



## **Addendum to Hyde-1 Exploration Drilling Environment Plan Summary EA-00-RI-00281.04**

**REVISION HISTORY**

<b>Revision</b>	<b>Author / Editor</b>	<b>Amendment</b>
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**LIST OF ACRONYMS**

Abbreviation	Description
AAR	After Action Reviews
AFMA	Australian Fisheries Management Authority
AHS	Australian Hydrographic Service (formerly Australian Hydrographic Office, or AHO)
ALARP	As Low As Reasonably Practicable
AMSA	Australian Marine Safety Authority
ASBTIA	Australian Southern Bluefin Tuna Association
CFA	Commonwealth Fisheries Association
CMR	Commonwealth Marine Reserves
DAFF	Department of Agriculture and Water Resources (formerly Department of Agriculture, Fisheries and Forestry)
DER	WA Department of Environment Regulation
DEWHA	Department of the Environment, Water, Heritage and the Arts
DMP	Department of Mines and Petroleum
DoD	Department of Defence
DotEE	Commonwealth Department of the Environment and Energy (formerly Department of the Environment).
DoF	WA Department of Fisheries
DoT	WA Department of Transport
DPaW	WA Department of Parks and Wildlife
EMBA	Environment that May Be Affected
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental Protection Outcome
GDA	Geocentric Datum of Australia
HSE	Health Safety Environment (also referred to as EHS)
JV	Joint Venture
KEF	Key Ecological Feature
MNES	Matters of National Environmental Significance
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MP	Marine Parks
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NWS	North West Shelf
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
PPA	Pearl Producers Association
ROV	Remotely Operated Vehicle
TD	Total Depth
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WHA	World Heritage Area

## 1. INTRODUCTION

Quadrant Energy Australia Limited (Quadrant Energy) drilled the Hyde-1 exploration well, located in permit area WA-418-P in Commonwealth waters off the coast of Western Australia, in February 2016. After drilling to a depth of approximately 50m below the seabed, the 5" drill pipe became stuck during cementing operations for the 36" conductor and could not be recovered. Consequently, the drill pipe was severed near the seabed and the Mobile Offshore Drilling Unit (MODU) relocated to the final Hyde-1A well site and completed drilling to target depth.

The 36" conductor remains embedded in the seabed, with associated housing and the 5" drill pipe (collectively referred to hereafter as 'the equipment') extending to a total height of approximately 5.9m above the surrounding seafloor (**Figure 1-1**), or approximately 384m below the sea surface. This unplanned event was not anticipated in the accepted (Rev 3) Hyde-1 EP. Quadrant Energy intends to surrender the petroleum permit with the equipment *in situ* once all regulatory pre-requisites have been met.

### 1.1 Titleholder

**Table 1-1** lists the titleholder companies for the petroleum activity covered under the EP.

**Table 1-1: Titleholder details for the petroleum activity**

Aspect	Details
Permit	WA-418-P
Titleholder	Quadrant Northwest Pty Ltd
Other Titleholder	Finder Exploration Pty Ltd
Titleholder business address	Level 9, 100 St Georges Terrace, Perth WA 6000
Titleholder telephone number	(08) 6218-7100
Titleholder fax number	(08) 6218-7200
Titleholder email address	<a href="mailto:HSE.Approvals@quadrantenergy.com.au">HSE.Approvals@quadrantenergy.com.au</a>
Titleholder ACN	131 225 619
Titleholder ABN	39 009 301 964

### 1.2 Compliance

The environment plan (EP) [EA-00-R1-281/1] for drilling of Hyde-1 was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 11 February 2014. Offshore activities described in the accepted EP have been completed.

Quadrant Energy revised the previously accepted EP, via Addendum, to address the proposed response to the unplanned drilling event. The revised EP was prepared in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGs(E)R) and accepted by NOPSEMA on 13 July 2017.

This Summary has been prepared in accordance with the requirements of regulation 11 (4) of the OPGGS(E)R and summarises the accepted Addendum.

