KUPE PHASE 2 DEVELOPMENT DRILLING PROGRAMME

Marine Consent and Marine Discharge Consent Application

Prepared for:

Beach Energy Resources NZ (Kupe) Limited
Private Bag 2022
New Plymouth
New Zealand

SLR Ref: 740.30012.00000-R01
Version No: -v1.0
April 2022

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BASIS OF REPORT

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
740.30012.00000-R01-v1.0	8 April 2022	SLR Consulting Limited	Rob Lieffering	Dan Govier
740.30012.00000-R01-v0.2	15 February 2022	SLR Consulting Limited	Rob Lieffering	
740.30012.00000-R01-V0.1	02 December 2021	SLR Consulting Limited	Dan Govier	

EXECUTIVE SUMMARY

Beach Energy Resources NZ (Kupe) Limited (**Beach**) is applying for a marine consent and a marine discharge consent (this combined application is hereafter referred to as the **consent application**) from the Environmental Protection Authority (**EPA**) under section 38 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (**EEZ Act**). This combined application seeks to authorise various activities associated with Beach's Kupe Phase 2 Development Drilling Programme within Petroleum Mining Licence 38146 (**PML 38146**), including activities restricted by section 20 and 20B of the EEZ Act. PML 38146 is located in the Taranaki Basin, offshore and to the south of Manaia and within New Zealand's Exclusive Economic Zone (**EEZ**). Beach is proposing to drill up to two development wells at the existing normally unoccupied Kupe Wellhead Platform (**Kupe WHP**) using a jack-up mobile offshore drilling unit (**MODU**).

This combined application includes activities which involve placement of structures on the seabed, removal of non-living natural material from the seabed or subsoil, disturbance of the seabed or subsoil, deposition of material on the seabed, causing of vibrations, causing of explosions, and the discharge of trace amounts of harmful substances to the sea via the deck drainage system of the MODU.

The Kupe Phase 2 Development Drilling Programme will require other approvals under the EEZ Act and other relevant legislation. Applications for these approvals will be lodged with the EPA (and/or other relevant agencies) in the future. All of the activities that will be the subject of the other future applications are outside the scope of the consents sought in this combined application.

The primary objective of the Kupe Phase 2 Development Drilling Programme is to fully develop the Kupe field to maximise production and extend the production plateau length of the field, thereby providing energy security to New Zealand into the future – a positive effect. In addition, potential economic benefits arising from the Kupe Phase 2 Development Drilling Programme could be significant on a regional and national scale. If successful, the proposed activities will enable significant incremental field production, which itself will generate material economic national benefits in respect of production-related jobs, demand-side (consumption) impacts, support for just transition, fiscal benefits to the Crown, gas market impacts, avoidance of higher carbon alternatives, economic efficiency of maximising existing assets/investments, electricity price stability, and export earnings. At a regional level, the projected regional (Taranaki) economic impact equates to 164 full time equivalent years, an increase in household incomes of $11 million, and a boost to the regional Gross Domestic Product of $20.9 million.

An Impact Assessment Area (**IAA**) has been defined, being a circle with a radius of 5 km centred on the Kupe WHP, within which all actual and potential impacts associated with the Kupe Phase 2 Development Drilling Programme will occur, including the deposition of drill cuttings on the seabed.

An Environmental Risk Assessment (**ERA**) has been undertaken to identify the relative significance of the effects of the Kupe Phase 2 Development Drilling Programme on the environment and existing interests. The ERA is based on a likelihood and consequence approach. When considering the actual and potential adverse effects on the environment and existing interests, the following elements were found to influence the overall risk of the proposed activities:

- The drilling will be undertaken in accordance with extensive planning, implementation of monitoring systems, safety measures, and reporting procedures prior to the commencement of any drilling;
- The MODU will only be on location temporarily. Drilling activities that may have effects will occur only during part of the time;

EXECUTIVE SUMMARY

- The effects from any discharges of trace amounts of harmful substances via the deck drainage system of the MODU, if they occur at all, will be intermittent. Rapid mixing of any discharged harmful substance will occur within the receiving waters, meaning any adverse effect would be very localised;
- The high-energy marine environment will rapidly disperse drill cuttings from the MODU, while near-seabed currents will assist in the recovery of any disturbance of the seabed;
- The effects associated with the Kupe Phase 2 Development Drilling Programme will be monitored as per an Environmental Monitoring Plan (set out in the conditions proffered in **Appendix A**) which will outline the pre- and post-drilling monitoring required; and
- The drilling will be undertaken at the Kupe WHP which currently has a 500 m Safety Zone around it under the Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006. This Safety Zone prohibits the entry of any ship into this area unless it is engaged in activities associated with the Kupe WHP or its associated facilities. This Safety Zone will also minimise risks from errant vessels or other marine traffic during the drilling activities.

Based on the above, the overall risk of adverse effects (including cumulative effects) on the environment, excluding effects on cultural values and associations, from planned activities associated with the Kupe Phase 2 Development Drilling Programme is assessed as ***moderate***, with the predicted magnitude of environmental impacts being, at worst, ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as ‘significant’. The CIA prepared by Ngāti Manuhiakai has assessed there to be a ‘high’ residual impact on mauri from some of the proposed activities.

Beach has prepared a set of proffered conditions which are included within **Appendix A**. This set of conditions is based on previous marine consents and marine discharge consents granted by the EPA in favour of other oil and gas operators throughout New Zealand.

This consent application has addressed the matters set out in sections 39, 59, 60, and 61 of the EEZ Act as summarised in **Table 1** to **Table 4.**

The activities which are the subject of this combined application promote the sustainable management of the natural resources of the EEZ. Further, the discharge of harmful substances to the sea will not result in any material harm to the environment meaning the environment will be protected from pollution. Accordingly, the granting of the consents being sought will meet the purpose of the EEZ Act.

