further consideration for HLA, CBA, MKA, KFA, KFB, WKF and FLA.

Disposal option #2 requires detailed calculations to be conducted to determine the final number of removed sections that could be placed on the seabed. Results will depend on the feasibility of cutting methods and whether they can meet the placement criteria.

2.3 Environmental impacts and risks evaluation

An environmental impacts and risks evaluation was undertaken in accordance with defined methodology described in *Section 7 of the EP* (DC1-EM-ALL-RPPLN-0003). The assessment was based on global studies and literature, supplemented by Bass Strait specific studies, which included:

- a comprehensive offshore environmental survey comprising of a detailed examination of fish and epibenthic communities, benthic infauna (species living within the seabed sediments) identification and sampling and analysis of sediments around the SPJs
- assessment of over 1000 hours of historical remotely operated vehicle (ROV) imagery captured during routine inspection and maintenance activities from 2008-2018 – to identify marine species present on and around the SPJs
- a material degradation study, which provided information on the predicted degradation of the SPJ constituents in the marine environment over time and included an environmental impact assessment of potential impacts to marine biota and habitats as a result of this degradation
- studies which assessed the potential impacts and risks of the decommissioning options to other users of the sea, specifically commercial shipping and fishing activities.

2.4 Environmental impacts associated with Steel Piled Jacket removal

Environmental impacts to the marine ecosystems that have established on and around the SPJs over the past 50 years have been assessed as the key differentiator between complete removal of the SPJs to below the seabed and the proposed end state options of retaining the lower sections of the SPJs in place.

The Esso facilities in Bass Strait are some of the oldest oil and gas structures in Australia, with the HLA, KFA and KFB SPJs installed in 1969. The Gippsland Basin is predominantly composed of a series of massive sediment flats, interspersed with small patches of natural reef and bedrock (Esso, 2009) and there is limited availability of hard habitats directly around the SPJs (Bax & Williams, 2001) (Neira, 2005). Given the relative lack of hard substrate in the Gippsland Basin, the long period of time the SPJs have been present in the marine environment and the number of SPJs installed in a relatively small area, it is expected that the SPJs are supporting an abundant and species rich marine ecosystem.

To support this position, an environmental survey (Environmental Survey 1 (Summer)) was completed in 2021. The ROV imagery collected during this survey was reviewed by the Australian Institute of Marine Science (AIMS). A further detailed review of over 1000 hours of historical ROV imagery collected between 2008 and 2018 during inspection and maintenance works was also undertaken by Deakin University in 2020/2021 (Sih T. , Cure, Yilmaz,

Macreadie, & McLean, 2021b). These studies investigated the marine ecosystems associated with the SPJs to understand the ecological value of the SPJs and the potential consequences of decommissioning. Results showed that the SPJs are supporting extensive ecosystems which are likely contributing to the richness and diversity of the ecosystems in the wider Bass Strait region.

The SPJs are almost completely covered in marine life, including anemones, crustaceans, sponges, algae, bivalves and barnacles which in turn provide habitat and food for many fish species and Australian fur seals. This is in contrast to the natural surrounding ecosystems studied during this survey (sandy seabed reference sites and a natural reef area) which were predominantly sand/mud and gravel with only patchy and sparse distributions of some epibenthic invertebrate species (AIMS, 2022a).

Figure 2-3 provides a selection of imagery captured as part of the environmental survey and illustrate some of the marine ecosystems present on and around the SPJs. Figure 2-4 provides a selection of imagery collected at the natural surrounding ecosystems.

Removing the SPJs to below the seabed will result in the loss of the majority of sessile (fixed to the structure) marine biota such as anemones, sponges, barnacles and crustacea, which in some instances cover the entire surface of the SPJs (Sih T. , Cure, Yilmaz, Macreadie, & McLean, Marine biota associated with oil and gas infrastructure off the Gippsland coast, 2021b). Removing the SPJs to below the seabed will also result in the complete loss of the encrusting biota on the structures and likely significant flow-on effects of such removal to the marine communities that remain (AIMS, 2022a). While partial removal of the structures will result in the loss of sessile biota on the upper sections of the jacket, the species richness and diversity associated with the lower sections (noted to be highest in the deepest depth bands) will be retained.

The structures are the dominant underwater hard substrate in the area, hence providing a unique habitat for marine species and supporting foraging habitat for protected species such as the Australian fur seal, which was frequently seen in footage and is known to forage around the SPJs. The habitat provided by the SPJs may also have flow-on effects in supporting local commercial fisheries by providing ‘nursery areas’ for fish to reproduce and shelter, habitat and food sources.

Furthermore, the potential placement of selected removed upper SPJ sections adjacent to the lower sections will result in additional hard substrate on the seabed for recolonisation by sessile biota (if some species are lost during relocation) and creation of habitat for mobile species such as demersal fish. Seabed placement is expected to mitigate some of the habitat reduction bought about by removal of the top sections of jacket, as over time, it is expected that benthic communities colonising the structure that is placed on the seabed may be colonised by communities presently observed in the base region of SPJs (AIMS, 2022a).