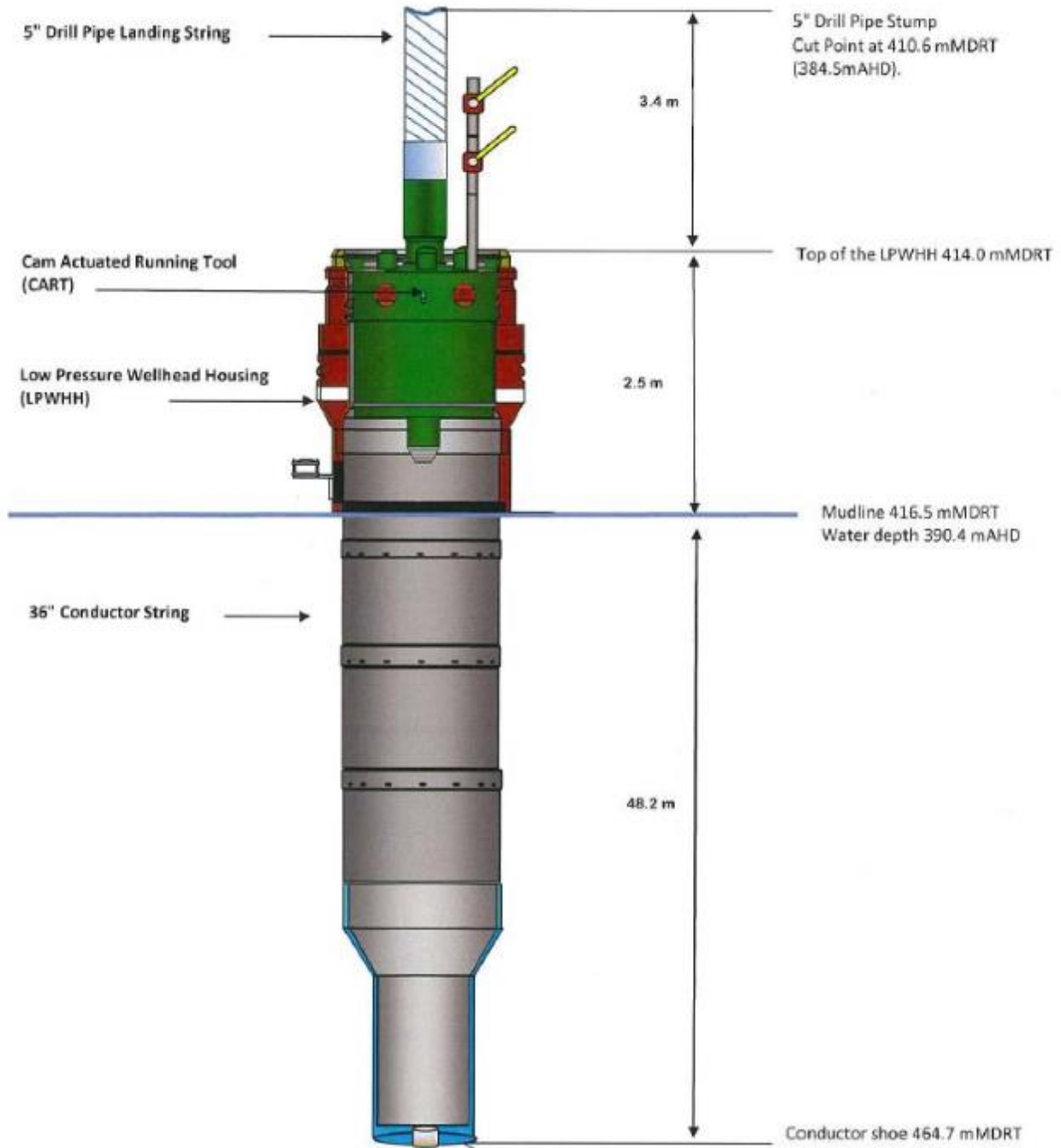


Figure 1-1: Drill pipe and 36" conductor schematic

## 2. ACTIVITY LOCATION AND DESCRIPTION

### 2.1 Location

The equipment is located in permit area WA-418-P (**Figure 2-1**) approximately 200 km north of Dampier, in approximately 390m water depth at the coordinates shown in **Table 2-1**.

**Table 2-1: Location coordinates**

Latitude	Longitude
18° 53' 08.66" S	116° 33' 23.75" E

### 2.2 Description

The Activity involves the response to an unplanned event that occurred during drilling for the Hyde-1 exploration well. The response involves leaving the equipment undisturbed *in situ* on the seabed.



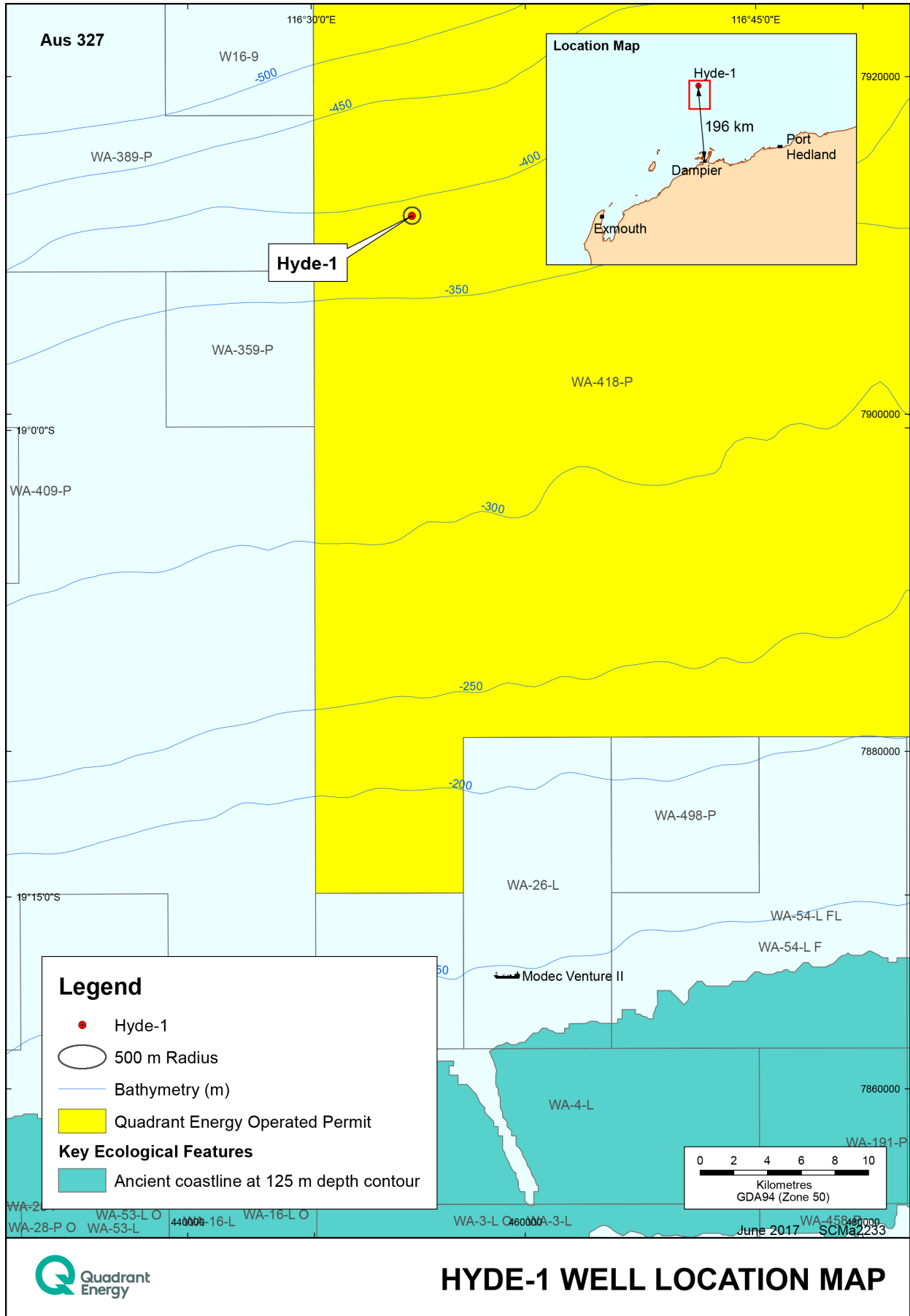


Figure 2-1: Location map

### 3. EXISTING ENVIRONMENT DESCRIPTION

#### 3.1 Overview

#### 3.2 Environment that may be affected

The unplanned event (and associated management response) does not present any risk of hydrocarbon spill and therefore the environment that may be affected (EMBA) is restricted to within (at most) a few hundred metres around the location of the equipment.