EXECUTIVE SUMMARY

Table 1 Section 39 legislative requirements

Section 39 of the EEZ Act	How this Requirement is Met
(1) An impact assessment must –	
(1)(a) – describe the activity (or activities) for which consent is sought; and	This consent application seeks the authorisation of various activities associated with Beach's Kupe Phase 2 Development Drilling Programme, including activities restricted by section 20 and 20B of the EEZ Act. A full description of the marine consent activities is included within **Section 2.2**, and those associated with the marine discharge consent are included within **Section 2.3** of this consent application.
(1)(b) – describe the current state of the area where it is proposed that the activity will be undertaken and the environment surrounding the area; and	The Kupe Phase 2 Development Drilling Programme will be undertaken within the Kupe field, offshore from the southern coast of South Taranaki, offshore and to the south of Manaia. An IAA has been defined in order to define the study area, and to assess the impacts associated with the drilling activities as part of the Kupe Phase 2 Development Drilling Programme (**Figure 10**). **Section 4** contains a detailed description of the current state of the physical environment, biological environment (including sensitive environments and protected species), the cultural environment, and the socio-economic environment within and surrounding the IAA.
(1)(c) – identify persons whose existing interests are likely to be adversely affected by the activity; and	An assessment has been undertaken to identify any persons whose existing interests are likely to be adversely affected by this consent application which is contained within **Section 5**.
(1)(d) – identify the effects of the activity on the environment and existing interests (including cumulative effects and effects that may occur in New Zealand or in the sea above or beyond the continental shelf beyond the outer limits of the Exclusive Economic Zone); and	An ERA has been undertaken in **Section 7** as part of this Impact Assessment (**IA**) to identify the effects of the activities (both planned activities and unplanned events) on the environment and existing interests, including cumulative effects and effects on human health and those that may occur in New Zealand or in the sea above or beyond the continental shelf beyond the outer limits of the EEZ .

EXECUTIVE SUMMARY

Section 39 of the EEZ Act	How this Requirement is Met
(1)(e) – identify the effects of the activity on the biological diversity and integrity of marine species, ecosystems, and processes; and	To identify the effects of the activity on the biological diversity and integrity of marine species, ecosystems, and processes, the ERA contained within **Section 7** of this consent application has been split into various sections based on the proposed activities, each of which have assessed the potential effects on the relevant receptors in the environment. The overall conclusion of these sections is that the risks to the receptors, with the exception of cultural values and associations, from the activities proposed as part of the Kupe Phase 2 Development Drilling Programme are, at worst, ***moderate***, with an associated magnitude of environmental effect of ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as 'significant'. The CIA prepared by Ngāti Manuhiakai has assessed there to be a 'high' residual impact on mauri from some of the proposed activities.
(1)(f) – identify the effects of the activity on rare and vulnerable ecosystems and habitats of threatened species; and	An assessment of the effects of the activity on rare and vulnerable ecosystems and habitats of threatened species is contained throughout **Section 7**. As outlined above, the overall conclusion of these sections is that the risks to the receptors, with the exception of cultural values and associations, from the activities proposed as part of the Kupe Phase 2 Development Drilling Programme are, at worst, ***moderate***, with an associated magnitude of environmental effect of ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as 'significant'. The CIA prepared by Ngāti Manuhiakai has assessed there to be a 'high' residual impact on mauri from some of the proposed activities.
(1)(g) – describe any consultation undertaken with persons described in paragraph (c) and specify those persons who have given written approval to the activity; and	Beach has engaged with parties who have an existing interest in the Kupe Phase 2 Development Drilling Programme, in addition to other stakeholders, as outlined within **Section 5.3**. No persons have provided written approvals at the time of lodgement of this consent application.
(1)(h) – include copies of any written approvals to the activity; and	As described above, no persons have provided written approvals at the time of lodgement of this consent application.
(1)(i) – specify any possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects; and	Beach has considered possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects which are discussed in detail within **Section 8**.

EXECUTIVE SUMMARY

Section 39 of the EEZ Act	How this Requirement is Met
(1)(j) – specify the measures that could be taken to avoid, remedy, or mitigate the adverse effects identified (including measures that the applicant intends to take).	A number of mitigation measures will be implemented throughout the Kupe Phase 2 Development Drilling Programme to avoid, remedy, or mitigate adverse effects. An assessment of the potential consequence for each risk across all receptors, based on the criteria described in **Table 20**, was undertaken on the assumption that all operational procedures and mitigation measures were in place. As a result, these mitigation measures have been considered for each of the activities proposed in **Section 2**, and their potential impacts on the receiving environment throughout **Section 7** by utilising the ERA process.
(2) An impact assessment must also, –	
(2)(a) – if it relates to an application for a Marine Discharge Consent, describe the effects of the activity on human health	The pathways for the proposed marine discharge consent activities to affect human health have been assessed in **Section 7.5**.
(2)(b) – if it relates to an application for a Marine Dumping Consent, – (i) describe the effects of the activity on human health; and (ii) specify any practical opportunities to reuse, recycle, or treat the waste or other matter:	As this consent application is not for a marine dumping consent, section 39(2)(b) is not applicable.
(2)(c) – if it relates to any other application, describe the effects on human health that may arise from the effects of the activity on the environment.	As this consent application includes a marine consent the assessment of effects on human health that may arise from the effects of the activity on the environment has been assessed within **Section 7.5**.
(3) – An impact assessment must contain the information required under subsections (1) and (2) in –	
(3)(a) – such detail as corresponds to the scale and significance of the effects that the activity may have on the environment and existing interests; and	This IA has considered the scale and significance of the effects that the activities associated with the Kupe Phase 2 Development Drilling Programme may have on the environment and existing interests, and the detail within this IA addressing the information required under sections 39(1) and (2) has taken this into account.

EXECUTIVE SUMMARY

Section 39 of the EEZ Act	How this Requirement is Met
(3)(b) – sufficient detail to enable the Environmental Protection Authority and persons whose existing interests are or may be affected to understand the nature of the activity and its effects on the environment and existing interests.	This consent application has been prepared in such detail as corresponds to the scale and significance of the potential impacts of the activity, and to provide adequate and appropriate information for the EPA and those persons who have existing interests to understand the nature of the activity (**Section 2**) and the effects on the marine environment and existing interests (**Section 7**).
(4) – The impact assessment complies with subsections (1)(c) to (f) and (2) if the Environmental Protection Authority is satisfied that the applicant has made a reasonable effort to identify the matters described in those provisions.	A comprehensive assessment of the existing environment (**Section 4**) and existing interests (**Section 5.2**) associated with the IAA has been undertaken. Based on this information, a detailed ERA has been undertaken within **Section 7** to determine the potential impacts and associated magnitude of environmental effects on the environment and existing interests. It is considered that the information contained within these sections provide the EPA with sufficient and appropriate information to consider the application under sections 39(1)(c) to (f) and 39(2).
(5) – The measures that must be specified under subsection (1)(j) include any measures required by another marine management regime and any measures required by or under the Health and Safety at Work Act 2015 that may have the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests.	An assessment of other marine management regimes has been undertaken within **Section 3.4** to outline any measures that may have the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests.