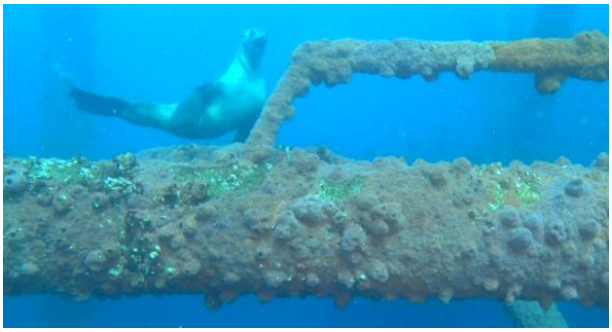
In summary, partial retention of the SPJs maximises the retention of the marine ecosystems established on and around the SPJs, whilst also ensuring impacts and risks to other users of the sea are minimised. This approach also avoids the risk of extensive dredging that may be required to remove jacket foundations to below the seabed. While the immediate footprint of the remaining infrastructure will be untrawlable, the area available for fishers to trawl is unchanged from when the platforms were producing.

Degradation of the remaining sections of the SPJs in the marine environment is expected to result in negligible environmental impacts. The degradation of the SPJ constituents (limited to steel, grout and sacrificial anodes) are estimated to occur at low concentrations over multiple centuries.

Benthic biota and fish observed on Halibut at 70 metres depth

Fish and jewel anemones on Cobia at 58 metres depth

Maori octopus at Flounder at 90 metres depth



Australian fur seal observed at Flounder at 53m depth

Red rock crab, sponges and jewel anemones observed at Cobia at 75 metres

Marine flora and fauna observed at Cobia at 73 metres

Abundance of butterfly perch observed at Halibut at 58 metres

Benthic communities observed at Halibut at 70 metres water depth

Figure 2-3 A selection of the marine ecosystems observed around the Steel Piled Jackets

Figure 2-4 Reference sites observed during Environmental Survey 1 (Summer)

2.5 Equal Or Better Outcome (EOBO) Assessment

An EOBO Assessment was undertaken to determine whether any of the feasible end state options would result in an equal or better environmental outcome when compared to the base case of complete removal. Further detail on the process followed for the EOBO assessment is provided in *Section 3.4 of the EP* (DC1-EM-ALL-RPPLN-0003).

The EOBO Assessment concluded that end state options D, E and F and Disposal Option #2 (that is, Option E plus placement) would each result in an equal or better outcome when compared to the base case.

2.6 As Low As Reasonably Practicable (ALARP) and acceptability assessment

Further assessment of Options D, E and F was undertaken to determine if the impacts and risks identified for each option could be reduced to levels that were ALARP and acceptable. These are the key criteria for EP acceptance under the OPGGS (Environment) Regulations.

Following the ALARP and acceptability assessment, it was concluded that for end state Option F it could not be demonstrated that the impacts and risks to other users of the sea (particularly commercial vessels) could be reduced to acceptable levels. This was based on:

- the requirements of IMO Standard 3.6 (IMO Res. A.672(16), 1989), which states that ”in cases of partial removal of a structure…an unobstructed water column sufficient to ensure safety of navigation, but not less than 55 metres, should be provided above any partially removed installation or structure which does not project above the surface of the sea”. Thus, providing an unobstructed water column of 26 metres (or slightly deeper in the case of MKA and FLA) is not consistent with IMO Standard 3.6 (IMO Res. A.672(16), 1989)
- consultation with Australian Maritime Safety Authority to date has, noted that while they do favour the benefits of complete removal of existing infrastructure, from a safety of navigation perspective, a 55-metre clearance would be adequate and is considered consistent with IMO Standard 3.6 (IMO Res. A.672(16), 1989)

As a result of the assessment for ALARP and acceptability, the end state Option F was not taken forward as an option for the SPJ’s. Options D and E were found to be ALARP and acceptable.

3 Proposed end states and disposal options

3.1 Proposed Steel Piled Jacket end state options

The outcomes of the: impacts and risks evaluation of the feasible end state options; the EOBO Assessment, and the ALARP and acceptability assessment were considered, and the proposed end state options for the Campaign #1 SPJs are:

- For the eight SPJs in deeper water (HLA, FTA, CBA, MKA, KFA, KFB, WKF and FLA):
  - Option E – Lower section left in place with cut line to achieve a minimum clearance of 55 metres below MSL. Strut footings at HLA, KFA and KFB will be cut at a practical location within the minimum clearance of 55 metres
- For the two SPJs in shallower water (WTA and BMA):
  - Option D – Lower section left in place, with cut line as close as practicable to the seabed, without large scale dredging of the seabed.

Refer to Figure 3-1 for a map showing the Campaign #1 SPJ's by proposed end state option and Figure 3-2 for a depiction of the proposed end states to be executed.