Review of the environment values within the EMBA included a search of the Commonwealth Department of the Environment and Energy (DotEE) Matters of National Environmental Significance (MNES) database and the National Conservation Values Atlas (DotEE 2016), as well as information gained through the consultation process. Specific aspects of the EMBA that are relevant to the assessment and management of risks for the unplanned event response, including particular values and sensitivities, are highlighted in the following sub-sections.

##### 3.2.1 Habitats

Benthic habitat in the EMBA comprises soft, mainly sandy sediments (**Figure 3-1**), typical of broad expanses of the sea floor on the North West Shelf (NWS). The water depths at the site make it unlikely that there is sufficient penetration of light to sustain hard corals or algae.

The NWS Bioregional Profile (DEWHA, 2008) indicates that the shelf slope is likely to support meiofauna (minute animals living between grains of sediment on the seabed, e.g. nematodes), larger infauna (e.g. polychaete worms and isopods) and sparsely distributed epibenthic communities (e.g. seapens) as well as mobile benthic species, such as deepwater sea cucumbers, crabs and polychaetes.

Based on available scientific literature it is assumed that the benthic habitat at the site is low in biological density, predominantly comprising sparse benthic infauna, inhabiting soft sediments. The ROV videography of the equipment and immediate surrounds supports this assumption (**Figure 3-1**). Habitats in the immediate vicinity of the equipment would have been disturbed during drilling at the site.



**Figure 3-1: Seabed images at the site**

##### 3.2.2 Marine protected areas and KEFs

There are no marine protected areas (Commonwealth and State marine reserves) or Key Ecological Features (KEFs) that occur within the EMBA. The nearest Commonwealth Marine Reserve (Argo Rowley Terrace) lies approximately 125 km to the north and the nearest KEF ('ancient coastline at 125 m depth contour') is located approximately 50 km to the south (**Figure 2-1**).

### 3.2.3 Commercial fisheries

The fishing zones for a number of State and Commonwealth-managed fisheries overlap the EMBA, however fisheries status reports (DoF 2015; ABARES 2016) and consultation undertaken for the Addendum indicates that potential fishing effort in the EMBA currently occurs in only one of these fisheries (North West Slope Trawl Fishery) and is low.

### 3.2.4 Tourism and recreation

Tourism and recreational use, including recreational fishing, is unlikely in the EMBA, due to the depth of the site, absence of seabed features and distance (>150 km) from the mainland and island shorelines.

### 3.2.5 Oil and gas industry

The NWS is a major oil and gas hub in Australia, with several companies operating on the Shelf. The EMBA is in a particularly isolated area of the NWS with respect to the main oil and gas operational and exploratory fields. There are currently no operating fields in the WA-418-P permit area.

### 3.2.6 Commercial shipping

The closest shipping lane is the main northern approach to the Port of Dampier, which lies approximately 25 km to the east. General marine vessel traffic may traverse the EMBA.

### 3.2.7 Cultural heritage places and shipwrecks

There are no listed cultural heritage places or records of shipwrecks in the EMBA.

### 3.2.8 Defence

There are no defence areas within or in the vicinity of the EMBA.

### 3.2.9 EPBC Act listed (threatened and migratory) species and ecological communities

A search of the EPBC Act Protected Matters Database indicates that eleven species listed as Threatened and Migratory (**Table 3-1**) and a further 10 species listed as migratory only under the EPBC Act may occur within the EMBA or surrounding area within a radius of 2 km of the equipment.

No critical habitats or Biologically Important Areas (BIA) for any of these species overlap with the EMBA, apart from the migration corridor BIA for the pygmy blue whale (*Balaenoptera musculus brevicauda*). This BIA extends along the entire Western Australian coast and is approximately 100 km wide through the region (DotEE 2016).

No listed threatened communities or wetlands of international importance (Ramsar sites) occur within the EMBA.

**Table 3-1: EPBC Act-listed threatened marine species**

Value/Sensitivity		EPBC Act Status			
Common Name	Scientific Name	Critically Endangered	Endangered	Vulnerable	Migratory
Great white shark	<i>Carcharodon carcharias</i>	x	x	✓	✓
Blue whale	<i>Balaenoptera musculus</i>	x	✓	x	✓
Sei whale	<i>Balaenoptera borealis</i>	x	x	✓	✓
Fin whale	<i>Balaenoptera physalus</i>	x	x	✓	✓
Humpback whale	<i>Megaptera novaeangliae</i>	x	x	✓	✓
Loggerhead turtle	<i>Caretta caretta</i>	x	✓	x	✓
Green turtle	<i>Chelonia mydas</i>	x	x	✓	✓
Leatherback turtle	<i>Dermochelys coriacea</i>	x	✓	x	✓
Hawksbill turtle	<i>Eretmochelys imbricata</i>	x	x	✓	✓
Flatback turtle	<i>Natator depressus</i>	x	x	✓	✓

#### 4. STAKEHOLDER CONSULTATION

Quadrant Energy understands retaining a broad licence to operate depends on the development and maintenance of positive and constructive relationships with a comprehensive set of stakeholders in the community, government, non-government and business sectors.

To allow an informed assessment by stakeholders of the potential impacts and risks of Quadrant Energy's activities, Quadrant Energy has established long-term and meaningful dialogue with those stakeholders who have demonstrated an interest in present and future petroleum activities.

Identified relevant stakeholders were informed of the unplanned event at the Hyde-1 location in March 2016, and associated management response in March 2017 (**Table 4-3**).

In consultation with the Australian Fisheries Management Authority (AFMA) and the Australian Maritime Safety Authority (AMSA), bottom trawlers in the North West Slope Trawl Fishery were identified as the only stakeholders potentially impacted by the response to the unplanned event. A small number of individual commercial fishers are licensed to fish in the area and were individually contacted in 2016 regarding the presence of the equipment. Stakeholders were again engaged in March 2017 to advise that, following risk assessment, it was considered that the presence of the equipment on the seabed would have low environmental impact and risk to other marine users and the preferred management response would be to leave the equipment undisturbed in perpetuity.