EXECUTIVE SUMMARY

Table 2 Section 59 considerations

Section 59 of the EEZ Act	How this Requirement is Met
(2) – If the application relates to a section 20 activity (other than an activity referred to in section 20(2)(ba)), a Marine Consent Authority must take into account –	
(2)(a) – any effects on the environment or existing interests of allowing the activity, including – (i) cumulative effects; and (ii) effects that may occur in New Zealand or in the waters above or beyond the continental shelf beyond the outer limits of the exclusive economic zone; and	As outlined within **Table 1**, an ERA (included within **Section 7**) has been undertaken as part of this consent application which identifies the effects of the Kupe Phase 2 Development Drilling Programme on the environment and existing interests, including an assessment on the potential cumulative effects (**Section 7.7**). The overall conclusion of **Section 7** is that the risks to the receptors, with the exception of cultural values and associations, are, at worst, ***moderate***, with an associated magnitude of environmental effect of ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as 'significant'. The CIA prepared by Ngāti Manuhiakai has assessed there to be a 'high' residual impact on mauri from some of the proposed activities. Effects that may occur in New Zealand are included in **Section 7.6**.
(2)(b) – the effects on the environment or existing interests of other activities undertaken in the area covered by the application or in its vicinity, including – (i) the effects of activities that are not regulated under this Act; and (ii) effects that may occur in New Zealand or in the waters above or beyond the continental shelf beyond the outer limits of the Exclusive Economic Zone; and	Other users utilise the wider offshore Taranaki area, including for fishing (both commercial and recreational), shipping, and other oil and gas activities (as detailed within **Section 4.5**) and these activities are dispersed over a wide area. The cumulative effects section of this IA (**Section 7.7**) includes an assessment of these activities that are not regulated under the EEZ Act.
(2)(c) – the effects on human health that may arise from effects on the environment; and	The potential effects on human health that may arise from effects on the environment has been included within the discussion contained in **Section 7.5**.

EXECUTIVE SUMMARY

Section 59 of the EEZ Act	How this Requirement is Met
(2)(d) – the importance of protecting the biological diversity and integrity of marine species, ecosystems, and processes; and	A detailed description of the existing environment within and surrounding the IAA is contained within **Section 4** and an ERA has been undertaken to determine the potential impacts on this existing environment (in addition to existing interests), outlined within **Section 7**. Contained within these sections is information relating to the biological diversity and integrity of marine species, ecosystems, and processes within and surrounding the IAA. The overall conclusion of these sections is that the risks to the receptors, with the exception of cultural values and associations, from the activities proposed as part of the Kupe Phase 2 Development Drilling Programme are, at worst, ***moderate***, with an associated magnitude of environmental effect of ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as 'significant'. The CIA prepared by Ngāti Manuhiakai has assessed there to be a 'high' residual impact on mauri from some of the proposed activities.
(2)(e) – the importance of protecting rare and vulnerable ecosystems and the habitats of threatened species; and	Similar to section 59(2)(d) discussed above, any potential rare and vulnerable ecosystems and habitats of threatened species have been identified within the existing environment section (**Section 4**). An assessment of potential impacts on these environments has been included within the ERA (**Section 7**). The overall conclusion of **Section 7** is that the risks to the receptors, with the exception of cultural values and associations, from the Kupe Phase 2 Development Drilling Programme are, at worst, ***moderate***, with an associated magnitude of environmental effect of ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as 'significant'. The CIA prepared by Ngāti Manuhiakai has assessed there to be a 'high' residual impact on mauri from some of the proposed activities.
(2)(f) – the economic benefit to New Zealand of allowing the application; and	An assessment of the economic benefits of the Kupe Phase 2 Development Drilling Programme to New Zealand has been summarised within **Section 6**, with the full commissioned report contained in **Appendix H**.
(2)(g) – the efficient use and development of natural resources; and	The primary objective of the Kupe Phase 2 Development Drilling Programme is to fully develop the Kupe field, to maximise production, and to extend the production plateau length of the field, providing energy security to New Zealand. In doing so, the Kupe Phase 2 Development Drilling Programme will provide for the efficient use and development of natural resources within PML 38146.

EXECUTIVE SUMMARY

Section 59 of the EEZ Act	How this Requirement is Met
(2)(h) – the nature and effect of other marine management regimes; and	An assessment of the relevant marine management regimes has been undertaken within **Section 3.4**, including the identification of any provisions within these regimes which will provide additional measures to avoid, remedy, or mitigate adverse effects from the activities associated with the Kupe Phase 2 Development Drilling Programme.
(2)(i) – best practice in relation to an industry or activity; and	The Ministry for the Environment has developed "Environmental Best Practice Guidelines for the Offshore Petroleum Industry" (MfE, 2006). These guidelines refer specifically to petroleum development and production activities and provide four key requirements for development and production activities: environmental assessment, health, safety and environment case, monitoring and reporting, and training and education. Beach is committed to following industry best practice and will comply with these requirements as appropriate for all operations.
(2)(j) – the extent to which imposing conditions under section 63 might avoid, remedy, or mitigate the adverse effects of the activity; and	A set of draft conditions is proffered within **Appendix A** which have been developed in accordance with section 63 of the EEZ Act and will provide further assurances that adverse effects from the activities associated with this consent application will be avoided, remedied, or mitigated.
(2)(k) – relevant regulations (other than EEZ policy statements); and	The applicable regulations and laws relevant to this activity have been considered within **Section 3.4**.
(2)(l) – any other applicable law (other than EEZ policy statements); and	
(2)(m) – any other matter the Marine Consent Authority considers relevant and reasonably necessary to determine the application.	It is considered there are no other matters relevant to this consent application that have not already been covered in this IA.
(2A) – If the application is for a Marine Discharge Consent, the EPA must take into account –	
(2A)(a) – the matters described in subsection (2), except paragraph (c); and	The matters within section 59(2) have all been discussed in detail above, and within the relevant sections of the IA, excluding paragraph (c).
(2A)(b) – the effects on human health of the discharge of harmful substances if consent is granted.	The potential effects on human health of the discharge of harmful substances if consent is granted is discussed within **Section 7.5**.