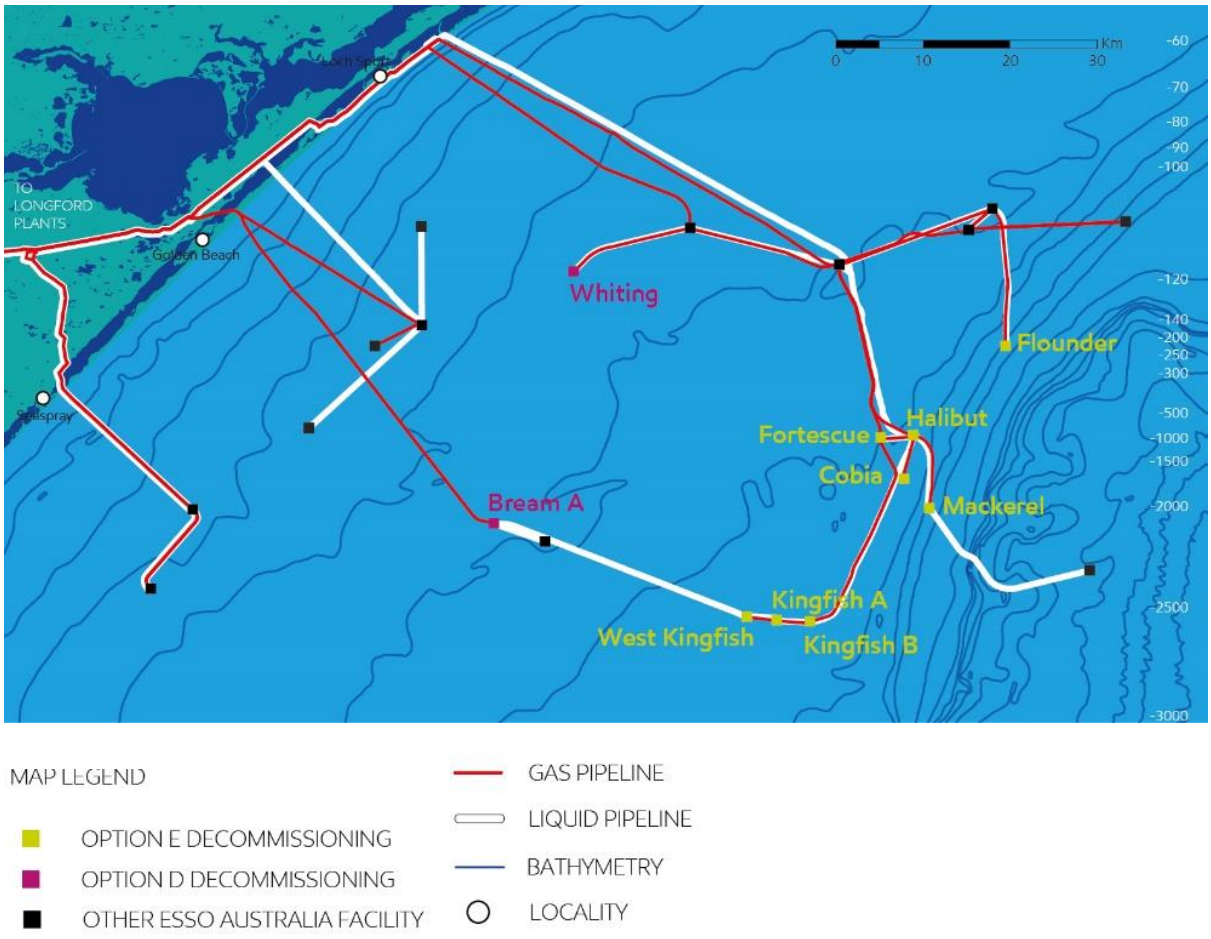


Figure 3-1 Location of Steel Piled Jackets showing proposed end state option

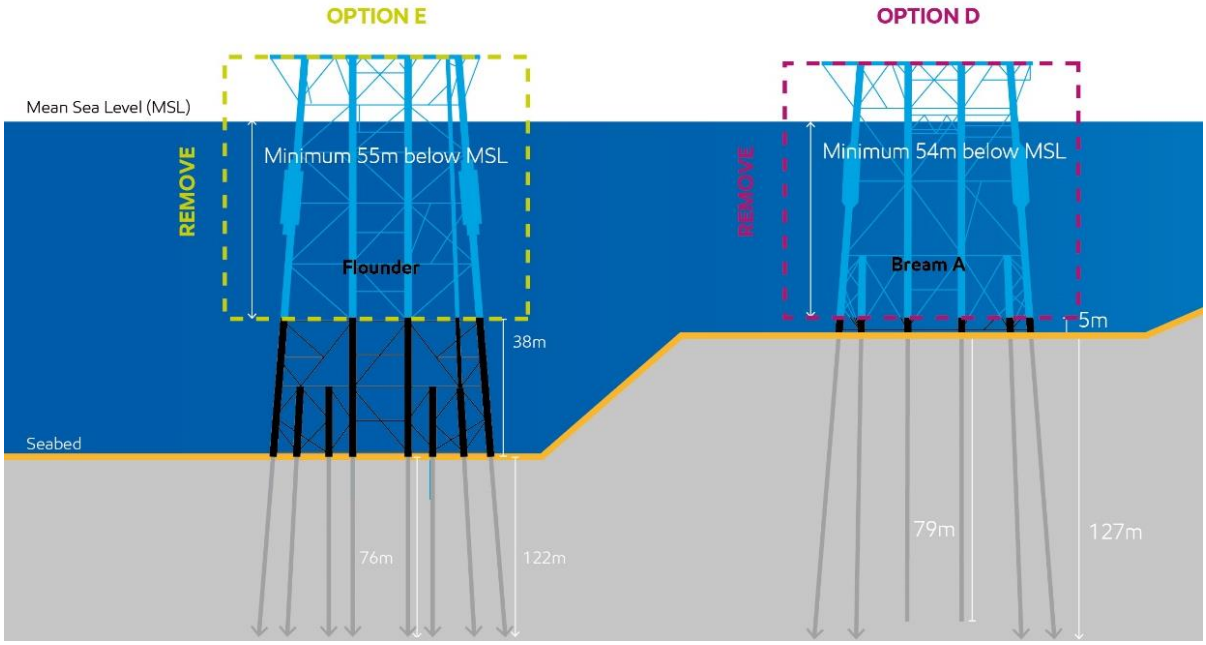


Figure 3-2 Depiction of typical Steel Piled Jacket end state options execution

The remaining materials to be left in place are carbon steel (in the lower SPJ and foundation piles) along with cement grout (in the space between the SPJ and the piles), and any remaining sacrificial anodes, which were attached to the SPJ in order to protect the structure from corrosion.