These stakeholders, as listed in **Table 4-2**, have been allowed adequate time to review consultation material and have raised no specific concern with any petroleum activities to date.

In consultation with AFMA and in information publically available on the AFMA website, Quadrant Energy notes there has been one vessel active in the North West Slope Trawl fishery for the 2012–13, 2013–14 and 2014–2015 fishing seasons, despite a number of permits being issued. This indicates latent effort in the fishery.

To eliminate potential impact to trawl fishers, individual fishers were provided coordinates and details on the equipment remaining on the seabed. In consultation with the Australian Hydrographic Service (AHS), the location of the equipment has been added permanently to nautical charts. Quadrant Energy and AFMA believe it is reasonable to expect that any new entrants to the fishery would undertake due diligence and obtain up-to-date charts for the relevant area, which would indicate the location of the equipment.

In addition, Quadrant Energy's wider stakeholder group, as listed in **Table 4-1**, receive *Quarterly Consultation Updates* via email. Updates from September 2016 to March 2017 have noted a structure remains in place on the seabed at the Hyde location, including the coordinates, a location map against relevant commercial fishing zones, and have provided return contact details if further information is required. No comment regarding the equipment has been received in response to a *Quarterly Consultation Update*.

Quadrant Energy considers that consultation with regulators and key stakeholders has been adequate; all stakeholders and relevant parties have been actively engaged by Quadrant Energy on activities at Hyde-1 since 2013, as evidenced in the NOPSEMA accepted EP. No stakeholder has objected to the Activity covered under this Addendum, nor claimed that perceived impacts or risks to their business are unacceptable.

All correspondence with external stakeholders is recorded and relevant consultation material and feedback received will be provided to the appropriate internal Quadrant Energy personnel when relevant.

**Table 4-1: Quarterly Consultation Update distribution list**

Group	Stakeholder
Marine Conservation	<ul style="list-style-type: none"> <li>Department of Fisheries (DoF)</li> <li>Department of Parks and Wildlife (DPaW)</li> </ul>
Shipping safety and security	<ul style="list-style-type: none"> <li>Australian Maritime Safety Authority (AMSA)</li> <li>Department of Defence (DoD)</li> <li>Department of Transport (DoT)</li> </ul>
Regulators	<ul style="list-style-type: none"> <li>Department of Mines and Petroleum (State)</li> </ul>
Fishing bodies	<ul style="list-style-type: none"> <li>A Raptis and Sons</li> <li>Austral Fisheries</li> <li>Australian Fisheries Management Authority (AFMA)</li> <li>Australian Southern Bluefin Tuna Association (ASBTIA)</li> <li>Commonwealth Fisheries Association (CFA)</li> <li>Marine Tourism WA</li> <li>MG Kailis</li> <li>Pearl Producers Association</li> <li>Recfishwest</li> <li>Shark Bay Seafoods</li> <li>WA Seafood Exporters</li> <li>Western Australian Fishing Industry Council (WAFIC)</li> <li>WestMore Seafoods</li> </ul>
Karratha/Port Hedland Stakeholder Reference Group	<ul style="list-style-type: none"> <li>City of Karratha</li> <li>Pilbara Port Authority (PPA)</li> <li>Town of Port Hedland</li> </ul>

**Table 4-2: Relevant stakeholder list**

Group	Stakeholder
Regulatory body	<ul style="list-style-type: none"> <li>Department of the Environment and Energy (DotEE)</li> </ul>
Shipping safety and security	<ul style="list-style-type: none"> <li>Australian Hydrographic Service (AHS)</li> <li>Australian Maritime Safety Authority (AMSA)</li> <li>Pilbara Port Authority</li> </ul>
Individual fishers and representative bodies	<ul style="list-style-type: none"> <li>A Raptis and Sons</li> <li>Austral Fisheries</li> <li>Australian Fisheries Management Authority (AFMA)</li> <li>WA Seafood Exporters</li> <li>WestMore Seafoods (Seafresh Holdings)</li> </ul>

**Table 4-3: Consultation summary**

Stakeholder	Consultation undertaken
DotEE	<p>Consultation with the DotEE has determined Quadrant is required to seek a Sea Dumping Permit under Article 1.4.1.4 of the London Protocol.</p> <p>Quadrant has informed DotEE this permit will be sought concurrently to the NOPSEMA EP assessment process.</p> <p>Quadrant has submitted an application seeking a SDP by email on 9/6/17 and DotEE has acknowledged receipt of this email.</p> <p>Consultation with DotEE, for the purposes on this EP, is closed. Quadrant commits to ongoing engagement with DotEE throughout their assessment process under</p>