EXECUTIVE SUMMARY

Section 59 of the EEZ Act	How this Requirement is Met
(2B) – If the application is for a marine dumping consent or relates to an activity referred to in section 20(2)(ba), the EPA must take into account—	
(2B)(a) – the matters described in subsection (2), except paragraphs (c), (f), (g), and (i); and	Section 59(2B) is not relevant to this consent application as it is not for a marine dumping consent.
(2B)(b) – the effects on human health of the dumping of waste or other matter, or the abandonment of the pipeline, if consent is granted; and	
(2B)(c) – any alternative methods of disposal of the waste, other matter, or pipeline that could be used; and	
(2B)(d) – whether there are practical opportunities to reuse, recycle, or treat the waste, other matter, or pipeline.	
(3) – the Marine Consent Authority must have regard to –	
(3)(aa) – EEZ policy statements; and	There are no relevant EEZ policy statements available at the time of drafting this consent application.
(3)(a) – any submissions made and evidence given in relation to the application; and	Section 59(3)(a) is not discussed within this consent application as the content of any submissions and evidence is not currently known for this consent application.
(3)(b) – any advice, reports, or information sought under this Part and received in relation to the application; and	Section 59(3)(b) is not discussed within this consent application as the content of any advice, reports or information sought is not currently known for this consent application.
(3)(c) – any advice received from the Māori Advisory Committee.	Section 59(3)(c) is not discussed within this consent application as the content of any advice received from the Māori Advisory Committee is not currently known for this consent application.

EXECUTIVE SUMMARY

Section 59 of the EEZ Act	How this Requirement is Met
(4) – When considering an application affected by section 74, the Marine Consent Authority must also have regard to the value of the investment in the activity of the existing consent holder.	Section 59(4) is not relevant to this consent application.
(5) – Despite subsection (3), the marine consent authority must not have regard to -	
(5)(a) – trade competition or the effects of trade competition; or	Trade competition, or the effects of trade competition, and the effects on climate change of discharging greenhouse gases into the air have not been discussed within this consent application as they are outside the scope of this consent application and the EPA must not have regard to them. No written approvals have been obtained at the time of lodgement of this consent application.
(5)(b) – the effects on climate change of discharging greenhouse gases into the air; or	
(5)(c) – any effects on a person’s existing interest if the person has given written approval to the proposed activity.	
(6) – Subsection (5)(c) does not apply if the person has given written approval by the person withdraws the approval by giving written notice to the Marine Consent Authority -	No written approvals have been obtained at the time of lodgement of this consent application.
(6)(a) – before the date of the hearing, if there is one; or	
(6)(b) – if there is no hearing, before the Marine Consent Authority decides the application.	

EXECUTIVE SUMMARY

Table 3 Section 60 considerations

<table>
<tr><th>Section 60 of the EEZ Act</th><th>How this Requirement is Met</th></tr>
<tr><td colspan="2">In considering the effects of an activity on existing interests under section 59(2)(a), a marine consent authority must have regard to –</td></tr>
<tr><td>(a) – the area that the activity would have in common with the existing interest; and</td><td rowspan="4">An assessment of the person(s) that have an existing interest in relation to this consent application has been undertaken within Section 5.2, which has identified two persons that have an existing interest.</td></tr>
<tr><td>(b) – the degree to which both the activity and the existing interest must be carried out to the exclusion of other activities; and</td></tr>
<tr><td>(c) – whether the existing interests can be exercised only in the area to which the application relates; and</td></tr>
<tr><td>(d) – any other relevant matter.</td></tr>
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EXECUTIVE SUMMARY

Table 4 Section 61 considerations

Section 61 of the EEZ Act	How this Requirement is Met
(1) When considering an application for a marine consent, a marine consent authority must –	
(1)(a) – make full use of its powers to request information from the applicant, obtain advice, and commission a review or a report; and	Should the EPA see the need for any additional information in relation to this consent application, Beach will respond in due course.
(1)(b) – base decisions on the best available information; and (1)(c) – take into account any uncertainty or inadequacy in the information available.	Beach has made all reasonable efforts to provide the information required by utilising the best available information, including the most recent studies aimed at describing the existing environment (**Section 4**) and identifying existing interests (**Section 5**) in order to assess the potential effects from the proposed Kupe Phase 2 Development Drilling Programme on those matters (**Section 7**). Any uncertainties associated with this consent application do not mean that the assessments and conclusions within this consent application are uncertain or inadequate. Rather, the approach taken in the preparation of this consent application has enabled the appropriate assessments of potential effects on the environment to be made so that the requirement to favour caution does not arise. This approach has involved using worst-case scenario assumptions to account for any possible uncertainty. Further, the information presented in this consent application is the best available information without unreasonable cost, effort, or time.
(2) – If, in relation to making a decision under this Act, the information available is uncertain or inadequate, the Marine Consent Authority must favour caution and environmental protection.	As discussed in relation to section 61(1)(b) of the EEZ Act above, it is considered that the information provided within this consent application is the best information available at the time of submission and is adequate for the EPA to make its decision.
(3) – If favouring caution and environmental protection means that an activity is likely to be refused, the Marine Consent Authority must first consider whether taking an adaptive management approach would allow the activity to be undertaken.	This subsection is not discussed in this consent application.

EXECUTIVE SUMMARY

Section 61 of the EEZ Act	How this Requirement is Met
(4) – subsection (3) does not -	
(4)(a) – apply to an application for – (i) a Marine Dumping Consent or (ii) a Marine Discharge Consent; or (iii) a Marine Consent in relation to an activity referred to in section 20(2)(ba); or	This subsection is not discussed in this consent application.
(4)(b) - limit section 63 or 64	This subsection is not discussed in this consent application.
(5) – in this section, best available information means the best information that, in the particular circumstances, is available without unreasonable cost, effort, or time.	As discussed in relation to section 61(1)(b) of the EEZ Act above, it is considered that the information provided within this consent application is the best information available at the time of submission.

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

CONTENTS

FIGURES

CONTENTS

CONTENTS

APPENDICES

ABBREVIATIONS AND DEFINITIONS

AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
bbl	Barrel
Beach	Beach Energy Resources NZ (Kupe) Limited
BOP	Blow-out Preventer
Calypso Science	Calypso Science Limited
CHARM	Chemical Hazard and Risk Management
CIA	Cultural Impact Assessment
CMA	Coastal Marine Area
Code of Conduct	Department of Conservation Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations
CPT	Cone Penetration Testing
CRMS	Craft Risk Management Standard – Biofouling on Vessels Arriving to New Zealand
D&D Regulations	Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015
DOC	Department of Conservation
DP	Dynamic Positioning
EC_{50}	Effects Concentration
EEZ Act	Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
EEZ	Exclusive Economic Zone
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Authority
ERA	Environmental Risk Assessment