4 Assessment of Environmental Impacts

The purpose of the Environmental Impact Assessment is to ensure that all impacts associated with the proposed SPJ end states are identified and evaluated, and the resulting impacts are demonstrated to be ALARP and acceptable according to the Esso impact and risk assessment methodology, which is described further in *Section 7 of the EP* (DC1-EM-ALL-RPPLN-0003).

The Environmental Impact Assessment focused on the proposed end states:

- **Option E –** Lower SPJ section left in place with cut line to achieve a minimum clearance of 55 metres below MSL. Strut footings (where present) cut at a practical location within the minimum clearance of 55 metres. This option selected for HLA, FTA, CBA, MKA, KFA, KFB, WKF and FLA.
- **Option D –** Lower section (including strut footings where present) left in place, with cut line as close as practicable to the seabed (without large scale dredging of the seabed). This option selected for WTA and BMA only.

The outcomes of the assessment are presented in Table 4-1.

Table 4-1 Impacts of proposed Steel Piled Jackets end states (Options D and E)

	Impact	Consequence evaluation	Control measures
Commercial shipping **End State Option E**	Potential future displacement of shipping from the most direct route (due to the need to avoid the locations of the SPJ sections remaining in place), resulting in incremental transit time.	No change in the short term as the locations of the infrastructure remaining in place are within the ATBA where commercial vessel movements are restricted. In the long term, no impacts are expected as the water clearance over the infrastructure remaining in place will meet international guidelines and standards to ensure the safety of navigation.	Where the water depth allows, SPJs to be cut at a depth which is consistent with IMO Standard 3.6 (IMO Res. A.672(16), 1989). Locations of remaining SPJ sections to be identified on navigational charts administered by the AHO to advise marine users of their presence.
Commercial fishing	Continued displacement of commercial fishing activities from the locations of the SPJ sections remaining in place.	No change while PSZs remain in force. In the long term, the infrastructure remaining in place will not be over trawlable. Commercial fishing activities involving trawling will need to continue to avoid the immediate footprint	Locations of remaining infrastructure to be identified on navigational charts administered by the AHO to advise marine

	Impact	Consequence evaluation	Control measures
End State Options D and E		of the facilities. Assuming that commercial fishing vessels will choose to continue to avoid an approximate 500-metre zone around each of the SPJs so as to avoid the risk of snagging on the infrastructure remaining in place, a continued trawling exclusion area of approximately 8 square kilometres of seabed would result. This is equivalent to 0.4 percent of the area assessed as being available for trawling operations in the Commonwealth Trawl Sector.	users of the presence of remaining infrastructure. Removal of the 500-metre PSZs around the SPJs will provide enhanced access for recreational and commercial fishing opportunities.
Leisure activities (fishing, boating, diving) **End State Options D and E**	Interference with leisure activities (fishing/boating/diving) due to the ongoing presence of the lower sections of the SPJs.	The proposed SPJ end states will result in retained habitat that is anticipated to support recreational fishing opportunities around the lower sections of the SPJs remaining in place. Given the water depths and the unobstructed water column provided, the physical presence of the SPJ lower sections remaining in place are unlikely to interfere with recreational boating activities. Recreational diving is not a credible activity to be considered, given the maximum depth advanced recreational divers can dive is approximately 40m.	Removal of the PSZs around the SPJs will provide enhanced access for recreational fishing opportunities.
Future marine industries **End State Options D and E**	Prevention of the use of the SPJ footprint area by future potential marine industries (wind farms, wave energy, aquaculture etc.).	No change while PSZs remain in force. In the long term, due to the presence of the deep foundation piles and plugged and abandoned wells, all end state options for the SPJs (including complete removal below the seabed) will prevent other future marine industries, such as offshore wind from installing facilities over the immediate footprint areas of the SPJs. The small footprint of infrastructure proposed to remain in place, relative to the size of Bass Strait, suggests that any impacts to the planning or viability of future projects are expected to be low.	None

	Impact	Consequence evaluation	Control measures
Material degradation[3] **End State Options D and E**	• Exposure of marine fauna to metals as a result of the degradation of steel and remaining sacrificial anodes present on some SPJs. • Bioaccumulation of metals.	The metal concentrations leaching into the water were predicted to be below applicable water quality guidelines at 1cm from the SPJ structure and are expected to fall to background levels within 1-2 metres from the SPJs as the water movements of the area aid dilution and dispersion. This results in a minimal impact to water quality around the SPJs and a low likelihood of negative (toxic) impacts on marine biota.	None
Gradual disintegration and collapse of remaining SPJ sections **End State Options D and E**	• Loss of habitat higher up in the water column as the structure collapses, and subsequent creation of hard substrate on the seabed in the collapse zone. • Smothering or crushing of marine fauna in the event of an instantaneous collapse of the structure, or a section of the remaining structure falling to the seabed.	Collapse of the remaining sections of the SPJs will occur gradually over a very long period of time – in the order of 500-1200 years and the collapse zone under the proposed end states was predicted to be within the current SPJ footprint. As the SPJs collapse, habitat higher up in the water column will be removed but hard substrate habitats will be created on the seabed. Due to the slow rates of degradation, the structures will continue to provide hard substrate habitat for marine organisms for a long time and the flora and fauna would adapt to the changing structure over time.	None

[3] Includes a) long term degradation of remaining SPJs leading to constituent (iron, chromium, copper, nickel) dissolution into immediate waters and sediments; and b) degradation of sacrificial anodes remaining on SPJs leading to constituent (aluminium, cadmium, copper, chromium, nickel, zinc) dissolution into immediate waters and sediments. Degradation of grout, leading to constituent dissolution into immediate waters and sediments was found to have no impact as the inert chemical properties of the cement grout are not considered to have any ecotoxicological effect on the surrounding environment (Kent Plc, 2022).