	the Sea Dumping Act.
AHS	<p>The AHS were contacted by phone and email on 23/3/16 and were advised an abandoned wellhead remained on the seafloor. The AHS were provided coordinates and details of the equipment. The AHS confirmed via email on 22/9/2016 and again on 11/4/17 the equipment on the seabed at the Hyde location has been added to the appropriate nautical chart. In response Quadrant has confirmed the equipment will remain in situ.</p> <p>Correspondence with the AHS is considered closed out, Quadrant does not anticipate further correspondence from the AHS on this matter.</p>
AMSA	<p>AMSA were contacted by phone and email on 23/3/16 and were given details of the equipment remaining on the seabed. AMSA confirmed the best course of action was to provide details of the equipment on the seabed to the AHS. No further consultation required on this activity.</p> <p>Additionally AMSA confirmed in consultation trawl fishers are the only marine users potentially impacted by the activity.</p>
AFMA	<p>In phone consultation on 23/3/16 Quadrant informed AFMA of details regarding equipment remaining on the seabed, AFMA advised Quadrant the North West Slope Trawl Fishery is the only potentially impacted fishery in the region, given water depth.</p> <p>Quadrant advised AFMA in phone consultation on 28/3/17 that individual consultation was conducted with license holders in this fishery as listed on the AFMA website. In addition to this, AFMA will look at including a line in management plans alerting fishers to the presence of submerged equipment on the seabed advising those individuals to be vigilant and informed (ie. updating nautical charts) as noted in emails between 29/3/17 and 12/4/17.</p> <p>Consultation with AFMA has been extensive on this topic and is considered closed out.</p>
Pilbara Port Authority	<p>The Pilbara Port Authority advised in phone consultation on 31/3/17 given the water depth, this equipment would have no impact to shipping.</p> <p>The Pilbara Port Authority confirmed this location is out of port limits and therefore no formal comment would be provided.</p>
<b>North West Slope Trawl Fishery</b>	
Austral Fisheries	<p>In phone consultation on 23/3/16 Austral Fisheries confirmed they have not been active in the region and have little interest. For completeness Quadrant provided Austral Fisheries location coordinates and details of the equipment remaining on the seabed via email on 29/3/17.</p> <p>Quadrant does not expect an email response from Austral Fishers to consultation and considers consultation closed for this activity.</p>
A Raptis and Sons Seafoods	<p>Quadrant has provided A Raptis and Sons location coordinates and details of the equipment remaining on the seabed in emails on 22/9/16 and 29/3/17.</p> <p>Consultation with AFMA indicates A Raptis and Sons are not active in the region.</p> <p>Quadrant does not expect a response from A Raptis and Sons to consultation and considers consultation closed for this activity.</p>
WA Seafood Exporters	<p>In phone consultation on 31/3/17 WA Seafood Exporters confirmed potential activity in the region and noted that their nautical charts were up to date.</p> <p>Quadrant has provided WA Seafood Exporters location coordinates and details of the equipment remaining on the seabed via email on 31/3/17, which WA Seafood Exporters confirmed they would use to stay away from the location.</p> <p>Quadrant does not expect an email response from WA Seafood Exporters to consultation and considers consultation closed for this activity.</p>
Westmore Seafoods	<p>In phone consultation on 23/2/16 Westmore Seafoods have confirmed they are</p>

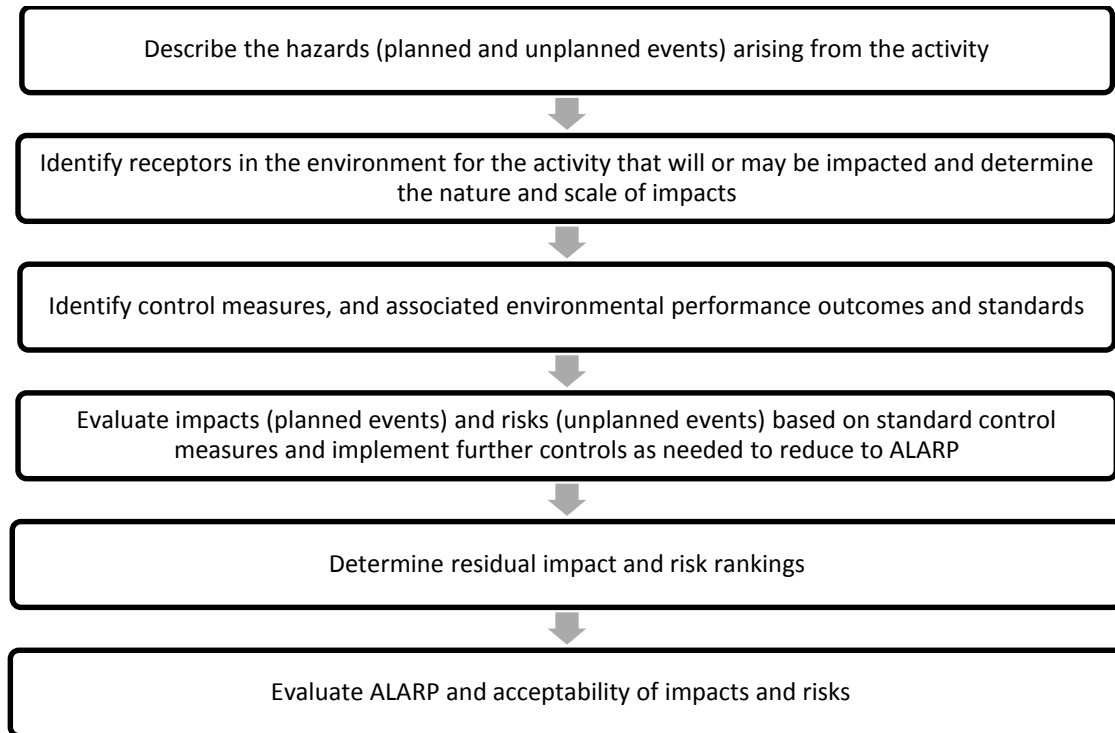
	<p>not currently active in the region and would have technology on board to detect items on the seabed. Quadrant has provided Westmore Seafood location coordinates and details of the equipment remaining on the seabed via email on 24/3/16.</p> <p>Quadrant followed up with Westmore Seafoods via email and phone on 29/3/17 confirming item would remain on the seabed and providing coordinates and equipment details again.</p> <p>Quadrant does not expect an email response from Westmore Seafoods to consultation and considers consultation closed for this activity.</p>
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## 5. ENVIRONMENTAL HAZARDS AND CONTROLS

### 5.1 Methodology

The impact and risk assessment approach applied for the Addendum is consistent with the requirements of AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines and ISO/IEC 31010 Risk Management – Risk Management Techniques. The approach can be mapped to the requirements of the OPGGS(E)R for an EP, as described by NOPSEMA (N04750-GN1344 Rev 3 2016). The key steps are illustrated in **Figure 5-1**.



**Figure 5-1: Environmental impact and risk assessment process**

The actual or potential impacts from a planned or unplanned event is assessed by considering the magnitude of an impact and sensitivity of the environmental receptors affected. Magnitude is a function of factors such as impact severity, extent and duration. Sensitivity is a function of factors such as vulnerability, uniqueness and protection status.

For each planned and unplanned event, various control measures, environmental performance outcomes and performance standards, and measurement criteria are identified.

For each planned and unplanned event, an environmental consequence (impact) level was assigned for each of the identified receptors. Each receptor has pre-defined impact criteria, which consider impact severity, extent and duration.