CONTENTS

ESRP	Emergency Spill Response Plan
FMA	Fisheries Management Area
FNZ	Fisheries New Zealand
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GHS 7	United Nations Globally Harmonised System of Classification and Labelling of Chemicals, 7th revised edition, 2017
HSWPEE Regulations	Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016
IA	Impact Assessment
IAA	Impact Assessment Area
IHS	Import Health Standard: Ballast Water from All Countries
IMMA	Important Marine Mammal Area
Kupe WHP	Kupe Wellhead Platform
LC_{50}	Lethal Concentration
LWD	Logging While Drilling
MACA	Marine and Coastal Area (Takutai Moana) Act 2011
MARPOL	International Convention for the Prevention of Pollution from Ships
MMP 55581	Minerals Mining Permit 55581
MMPR	Marine Mammal Protection Regulations 1992
MMR	Marine Management Regime
MNZ	Maritime New Zealand
MODU	Mobile Offshore Drilling Unit
MWD	Measurement While Drilling
NIMS	Non-indigenous Marine Species
Ngaruahine	Te Korowai o Ngāruahine Trust
Ngāti Manuhiakai	Ngāti Manuhiakai hapū
Ngāti Ruanui	Te Runanga o Ngāti Ruanui Trust
NM	Nautical Mile
NOEC	No Observable Effects Concentration
NZCPS	New Zealand Coastal Policy Statement
OIW	Oil-in-Water
OSCP	Oil Spill Contingency Plan
OTEMP	Recommendations for an Offshore Taranaki Environmental Monitoring Protocol: Drilling- and production-related discharges
OWS	Oily Water Separator
PAH	Polycyclic Aromatic Hydrocarbons

CONTENTS

Permitted Activities Regulations	Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013
PML 38146	Petroleum Mining Permit 38146
PNEC	Predicted No Effects Concentration
ppm	Parts Per Million
PRCP for Taranaki	Proposed Regional Coastal Plan for Taranaki
PTS	Permanent Threshold Shift
RMA	Resource Management Act 1991
ROV	Remotely Operated Vehicle
SDS	Safety Data Sheet
Sodium hypochlorite	SODIUM HYPOCHLORITE POTABLE GRADE
SSC	Suspended Sediment Concentration
STB	South Taranaki Bight
TAD	Tender Assisted Drilling
The Notice	Hazardous Substances (Hazard Classification) Notice 2020
TIA	Towed Imaging Array
TRC	Taranaki Regional Council
TSS	Total Suspended Sediment
TTRL	Trans-Tasman Resources Limited
TTS	Temporary Threshold Shift
VSP	Vertical Seismic Profiling
WBM	Water-based muds
WCCP	Well Control Contingency Plan
WCNI MMS	West Coast North Island Marine Mammal Sanctuary
WFT	Wireline Formation Testing
WWCI	Wild Well Control Incorporated

1 Introduction

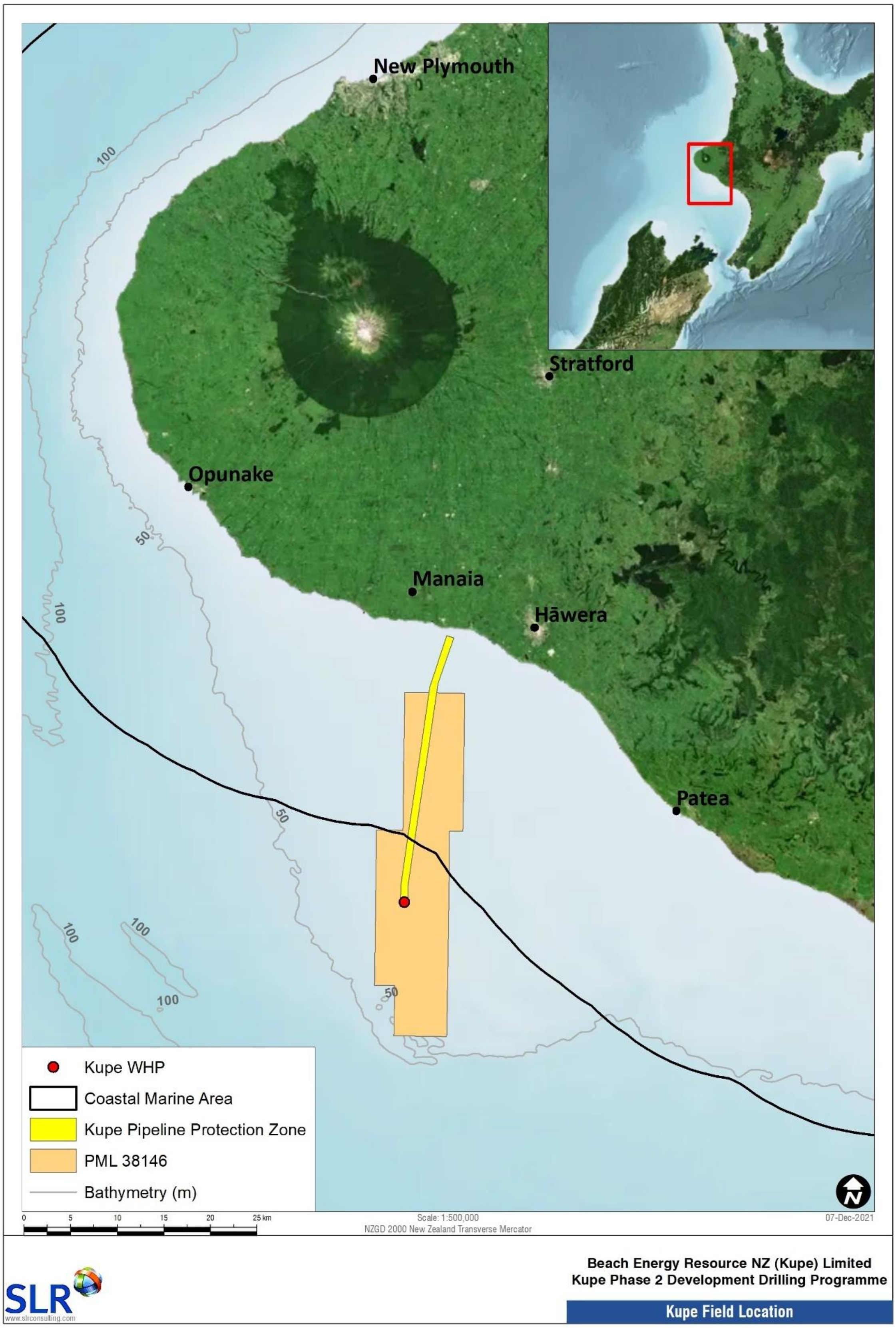
1.1 Purpose of the Application

Beach Energy Resources NZ (Kupe) Limited (**Beach**) is applying for a marine consent and a marine discharge consent (this combined application is hereafter referred to as the **consent application**) from the Environmental Protection Authority (**EPA**) under section 38 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (**EEZ Act**). This consent application seeks to authorise various activities associated with Beach's proposed Kupe Phase 2 Development Drilling Programme within Petroleum Mining Licence 38146 (**PML 38146**), being activities restricted by section 20 and 20B of the EEZ Act.