	Impact	Consequence evaluation	Control measures
Dredging of the seabed[4] **End State Option D**	Injury/mortality to marine fauna present in the dredged area of seabed and the area where dredge spoil is placed through direct physical impact (including smothering).	External cutting of SPJ piles at BMA and WTA may be required to facilitate the optimum cut pattern for removal as close as practicable to the seabed. This may result in some localised limited dredging of the seabed to allow the cutting equipment to access a suitable external cutting location. In the areas where seabed material is removed, sessile benthic fauna and infauna that is too slow or unable to move away is likely to be buried or smothered as sediments become mobile in the water column and then settle back on the seabed. Impacts from smothering as a result of dredging will be limited to close proximity of the WTA and BMA SPJs. No long term changes to benthic ecosystems are anticipated.	None
	Change in water quality affecting fish and mobile invertebrates, sessile biota and sediment infauna from seabed disturbance, which can lead to increased turbidity and potential release of contaminants within the sediments.	Turbidity is expected to resolve in a short period of time following the completion of dredging. Larger, mobile fauna such as fish and crabs have the ability to move away from the sediment plume generated by dredging and are likely to be less affected however localised turbidity may impact gill function in impacted individuals. Turbidity impacts are likely to be short term and temporary.	None

The Environmental Impact Assessment also covered disposal option #2, which involves placing selected SPJ sections on the seabed adjacent to the SPJ lower sections remaining in place. The outcomes of the assessment are presented in Table 4-2.

[4] Some limited dredging of the seabed may be required if internal cutting of the SPJ piles at BMA and WTA is not feasible and access is required to allow external cutting to be undertaken.

Table 4-2 Impacts of disposal option #2

	Impact	Consequence evaluation	Control measures
Commercial fishing	Continued displacement of commercial fishing activities from the locations of the SPJ sections remaining in place.	The removed sections of jacket will be placed as close as practicable to the base of the remaining structure to minimise the area of seabed unavailable for commercial fishing activities involving trawling.	Removed sections will be cut and placed so as to ensure clearance is consistent with IMO Standard 3.6 (IMO Res. A.672(16), 1989). Locations of removed SPJ sections placed on the seabed will be identified on navigational charts to advise other users of their presence.
Leisure activities (fishing, boating, diving)	Interference with leisure activities (fishing/boating/diving) due to the ongoing presence of the lower sections of the SPJs.	Placing some sections of the removed SPJs adjacent to the lower sections remaining in place will not result in any incremental impacts to recreational activities over those identified for the SPJ lower sections remaining in place.	None. Removal of the PSZs around the SPJs will provide enhanced access for recreational fishing opportunities.
Future marine industries	Prevention of the use of the SPJ footprint area by future potential marine industries (wind farms, wave energy, aquaculture etc.).	The incremental footprint on the seabed as a result of the placement of some sections of removed SPJ adjacent to the SPJ lower sections will be small as placement is expected to occur within close proximity to the SPJ lower sections. For the purpose of this EP, placement within a 200m radius of the remaining SPJ lower sections has been assumed. There may be limited exceptions where placement may need to occur a small distance further out based on heavy lift vessel operating parameters and/or the need to preserve clearance around any existing seabed features such as pipelines. Any incremental impacts over those identified for the SPJ lower sections remaining in place to future marine projects as a result of the physical presence of some SPJ sections being placed on the seabed are expected to be inconsequential.	Locations of removed SPJ sections placed on the seabed will be identified on navigational charts to advise other users of their presence. Removed sections of SPJs will be placed on the seabed within an approximate 200m radius of the lower SPJ sections remaining in place. If seabed placement is required to occur outside a 200m radius due to execution requirements or the need to avoid existing seabed features, an assessment of any incremental impacts and risks will be undertaken as part of the Campaign #1 SPJs – End State Execution EP.