The consequence definitions are outlined in **Table 5-1** below.

**Table 5-1: Consequence level descriptions**

Consequence Level		Consequence Level description
1	Negligible	No impact or negligible impact.
2	Minor	Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect with rapid recovery.
3	Moderate	Significant impact to local population, industry or ecosystem factors. Medium term recovery.
4	Major	Major long-term effect on local population, industry or ecosystem factors. Slow recovery over decades.
5	Critical	Complete loss of local population, industry or ecosystem factors AND/ OR major wide-spread regional impacts with slow recovery.

For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event as well as the consequence level of the potential impact should that event occur. The likelihood rankings used for the EP Addendum are outlined in Table 5-2 below.

**Table 5-2: Likelihood descriptions**

No.	Matrix	Description
5	Probable	1. Event has occurred frequently within the Company. 2. Between 1 and 10 incidents every 10 years (i.e. up to frequency 1/year).
4	Likely	1. Event has occurred frequently within the Industry. 2. Between 1 and 10 incidents every 100 years (i.e. up to frequency $10^{-1}$ /year).
3	Unlikely	1. Event has occurred occasionally within the the Company. 2. Between 1 and 10 incidents every 1000 years (i.e. up to frequency $10^{-2}$ /year).
2	Very Unlikely	1. Has occasionally occurred within the Industry. 2. Between 1 and 10 incidents every 10,000 years (i.e. up to frequency $10^{-3}$ / year).
1	Rare	1. Could happen under exceptional circumstances only. 2. Between 1 and 10 incidents every 100,000 years (i.e. up to frequency $10^{-4}$ / year).

Risk rankings (consequence x likelihood) are assigned in accordance with Quadrant Energy's Risk Matrix as shown below.

		SEVERITY				
		1. Negligible	2. Minor	3. Moderate	4. Major	5. Critical
LIKELIHOOD	5. Probable					
	4. Likely					
	3. Unlikely					
	2. Very Unlikely					
	1. Rare					

High Risk - reduction of risk required

Medium Risk - reduction of risk required based on ALARP principle

Low Risk - deemed acceptable based on standard risk controls in place

### 5.1.1 Evaluating impact and risk acceptability

Quadrant Energy considers an impact or risk to be acceptable if the following criteria are met:

1. The consequence level of a planned event is ranked as Negligible or Minor; or the risk ranking of an unplanned event is ranked as Low or Medium Risk (and ALARP).
2. An assessment has been completed to determine if further information/studies are required to support or validate the consequence assessment. Additional information is utilised where required.
3. Performance standards are consistent with legal and regulatory requirements.
4. Activity is consistent with Quadrant Energy Environmental Management Policy.
5. Stakeholder feedback relevant to the impact or risk has been evaluated and any concerns managed.
6. Control measures have been demonstrated to reduce the impact or risk to ALARP.

### 5.1.2 Evaluating if impacts and risks are ALARP

For planned and unplanned events, an assessment is undertaken to demonstrate that the standard control measures adopted reduce the impact (consequence level) or risk to as low as reasonably practicable (ALARP). This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort in order to reduce the consequence level or risk. If this cannot be demonstrated then the further controls are adopted. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk. For example, more detail is required for a risk ranked as Medium compared to a risk ranked as Low.

## 5.2 Environmental risk treatment summary

The environmental assessment for the response to the unplanned event concluded that the physical presence of the equipment on the seabed could result in seabed disturbance, altered sediment composition, and the creation of artificial habitat.

It was also concluded that the ongoing physical presence of the equipment presents a low risk of interference to other users, specifically to trawl fishers.

The only feasible alternative to leaving the equipment *in situ* was identified as cutting and removal of the equipment and this would require mobilisation of a marine spread (vessel). A detailed review of this option

was undertaken following the unplanned event. This review found that the financial cost associated with retrieval of the equipment would be significant (estimated lower end of the cost range being \$1.7M AUD depending on vessel type/availability). Retrieval operations would result in direct disturbance to the seabed, and introduce additional environmental impacts compared to leaving the equipment *in situ*. The risk assessment concluded that the overall cost of the retrieval option, including safety risks, was grossly disproportionate to any environmental benefits given the negligible impact posed by the equipment remaining on the seabed.

### 5.2.1 Physical presence – seabed disturbance

<b>Aspect</b>	The response to the unplanned event will result in the equipment remaining on the seabed permanently (until it degrades). The presence of this equipment on the seabed has displaced the benthic habitats within its footprint and could potentially cause disturbance (e.g. scouring/erosion) to the surrounding seabed.
<b>Potential receptors:</b>	Physical Environment / Habitat Threatened / Migratory / Local Fauna
<b>Nature and scale of environmental impacts</b>	
<i>Benthic Habitats</i> The area of direct disturbance to seabed habitats due to the equipment would be within an approximately 40" diameter area at the equipment location. Studies of erosion/accretion around subsea structures (e.g. shipwrecks, artificial reefs) indicate indirect impacts may be limited to within 20m of the structure (Smiley 2006; Lewis and Pagano 2016). This would likely comprise the area previously disturbed by drilling.	
<i>Fauna</i> Changes to the seabed at and immediately surrounding the equipment footprint could potentially result in changes to associated benthic fauna communities. The extent of impact would be restricted to the area of changed habitat, which would be highly localised (see above).	
<b>Management Controls</b>	
No practicable control measures identified	
<b>Environmental assessment</b>	
<b>Physical Environment / Habitat</b>	<b>Negligible – No or negligible reduction in habitat area/function.</b>
The seabed in the vicinity comprises relatively flat topography of soft sediments; the habitat type is widely distributed and well represented in the region. No sensitive seabed features have been identified at the equipment location and it has been subject to previous (drilling) disturbance. There are no protected areas or KEFs in the vicinity. Given the very small scale of potential effect and the expected absence of sensitive or conservation value habitats in the EMBA, any localised changes to habitats would have <i>Negligible</i> consequences for habitat area and/or ecosystem function.	
<b>Threatened / Migratory / Local Fauna</b>	<b>Negligible – Short term behavioural impacts only to small proportion of local population and not during critical lifecycle activity. No decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle / introduction of disease.</b>
The benthic habitats in the area potentially affected are expected to support a low diversity of benthic infauna and low diversity of epifauna. Considering the depth and remoteness of the equipment location on the seabed, the areas' lack of importance to protected species, the previous disturbance and the very small scale of any potential changes in local habitat, the consequences for fauna are predicted to be <i>Negligible</i> .	
<b>ALARP and Acceptability evaluation</b>	
Is the consequence ranked as Negligible or Minor?	Yes – Maximum consequence is Negligible.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.