PML 38146 is located in the Taranaki Basin, offshore and to the south of Manaia. Beach is proposing to drill up to two development wells at the existing unmanned Kupe Wellhead Platform (**Kupe WHP**). The location of PML 38146 and the Kupe WHP are shown in **Figure 1**. Details of the activities associated with the Kupe Phase 2 Development Drilling Programme for which consent is sought are provided within **Section 2**.

Beach is proposing to undertake the drilling associated with the Kupe Phase 2 Development Drilling Programme using a mobile offshore drilling unit (**MODU**). A specific MODU to undertake the drilling programme has not yet been contracted, however, Beach will use a jack-up MODU (hereafter just referred to as the MODU) for the drilling activities due to the shallow water depth in the Kupe field.

Figure 1 General location map



1.2 Structure of the Application

Section 2 presents information on the proposed Kupe Phase 2 Development Drilling Programme which are subject to this consent application.

Section 3 describes the legislative framework that this Impact Assessment (**IA**) has been prepared in accordance with and explains how all relevant regulatory requirements will be complied with.

Section 4 describes the existing environment in and around the Kupe field; including the physical, biological, cultural, and socio-economic environments.

Section 5 presents information on the persons with existing interests as well as the engagement process that Beach has undertaken.

Section 6 describes the economic benefit to New Zealand of allowing the application.

Section 7 details the Environmental Risk Assessment (**ERA**) component of the IA. This section describes the nature of the activities that are the subject of this consent application and the associated effects on the environment and persons with existing interests, taking into account the measures to avoid, remedy, or mitigate effects of the proposed activity.

Section 8 outlines the consideration of alternatives to the activities proposed within this consent application.

Section 9 provides a commentary on the conditions proffered by Beach, which are themselves contained within **Appendix A**.

Section 10 outlines the purpose of the EEZ Act and commentary on how this consent application meets the purpose.

Section 11 presents the conclusions of the IA.

Section 12 lists the references cited in this document.

There are several appendices (**Appendix A** to **Appendix J**) which contain reports and information that have been utilised throughout this consent application.

2 Activity Description

2.1 Description of the Kupe Field

2.1.1 Taranaki Basin Geology

The Taranaki Basin is located along the west coast of the North Island of New Zealand and covers an area of about 115,000 square kilometres, most of which is offshore.

The Taranaki Basin was formed in the Late Cretaceous due to rifting associated with the breakup of Gondwana and the separation of New Zealand and Australia. This extension created a series of half-graben depocentres that were progressively filled with non-marine syn-rift strata followed by later marine transgression.

The Taranaki Basin was part of a large passive margin setting during the Paleocene and Eocene that culminated in maximum marine transgression in the Oligocene with widespread limestone deposition.

Tectonic compression and major uplift occurred in the Miocene and parts of the Taranaki Basin were inverted. The Pliocene to Recent has featured rapid progradation of the shelf and the development of thick clinoforms.

The main source rocks in the Taranaki Basin are Late Cretaceous to Paleocene-aged coals and coaly shales. These source rocks are buried unevenly across the basin and produce oil, gas, and condensate depending on their depth of burial and thermal maturity. Reservoir and seal units are present throughout the Late Cretaceous to Miocene section and stacked pay intervals are common.

2.1.2 Kupe Field

The Kupe field (**Figure 1**) is located ~30 km south of the Taranaki coastline in about 35 m of water. The discovery well Kupe South-1 (KS-1) was drilled in 1986 and flowed 2,000 barrels (**bbl**) per day of oil and 5.4 million standard cubic feet per day of gas. This was followed by the drilling of KS-2 in 1987, and the KS-3 well and sidetracks (KS-3a and KS-3b) in 1988. KS-2 and KS-3 both encountered a significant gas column, with a thin viscous oil rim.

The Kupe field produces through the unmanned Kupe WHP built above the three field production wells and the platform can accommodate up to six wellheads. A 12” diameter multiphase subsea pipeline transports the raw gas and liquids from the Kupe WHP to the Taranaki shore to an onshore production station where it is processed. Once processed, an 11.7 km sales gas pipeline takes natural gas from the production station to Kapuni where it is injected into the North Island transmission network. Condensate is transported from the production station via road and shipped internationally, while LPG is transported via road for the local market. The Kupe WHP wells are a critical part of New Zealand’s energy infrastructure and provide around 15% of the country’s natural gas as well as meeting half of the country’s LPG demand.

2.2 Marine Consent Activities

2.2.1 Pre-Drill Works

Pre-drill works are required prior to the arrival of the MODU at the Kupe WHP which are discussed in the following sections. Beach is applying for a marine consent under section 20(2)(a), (2)(d), (2)(e), (2)(f), (2)(g), and (4)(b) of the EEZ Act for these pre-drill works.

2.2.1.1 Seabed Surveys

Seabed surveys may need to be undertaken before drilling the development wells. These may include geotechnical coring and/or Cone Penetration Testing (**CPT**) to assess seabed conditions prior to arrival of the MODU. These seabed surveys will likely take place from a vessel utilising standard industry equipment that is lowered to the seabed and powered by the vessel using either electrical or hydraulic means. Piston corers are typically used to collect seabed samples from the top 5 – 6 m of seabed. CPT involves the pushing of a 5 – 10 cm^2 cone up to 30 m into the seabed to determine the resistance of the near-surface sediments.

For both coring and CPT surveying, the area of disturbed seabed is minimal due to the small size of the coring or testing tool. Both methods of seabed surveying are deployed from a vessel that maintains station using Dynamic Positioning (**DP**). Therefore, the only potential for seabed disturbance is from the actual coring and CPT surveying; examples of the scale of the likely disturbance are provided below for what may be undertaken at as part of the pre-drill works.

As an example, previous similar operations undertaken by Beach utilised a piston coring device which extracted three cores, with 67 mm internal diameters and lengths of ~5 m, being recovered from the seabed. Based on these dimensions, a full core sample from this sampler collects approximately 0.018 m^3 of sediment per core. In some situations, more than one core may be attempted per site where insufficient penetration or recovery is achieved.

In terms of CPT operations, the seabed disturbance from the cone is 0.03 m^3 per CPT, with no sediments being removed. However, to undertake the CPT operations, the cone is within a heavy piece of equipment, with approximate dimensions of 3 x 3 m with a weight of approximately 5,000 kg. So, the area of disturbance to the seabed for each CPT test will be in the order of approximately 9 m^2.