	Impact	Consequence evaluation	Control measures
Relocation of removed section(s) of jacket to deeper depths.	Injury/mortality to sessile biota due to environmental requirements (light/nutrients) not being present in deeper water.	Marine life established at higher points on the SPJ structure may be lost when the section is placed on the seabed due to the change in conditions, such as light and nutrients, in deeper water. Placement of cut SPJ sections on the seabed is expected to increase the overall habitat available for sessile biota, by the provision of additional hard substrate on the seabed, much like the SPJ structures at present. In the long term, recolonisation of the jacket structure over time would occur with other marine life suited to seabed depth.	None
	Change in habitat for fish where the lack of certain environmental conditions found in the sections of SPJ closer to the surface make it unlikely for the species to migrate to the placed sections of SPJ in deeper water.	Habitat for mobile species such as certain fish which require specific conditions like light and food sources present on the higher points of the SPJ structure will be lost. Placement of the cut SPJ sections on the seabed will increase the overall habitat and food source availability for mobile species such as fish. In the long term, mobile species such as fish will either move downward on the remaining SPJ structure if conditions are suitable or migrate to other habitats.	None
Disturbance of seabed sediments as a result of placement of removed SPJ section(s) on the seabed	Injury/mortality to benthic infauna through direct physical impact (including smothering) in the placement area.	Impacts to benthic (living within the seabed sediments) infauna will be limited to the immediate footprint of the placed SPJ sections, hence expected to be minor, short term and localised. Seabed disturbance from the placement of cut sections of jackets on the seabed is expected to be limited to close proximity to the jacket lower sections (within an approximate 200m radius).	Removed sections of SPJs will be placed on the seabed within an approximate 200m radius of the lower SPJ sections remaining in place. If seabed placement is required to occur outside a 200m radius due to execution requirements or the need to avoid existing seabed features, an assessment of any incremental impacts and risks will be undertaken as part of the Campaign #1 SPJs – End State Execution EP.

	Impact	Consequence evaluation	Control measures
		Infauna and communities around the SPJs show natural small-scale variation, however, are mostly homogenous. It is possible that activities will produce a slight alteration of the local habitat and community structure due to the small amount of changed substrate in an area of uniform soft sediments. However, any impacts are expected to be inconsequential or have no adverse effects. No long term impacts to benthic infauna are expected.	
	Change in water quality from seabed disturbance leading to increased turbidity and potential release of contaminants within the sediments.	Suspension of sediments and the subsequent change in water quality may impact local fish species or encrusting organisms by physical smothering, or exposure to potential contaminants in the sediments. Turbidity impacts are likely to be short term and temporary as sediments will settle and water quality will return to pre-disturbance levels. Regarding contaminants in the sediments, the concentrations of metals and polyaromatic hydrocarbons measured in sediment samples collected around the existing SPJs in 2021 (Hook, et al., 2022) concluded that concentrations rarely exceeded the higher screening levels for the analytes sampled, suggesting there is not widespread nor significant contamination of sediments around the SPJs based on screening values. Any impacts will be localised and temporary and ambient water quality will return to background levels following seabed disturbance. No long term impacts to water quality are expected.	None

5 Assessment of Environmental Risks

The purpose of the risk assessment is to ensure that all risks associated with unplanned events that *may possibly* occur are identified, evaluated, and the resulting risks are demonstrated to be reduced to ALARP and acceptable levels. The risk assessment was carried out in accordance with the Esso risk assessment methodology, as described in *Section 7 of the EP* (DC1-EM-ALL-RPPLN-0003).The risk assessment focused on the proposed end states:

- Option E – Lower section left in place with cut line to achieve a minimum clearance of 55 metres below MSL. Strut footings (where present) will be cut at a practical location within the minimum clearance of 55 metres (HLA, FTA, CBA, MKA, KFA, KFB, WKF and FLA):
- Option D – Lower section (including strut footings where present) left in place, with cut line as close as practicable to the seabed (without large scale dredging of the seabed). (WTA and BMA).

The risk scenarios, potential impacts and proposed control measures for these end states are described in Table 5-1.

Table 5-1 Risks of proposed end states (Options D and E)

Scenario and potential impact	Consequence and likelihood evaluation	Proposed controls
Unplanned interaction between commercial fishing equipment and the lower sections of the SPJs remaining in place.	An interaction between commercial fishing equipment such as nets and the lower sections of the SPJ remaining in place may result in socioeconomic impacts such as loss of income due to loss of current and future fishing catch, having to replace and/or repair fishing vessel and fishing equipment. A risk assessment undertaken by AMC Search considered a number of factors that would influence the likelihood of fishing equipment interacting with the lower sections of the SPJ remaining in place. These include: • A fishing vessels inability to detect a hazard in the fishing equipment's pathway using the vessels electronic devices (plotters, vessel automatic identification system, GPS) or inability to navigate safely around marked obstacles • lapses in good vessel operational practices • the duration a fishing vessel is in the vicinity of the SPJs • the extent of the area covered by the equipment for each fishing method and how much seabed is covered per day. The likelihood of an interaction between a commercial vessel and the lower sections of the SPJ remaining in place was assessed as unlikely, with a number of the factors above having to be present for this to occur.	Locations of remaining SPJ lower sections to be identified on navigational charts administered by the AHO to advise marine users of their ongoing presence. Esso to offer to update plotter files for commercial fishing vessels active in the area. The current model for compensation for claims of equipment damage as a result of interaction with Esso facilities, the Fisherman's Tribunal, will remain in place, until such time as all Bass Strait operations are no longer producing.