Are performance standards consistent with legal and regulatory requirements?	Yes – No breaches of applicable legal or regulatory requirements identified. No controls identified.
Activity consistent with Quadrant Energy Environmental Management Policy?	Yes – Aligns with Quadrant Energy Environmental Management Policy.
Activity consistent with stakeholder expectations?	Yes – No concerns raised.
Alternatives or additional controls considered to reduce impact/risk?	Yes – No reasonably practicable options/additional controls identified.
Impact or risk is considered to be ALARP?	Yes – Impact considered ALARP.

The unretrieved equipment is in a location comprised of soft sediment with sparse benthic fauna, and no recognised conservation importance. The impact to seabed habitats and associated fauna is *Negligible*. The impact has been assessed to be ALARP and is considered Acceptable.

### 5.2.2 Physical presence – altered sediment composition

<b>Aspect</b>	The response to the unplanned event will result in the equipment remaining on the seabed where it will gradually degrade.
<b>Potential receptors:</b>	Physical Environment / Habitat Threatened / Migratory / Local Fauna
<b>Nature and scale of environmental impacts</b>	
<i>Benthic Habitats</i> The breakdown of the equipment on the seabed will affect sediment quality through the introduction of breakdown products (predominantly iron oxides) into the surrounding sediments. The presence of introduced breakdown compounds in the sediments may affect benthic fauna. The area of input to sediments would be within the proximity of the equipment location and likely within the area disturbed during open-hole drilling.	
<i>Fauna</i> Changes to sediment quality may affect associated benthic fauna communities. The extent of impact would be restricted to the area of changed habitat (see above), which would be highly localised. Iron is naturally occurring and generally has low toxicity to marine biota.	
<b>Management Controls</b>	
No practicable control measures identified	
<b>Environmental assessment</b>	
Physical Environment / Habitat	Negligible – No or negligible reduction in habitat area/function.
The seabed in the vicinity comprises relatively flat, soft sediments; the habitat type is widely distributed and well represented in the region. No sensitive seabed features have been identified at the equipment location and there are no protected areas or KEFs in the vicinity. Given the very small scale of potential effect and the expected absence of sensitive or conservation value habitats in the EMBA, any localised changes to sediment quality would have <i>Negligible</i> impact on habitat area and/or ecosystem function.	
Threatened / Migratory / Local Fauna	Negligible – Short term behavioural impacts only to small proportion of local population and not during critical lifecycle activity. No decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle / introduction of disease.
The benthic habitats in the area potentially affected support a low diversity of benthic infauna and low diversity of epifauna. Considering the depth and remoteness of the equipment location on the seabed, the areas' lack of	

importance to protected species and the slow rate and very small scale of any potential changes in sediment quality, the impacts to fauna are predicted to be <i>Negligible</i> .	
<b>ALARP and Acceptability evaluation</b>	
Is the consequence ranked as Negligible or Minor?	Yes – Maximum consequence is Negligible.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are performance standards consistent with legal and regulatory requirements?	Yes – No breaches of applicable legal or regulatory requirements identified. No controls identified.
Activity consistent with Quadrant Energy Environmental Management Policy?	Yes – Aligns with Quadrant Energy Environmental Management Policy.
Activity consistent with stakeholder expectations?	Yes – No concerns raised.
Alternatives or additional controls considered to reduce impact/risk?	Yes – No reasonably practicable options/additional controls identified.
Impact or risk is considered to be ALARP?	Yes – Impact considered ALARP.

The unretrieved equipment is in a location comprised of soft sediment with sparse benthic fauna, and no recognised conservation importance. The impact to sediment quality and associated fauna is *Negligible*. The impact has been assessed to be ALARP and is considered Acceptable.

### 5.2.3 Physical presence – creation of artificial habitat

<b>Aspect</b>	The response to the unplanned event will result in the equipment remaining on the seabed where it will provide an area of hard substrate where previously there were soft sediments.
<b>Potential receptors:</b>	Threatened / Migratory / Local Fauna
<b>Nature and scale of environmental impacts</b>	
The presence of hard substrate with vertical relief where there was previously flat, sandy sediments is likely to result in the development of more diverse attached (encrusting) communities, which in turn may support more abundant and diverse fauna (notably fish) communities. This ‘reef effect’ on and in the area immediately surrounding anthropogenic structures has been well documented (e.g. Love and York 2005; Pradella <i>et al</i> 2013) and is likely to remain until the equipment has degraded.	
<b>Management Controls</b>	
No practicable control measures identified	
<b>Environmental assessment</b>	
<b>Physical Environment / Habitat</b>	<b>Negligible – No or negligible reduction in habitat area/function.</b>
The unretrieved equipment provides hard substrate with vertical relief (to ~5.9m above seabed) in an area that was flat, soft sediments and a deep (~390m) overlying water column; these habitat types are widely distributed and well represented in the region. No sensitive seabed features have been identified at the equipment location and there are no protected areas or KEFs in the vicinity. Given the very small scale of potential effect and the expected absence of sensitive or conservation value habitats in the EMBA, any localised changes to habitat type would have <i>Negligible</i> impact on habitat areas and/or ecosystem function.	