2.2.1.2 Site Clearance

Should the seabed survey(s) identify any anthropogenic debris or material in the area where the MODU will be installed, these may be required to be removed. If any material is proposed to removed then this will be done utilising an Remotely Operated Vehicle (**ROV**) and generally involves the material being relocated away an appropriate distance.

2.2.2 Installation of Mobile Offshore Drilling Unit

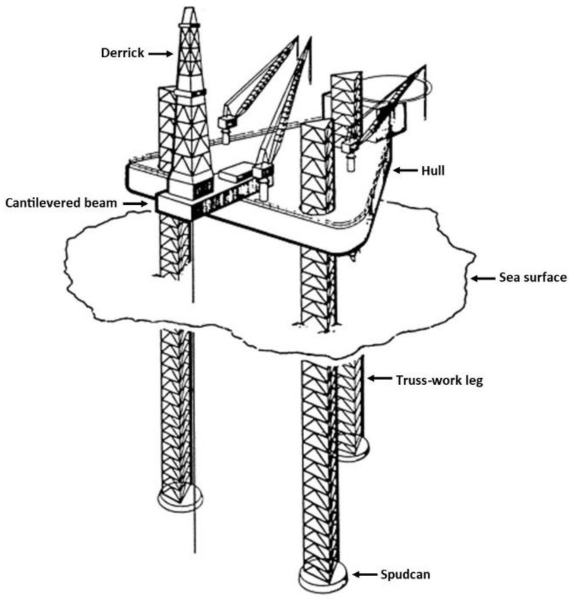
2.2.2.1 Introduction

The MODU selected for the Kupe Phase 2 Development Drilling Programme will depend on the suitability and availability of the MODU at the time the drilling is planned to commence.

Beach is applying for a marine consent for the installation of a MODU under section 20(2)(a), (2)(e), (2)(f), (2)(g), (4)(a), and (4)(b) of the EEZ Act. The process of installing the MODU is described below.

A jack-up MODU (**Figure 2**) is comprised of a buoyant hull that holds all of the drilling equipment which is fitted with three (sometimes four) moveable legs that are jacked down to the seabed to raise the hull out of the water. On the base of each leg is a spudcan which is an inverted cone that provides stability to vertical and lateral forces on the MODU.

Figure 2 Simplified diagram of a generic jack-up MODU



Source: Adapted from Williams, *et al.*, 1998

For the proposed drilling activities at the Kupe WHP, the MODU will be required to cantilever over the platform itself so it can drill through the existing empty conductor slots. **Figure 2** shows a drilling derrick mounted on cantilevered beam which extends outward from the drilling deck. A further example of this can be seen in **Figure 3**, which shows the Ensco 107 jack-up MODU cantilevered over the Kupe WHP during the last drilling programme undertaken in the Kupe field.

Figure 3 Example of jack-up MODU cantilevered over the Kupe WHP

Note: The Kupe WHP is in the forefront of the figure, painted yellow.

2.2.2.2 Soft Pinning

It may be necessary to temporarily position the MODU somewhere away from the Kupe WHP. This temporary positioning is known as 'soft pinning' the legs in a 'standing off' location. If soft pinning is to occur, this would be in close proximity to the Kupe WHP and within the 'Safety Zone' that extends 500 m from the Kupe WHP (discussed in more detail in **Section 3.4.2**).

Soft pinning involves at least one of the legs being lowered until the bottom of its spudcan is only just touching the seabed. If all legs are touching the seabed as part of this process, the disturbance associated with the soft pinning will be similar to those outlined in **Table 5**. This is in order to provide a 'stop' point during the 'Arriving On Location' process. At this stop point, all of the necessary preparations can be made before moving the MODU to its final location. These preparations may include running lines, powering up any thrusters on the unit, and coordinating with assisting tugs.

2.2.2.3 Final Location Approaching

Regardless of whether the MODU makes a stop at a soft pin location (discussed in **Section 2.2.2.2**) or remains directly on course to its final location beside the Kupe WHP, there will need to be some way of positioning the MODU properly for ballasting or preloading operations. The holding position is achieved by traveling to the location with all legs lowered to just above the seabed. Once the MODU reaches the final location, the legs are then lowered so that they can securely hold the MODU on location without the need for tugs.

2.2.2.4 Installation of the MODU

The MODU needs to be installed alongside the Kupe WHP prior to drilling commencing. The duration the MODU is on location will depend on various factors, such as the total depth and difficulty of the well, the degree of formation evaluation operations, and adverse weather conditions delaying operations. In addition, as this consent application includes the drilling of up to two development wells at the Kupe WHP, various activities will be required upon completing the drilling of the development wells in order to tie back the well into the operations onboard the Kupe WHP, which may extend the time that the MODU is on location.

It is anticipated that each of the development wells will be completed within 79 days. In order to account for any operational or weather constraints, this consent application has assumed a 95-day time period for assessment purposes for each well to be drilled.

Once the MODU has been moved into place by the support vessels, the legs are jacked down onto the seabed and a process called pre-loading is undertaken. Pre-loading involves the intake of additional ballast water on the hull of the MODU to increase its weight. This weight drives the legs securely into the seabed to a point where they will not penetrate further. After pre-loading operations are completed, the hull of the MODU is then raised out of the water using the jacking system to a pre-determined height above the sea surface so that wave, tidal and current loadings only act upon the legs and not the hull itself.

The extent of the disturbance from the installation of a MODU is directly correlated to the size of each spudcan, and the number of legs on the MODU. Typically, spudcans have an area of approximately 240 m^2 per leg (based on a spudcan diameter of approximately 17.5 m). This represents a maximum total area of 960 m^2 for a MODU with four legs (**Table 5**). Should soft pinning be required, there is a potential that the areas of disturbance may be double those presented in **Table 5**, dependant on how many legs are required to be lowered as part of the 'stop' point (discussed in **Section 2.2.2.2**).

Table 5 Summary of approximate area of disturbance for the installation of a jack-up MODU

Description	Approximate disturbance of seabed (m^2)		
	Per leg	Three legs	Four legs
Placement of spudcans	240	720	960

2.2.3 Drilling

2.2.3.1 Introduction

Beach is proposing to drill up to two development wells at the Kupe WHP as part of the Kupe Phase 2 Development Drilling Programme. The depth of the two development wells be approximately 3,370 m True Vertical Depth Subsea.