Scenario and potential impact	Consequence and likelihood evaluation	Proposed controls
SPJ lower sections remaining in place: • provide potentially suitable habitat for initial colonisation by an Invasive Marine Species (IMS) • act as potential vectors to the spread of introduced IMS (between multiple SPJs and/or natural areas).	Where habitat is suitable, IMS are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the local ecosystem. IMS could deplete fishing grounds and aquaculture stock. The introduction of an IMS would require: • colonisation and establishment of the marine pest on a vector (e.g. vessel hull) in a donor region (e.g. home port) • survival of the settled marine species on the vector during the voyage from the donor to the recipient region (e.g. location of the SPJ lower sections) remaining in place • colonisation (e.g. dislodgement or reproduction) of the marine species on the SPJ lower sections remaining in place, followed by successful establishment of a viable new local population. The probability of all of these steps being realised and an affected vessel dislodging an IMS in close enough vicinity to the SPJ lower sections remaining in place to allow survival and colonisation of an IMS is considered to be very low. Despite the probability of successful establishment of an IMS colony on the SPJ lower sections remaining in place being considered as very low, if this was to occur there is potential for larvae of the IMS to spread across the SPJ lower sections remaining in place and to nearby natural reef areas. The risk of this spread depends on the organisms present on the SPJs, and the degree of ecological connectivity between the SPJs and nearby reef areas. The nearest marine areas of higher value or sensitivity are the East Gippsland Marine Park, over 120 kilometres to the east and Beagle Marine Park, over 90 kilometres to the southwest of the nearest SPJ location. No IMS were observed on imagery collected during Environmental Survey 1 (Summer) or the review of historical ROV footage. As the likelihood of introduction and colonisation of IMS onto the SPJ lower sections remaining in place in the future is considered to be low, even if the structures are ecologically connected (which is to be further assessed by undertaking a study on connectivity), the likelihood of the SPJ lower sections remaining in place facilitating the spread of IMS to marine areas of higher value or sensitivity is considered to be very unlikely.	None

Scenario and potential impact	Consequence and likelihood evaluation	Proposed controls
The presence of the lower sections of the SPJs remaining in place could result in an unplanned interaction with a commercial shipping vessel, leading to loss of cargo (assumed on a worst-case basis to be a hazardous substance release to the marine environment).	This scenario has been assessed as not credible. Consistency with IMO Standard 3.6 (IMO Res. A.672(16), 1989) ensures that an unobstructed water column of at least 55m will be provided above the lower sections of HLA, FTA, CBA, MKA, KFA, KFB, WKF and FLA to ensure the safety of navigation. Due to the water depth at WTA (54m) and BMA (59m), the SPJs at these locations will be cut as close to the seabed as practicable – which may be up to 5m above the seabed depending on the feasibility of internal or external cutting methods. For WTA this will not achieve an unobstructed water column of at least 55 metres, and for BMA this may not achieve an unobstructed water column of 55m, depending on the depth of cut that can be achieved. A risk assessment carried out by AMC Search in 2022 calculated the 'dynamic clearance,' which takes into account the effects of waves causing a vessel to move up and down in the vertical plane, for a vessel with a sailing clearance of 18m. Just 1.6% of vessels transiting through the area in the vicinity of the SPJs have a sailing clearance in excess of 17m. The 'dynamic clearance' was calculated at various wave heights expected to be experienced in Bass Strait based on hind cast data. The maximum 'dynamic clearance' for a vessel of this size transiting Bass Strait, including safety factors, was calculated to be 38.2m. This means that a clearance of at least 38.2 would be required to allow the safe passage of vessels in even the most extreme weather conditions. A maximum elevation of 5m above the seabed has been assumed for the lower sections of WTA and BMA remaining in place - hence the water clearance above WTA would be approximately 49m and the clearance above BMA would be approximately 54m. Hence the likelihood of a surface vessel interacting with the lower sections of the SPJs remaining in place, is not credible, even in the event that existing controls preventing large vessels from entering the area (TSS and ATBA) are potentially removed in the future and vessels are able to transit directly over the SPJ lower sections remaining in place.	

The risk assessment also covered disposal option #2, which involves placing selected SPJ sections on the seabed adjacent to the SPJ lower sections remaining in place. The outcomes of the assessment are presented in Table 5-2.

Table 5-2 Risks of disposal option #2

Scenario	Consequence and likelihood evaluation	Proposed controls
Unplanned interaction between commercial fishing equipment and the lower sections of the SPJs remaining in place.	See Table 5-1.	None
SPJ lower sections remaining in place: • provide potentially suitable habitat for initial colonisation by an Invasive Marine Species (IMS)	See Table 5-1.	None

Scenario	Consequence and likelihood evaluation	Proposed controls
• act as potential vectors to the spread of introduced IMS (between multiple SPJs and/or natural areas).		
The presence of the placed sections of jackets could result in an unplanned interaction with a commercial shipping vessel, leading to loss of cargo (assumed on a worst-case basis to be a hazardous substance release to the marine environment).	If some removed upper sections of SPJs are placed on the seabed they will be placed within a 200m radius of the lower sections of the SPJs. Placed sections will also be cut to ensure that when placed, a minimum clearance of at least 55 metres will be provided below MSL. As such, the assessed risk of this scenario is consistent with the risk assessed for the lower sections of HLA, CBA, MKA, KFA, KFB, WKF and FLA remaining in place, which was not credible.	None

5.1 Fishing industry compensation arrangements

Controls will be implemented to ensure the risk of interaction with a fishing vessel is reduced to ALARP and acceptable levels. In the event an unplanned interaction between a commercial fishing vessel and infrastructure remaining in place does occur, Esso will continue to use the current model for compensation for claims of equipment damage as a result of interaction with Esso facilities, namely the Fisherman's Tribunal. The Fisherman's Tribunal will continue to function until such time as all Bass Strait operations are no longer producing.

Esso is currently considering options for managing compensation claims for the period after the Bass Strait operations are no longer producing and petroleum titles have been returned to the Australian Government. A review is being undertaken of two schemes currently operating in the U.K. sector of the North Sea, being the:

- Oil & Gas UK Fishermen's Compensation Fund
- UK Fisheries Offshore Oil and Gas Legacy Trust Fund Limited.