<b>Threatened / Migratory / Local Fauna</b>	<b>Negligible – Short term behavioural impacts only to small proportion of local population and not during critical lifecycle activity.</b> <b>No decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle / introduction of disease.</b>	
The hard substrate provided by the equipment will likely support an increase in local biodiversity, but this effect will be limited to the immediate vicinity and be insignificant in a regional context given the small size of the equipment. Considering the depth and remoteness of the equipment location, the areas' lack of importance to protected species and the very small scale of any (positive) impact to local fauna abundance and diversity, the creation of artificial habitat is predicted to have <i>Negligible</i> consequences to fauna.		
<b>ALARP and Acceptability evaluation</b>		
Is the consequence ranked as Negligible or Minor?	Yes – Maximum consequence is Negligible.	
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.	
Are performance standards consistent with legal and regulatory requirements?	Yes – No breaches of applicable legal or regulatory requirements identified. No controls identified.	
Activity consistent with Quadrant Energy Environmental Management Policy?	Yes – Aligns with Quadrant Energy Environmental Management Policy.	
Activity consistent with stakeholder expectations?	Yes – No concerns raised.	
Alternatives or additional controls considered to reduce impact/risk?	Yes – No reasonably practicable options/additional controls identified.	
Impact or risk is considered to be ALARP?	Yes – Impact considered ALARP.	

The unretrieved equipment is in a location comprised of soft sediment with very deep waters, and no recognised conservation importance. The impact to habitat and fauna from the creation of a small area of artificial habitat is Negligible. The impact has been assessed to be ALARP and is considered Acceptable.

#### 5.2.4 Physical presence – disruption of other users

There is a risk the presence of the equipment on the seabed could disrupt other users, specifically commercial fishers. For unplanned events, a risk level is determined using an assessment of the likelihood of the event as well as the consequence level should that event occur.

<b>Hazard / Event</b>	The response to the unplanned event will result in the equipment remaining on the seabed. The physical presence of the equipment on the seabed has the potential to interfere with other users of the area, specifically commercial fishers.	
<b>Potential receptors:</b>	Socio-Economic Receptors	
<b>Nature and scale of environmental impacts</b>		
The physical presence of the equipment may disrupt commercial fishing operations through a loss of fishing area and/or potential interference (e.g. trawl net snagging) to fishing practices. Stakeholder consultation with commercial fishing industry representatives has been undertaken and no concerns were raised. The equipment occupies an extremely small proportion of very large fishing zones and extends only approximately 6m into the approximately 390m of water depth above the seabed. The potential impact to commercial fisheries is expected to be <i>Minor</i> .		
<b>Management Controls</b>		
<b>Control measure</b>	<b>Environmental benefit</b>	

Maritime notices	Information provided so that the maritime industry is aware of presence of equipment.
Stakeholder consultation strategy	Relevant persons notified of unplanned event (including positional coordinates of unretrieved equipment) and proposed management to reduce the impact to them. Stakeholder database records all correspondence.
Equipment permanently marked on navigation charts	Mariners (including fishers) made aware of and able to navigate around equipment presence/location.
<b>Environmental assessment</b>	
<b>Likelihood</b>	<b>Very Unlikely</b>
<p>Due to its remoteness, deep waters and lack of seabed features, the location has limited prospectivity for fishing activity. Due to the small height of the equipment relative to the overlying water column, only bottom trawling activity that went directly over the site might be affected. The equipment presents an isolated, small vertical feature in a relatively flat seabed that may be detectable to sonar used by trawling vessels.</p> <p>The probability of fishers interacting with the equipment is further minimised by the notification/consultation undertaken and having the location of the equipment marked on navigation charts. No existing stakeholders have raised a concern regarding the equipment remaining <i>in situ</i>. Any future users could reasonably be expected to become aware of its presence through due diligence. The likelihood of disruption to commercial fishing is therefore considered to be <i>Very Unlikely</i>.</p>	
<b>Consequence</b>	<b>Minor</b>
<p>Fishing effort in the area is low and the small size (approx. 40”diam) of the equipment minimises any deviation from normal fishing practices that may be required to avoid it. In the event of interaction, the impact would likely be limited to damage or (at worst) loss of one trawl net. The consequences are therefore expected to be <i>Minor</i>.</p>	
<b>Overall Residual Risk Ranking</b>	<b>Low Risk</b>
Is the risk ranked as Low or Medium?	Yes – Low Risk.
Is further information required in the consequence assessment?	No – Potential impacts and risks well understood through the information available.
Are performance standards consistent with legal and regulatory requirements?	Yes – Management consistent with maritime requirements and NOPSEMA guidance regarding stakeholder consultation.
Activity consistent with Quadrant Energy Environmental Management Policy?	Yes – Aligns with Quadrant Energy Environmental Management Policy.
Activity consistent with stakeholder expectations?	Yes – No concerns raised.
Alternatives or additional controls considered to reduce impact/risk?	Yes – No reasonably practicable options/additional controls identified.
Impact or risk is considered to be ALARP?	Yes – risk is considered ALARP.

The unretrieved equipment is in very deep water at a remote location where the seabed comprises soft sediment with sparse benthic fauna, and no features that indicate potential importance to commercial fishing. Current fishing levels in the area are low. Consultation with relevant stakeholders, including commercial fishers, has indicated no particular concerns with the presence of the equipment on the seabed. With the controls in place, the risk has been assessed to be Low (and ALARP) and is considered Acceptable.



## 6. MANAGEMENT APPROACH

Quadrant Energy is managing the response to the unplanned event in compliance with all measures and controls detailed within the EP revision (Addendum) accepted by NOPSEMA under the OPGGS (E) Regulations, other environmental legislation and consistent with the operational commitments made in Quadrant Energy’s Environmental Management Policy. Relevant elements of Quadrant Energy’s Health, Safety and Environment Management System (HSEMS) have been considered and applied in the development of the Addendum as outlined in **Table 6-1**.

By the application of these elements of the HSEMS, Quadrant Energy has ensured that the environmental impacts and risks of the unplanned event response have been identified and reduced to ALARP and acceptable levels through the implementation of appropriate control measures.

**Table 6-1: Quadrant Energy HSEMS elements relevant to Activity**

Element of HSEMS	Title
1	Leadership, accountability and responsibility
3	Hazard identification, risk and impact assessment and controls
4	Workforce involvement and stakeholder consultation
6	Design, construction, installation, commissioning and decommissioning
7	Asset Integrity
13	Incident reporting, investigation and follow-up

Since the unplanned event response and associated management measures were closed out by acceptance of the EP revision, no further monitoring, recording, audit, management of non-conformance, or review of environmental performance will be undertaken.

## 7. CONTACT DETAILS

Further information about the response to the unplanned drilling event can be obtained from:

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