The UK Fishermen's Fund provides a process similar to Fisherman's Tribunal (established by Esso) while the UK Trust Fund provides a model for a self-sustaining trustee-managed entity in the oil and gas industry.

More work will be undertaken to identify and develop a scheme that is suitable for Bass Strait fishing compensation claims that may arise after all Bass Strait operations are no longer producing. Until this time, the existing Fisherman's Tribunal will continue to address fishing compensation claims.

6 Post-decommissioning monitoring

When determining the proposed post-decommissioning monitoring of the infrastructure remaining in place, Esso has considered:

- the outcomes of the environmental impact and risk evaluation presented in the EP
- the monitoring and survey expectations outlined in Section 270 Consent to surrender title (NOPSEMA, 2022)
- a review of international and Australian post-decommissioning monitoring precedence.

The proposed post-decommissioning monitoring of the Campaign #1 SPJs is outlined in the following sections.

6.1.1 'As left' survey(s)

'As left' post-decommissioning survey(s) will be undertaken to:

- confirm the SPJs have been decommissioned in accordance with the proposed SPJ end states
- identify any remaining items or debris that may be present.

The 'as left' survey(s) will be undertaken following the completion of decommissioning Campaign #1 execution activities.

6.1.2 Post-decommissioning environment survey

A post-decommissioning environmental survey, with a scope and timing to be determined in consultation with stakeholders and NOPSEMA will be undertaken to:

- confirm that decommissioning execution activities have not resulted in any unplanned impacts to the local environment
- verify that the benthic habitat that has been created on and around the SPJs continues to provide ecosystem function to the species utilising the habitat
- provide information to support the criteria for title surrender as per Section 270(e) and (f)[5] of the OPGGS Act.

[5] Section 270(e) requires that the registered holder of the permit, lease or licence has provided, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the surrender area. Section 270(f) requires that the registered holder of the permit, lease or licence has, to the satisfaction of NOPSEMA, made good any damage to the seabed or subsoil in the surrender area caused by any person engaged or concerned in the operations authorised by the permit, lease or licence.

7 Stakeholder consultation

Based on more than 50 years of operations in Bass Strait, Esso has become familiar with relevant stakeholders and other users of the local marine environment in the areas in which the SPJs are located. Esso recognises the importance of stakeholder consultation and notification and is committed to ongoing engagement.

7.1 Stakeholder identification

Stakeholders for this EP were identified through:

- identification of marine users and interest groups active in the area (e.g. commercial fisheries, recreational fishers, other energy producers, local business, etc.)
- discussions with identified stakeholders to identify other potentially impacted persons
- a review of legislation applicable to petroleum and marine activities
- active participation in industry bodies and collaborations e.g. APPEA, Centre for Decommissioning Australia, National Energy Resources Australia, and National Decommissioning Research Initiative
- leveraging existing relationships with relevant Commonwealth and state departments and agencies to identify other relevant stakeholders.

7.2 Consultation process

A comprehensive consultation process on decommissioning began in 2020 as part of the *Bass Strait Operations EP* (AUGO-EV-EMM-002) and has continued with a phased approach to introduce the various aspects of decommissioning to stakeholders, and to seek their comment. The phases are:

- Phase 1 – Introduced the decommissioning topic to stakeholders as part of usual business engagement. A combination of in person discussions and broad engagement through Esso publications.
- Phase 2 – The *Bass Strait Operations Decommissioning Report 2021* (Esso, 2021) provided to a broad range of stakeholders in December 2021 providing a progress update on Esso's planned decommissioning activities in Bass Strait including information about key safety, health, environment and social management information. In person discussions were held with interested stakeholders and stakeholders were encouraged to provide feedback.
- Phase 3 – Information bulletin #1 provided to a broad range of stakeholders in March and April 2022 outlining the feasible end state options being considered for the SPJs and monotowers. In person discussions were held with interested stakeholders and stakeholders were encouraged to provide feedback.
- Phase 4 – Information bulletin #2 provided to a broad range of stakeholders in June 2022 outlining the end state options proposed for the SPJs and monotowers which are considered to deliver an equal or better environmental outcome than complete removal. A summary of the potential impacts and risks associated with the proposed end state options was also provided. In person discussions were held with interested stakeholders and stakeholders were encouraged to provide feedback.
- Phase 5 – Invitation for public comment on EP via NOPSEMA Consultation Hub. Engagement with all stakeholders is an ongoing process and will continue post the submission of this EP.

7.3 Provision of sufficient information

Esso uses different forms of engagement with stakeholders depending on the stakeholder group. Given the nature of engagement, the process will always be context-specific, meaning that techniques, methods, approaches and timetables are tailored to the issue, to the situation and to the various types of stakeholders being consulted. At all times the provision of sufficient information is the focus.

7.4 Stakeholder feedback

Based on stakeholder feedback as at end-June 2022, the primary stakeholder issues of concern regarding the proposed end states for the SPJs are:

- interaction with other marine users and commercial fishers
- potential involvement in work programs associated with decommissioning execution work program
- Petroleum Safety Zones (PSZs)
- alternate uses of the facilities.

Esso has considered all stakeholder responses throughout the development of this EP. Esso will continue to incorporate stakeholder feedback into future decommissioning plans through maintaining ongoing consultation with relevant community, government and non-government stakeholders.

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