The primary objective of the Kupe Phase 2 Development Drilling Programme is to fully develop the field, to maximise production, and extend the production plateau length of the field, thereby providing energy security to New Zealand. Initially one development well is planned, with drilling the second development well being contingent on the results of the first well. This additional development well (if drilled) will further assist in securing further energy security to New Zealand.

Once installed, the well(s) will be connected to the existing tie-in points on the Production Header and Blow Gas Header on the Kupe WHP, consistent with the existing Kupe WHP Basis of Design. Most of the associated infrastructure installation may occur during Simultaneous Operations with the drilling team, to utilise the MODU facilities.

Beach is applying for a marine consent for drilling and installation of well casing/tubing under section 20(2)(a), (2)(b), (2)(d), (2)(e), (2)(f), (2)(g), and (4)(b) of the EEZ Act.

2.2.3.2 Development Well Drilling

The development wells will be drilled via existing empty conductors on the Kupe WHP. The conductors are 26" in diameter and were previously driven to ~52 m below the seabed. The initial drilling will involve removal/cleaning of any sediment that may be present within the conductor. A diverter will be installed above, and connected to, the conductor via an extension pipe. The diverter will be in place during the drilling of the first and second (potentially) hole sections (22" and 17.5" in diameter, respectively) below the conductor. A diverter is device used to direct fluid flowing from a well away from the drilling rig in the event a 'kick'[1] is encountered at shallow depths and allows the contents of the well to flow through side outlets (diverter lines).

Casing, with a diameter of 18 5/8", will be installed and cemented in the 22" hole, after which a wellhead will be installed at the Kupe WHP level. The wellhead will be connected to a blow-out preventer (**BOP**) located on the MODU by way of a short length (approximately 6-10 m) of high-pressure pipe. A BOP is a piece of safety equipment designed to prevent uncontrolled flow of formation fluids during drilling and completion operations. A BOP consists of a set of valves that may be closed remotely by the drilling crew in the event that unexpected well pressures are encountered or for any reason there is concern about loss of control of the well fluids.

Drilling will then continue involving a series of reducing diameter holes (from 17.5"[2] to 8.5" in diameter) with casings installed which are cemented in place. The development wells will involve both vertical and angled drilling – in the case of the first development well the drilling will be directed in a south-westerly direction from the Kupe WHP. The total measured length of drilling of the first development well will be ~4,200 m and will reach a True Vertical Depth Subsea of ~3,370 m. The bottom section of the development wells consists of a cemented 5" diameter liner.

[1] A kick is an unwanted influx of formation fluid, oil, water, or gas into the wellbore due to an underbalanced condition in which pressure inside the wellbore or bottom-hole pressure is less than formation pressure.
[2] The size of the lower sections of the wells are yet to be confirmed, however 17.5" will be the largest diameter.

Once the liner has been installed the well will be completed. The well completion will commence by running a drill pipe and various tools that are designed to clean the liner and casing, then circulating a series of chemical pills designed to clean residual drilling mud from the wall of the casing. These chemicals will be followed by filtered water (seawater) until the returned water has achieved the required cleanliness. Once this has been completed, the drill pipe and tools will be removed from the well. The completion can then be installed, which will consist of a 5½" diameter tubing string which will include various items of completion equipment including a packer which will seal the bottom section of the well from the annular space between the tubing and the production casing, pressure and temperature gauges, connected back to the surface, which provide valuable data for managing the reservoir, chemical injection system to allow treatment of any flow assurance issues, and a surface controlled subsurface safety valve, which can be closed in the event of any loss of containment at the surface throughout well life. After the completion has been run and tested to verify its performance a 'xmas tree'[3] will be installed on the well at the surface. The xmas tree will provide production control for the life of the well. The packer and the tubing and other completion items above the packer form part of the primary well barrier envelope.

After completion of the well a series of perforations are created by use of shaped charges over a length of approximately 70 - 100 m through the 5" liner and cement. These perforations connect the reservoir with the well and it is through these perforations that the hydrocarbons flow. These perforations will be undertaken utilising explosive charges at a significant depth below the seabed (i.e. over 3 km), with no vibrations anticipated to be felt at the seabed or through the water column.

2.2.3.3 Directional Control

Due to the close proximity (short distance) between the wells across 22" hole (18-5/8" casing) sections, very robust directional drilling control is required to avoid any collision event with the existing production well(s).

Directional control is usually managed by taking directional survey data points (inclination, azimuth, depth) at every 30 m (or more frequently) using Measurement While Drilling (**MWD**) tools. Directional survey data received from the MWD tools are used to position the wellbore as per the planned trajectory.

A typical MWD tool uses an accelerometer and magnetometer to measure inclination and azimuth, respectively. An accelerometer sensor uses Earth's gravitational force to measure inclination at a desired surveying depth. A magnetometer sensor uses Earth's magnetic field to measure azimuth at a desired surveying depth.

In a situation where a close proximity with other offset well exists (e.g. platform, templates, etc.), the magnetometer component of a MWD tool is highly affected by external magnetic fields caused by casing (steel) that is installed in offset well(s) in close proximity. This problem is called 'magnetic interference' and it leads to inaccurate well placement that may result in a collision event. In order to mitigate this risk, Beach is planning to use a Gyro type surveying tool that could be deployed as part of the Drilling Bottom Hole Assembly or Wireline. Gyro tools calculate azimuth by sensing the angular speed, or rate, of Earth's rotation and are not affected by magnetic interference.

[3] An 'xmas tree' (also referred to as a Christmas Tree) is an assembly of valves, casing spools, and fittings used to regulate the flow of pipes in a well.

2.2.3.4 Installation of Well Casing

As each section of a well is completed, a casing or liner will be installed and cemented into place to prevent hole collapse and maintain well integrity. The cement is pumped from the MODU to the bottom of the casing shoe and is pushed up the outside of the casing to ensure it is fixed in the ground and that no flow paths exist up the outside of the well.

The volume of engineered cement required for the well casing is calculated to ensure minimum volumes remain on the MODU once cementing is complete. On completion of cementing operations, the system will be washed with up to 3 m^3 of wash-water and discharged overboard. It is estimated that this discharge would be >95% water and the discharge would occur over approximately 30 minutes until the cement unit and topside pipework is cleaned sufficiently.

As well as cement, small amounts of steel swarf and polymer may be removed from the well during drilling. The majority of this material is then separated out during the processing of cuttings and disposed of overboard.

2.2.3.5 Drilling Fluids

Drilling fluids, which are also known as drilling 'muds', are required during the drilling process for a variety of reasons, including:

- Providing a well control barrier by exerting hydrostatic pressure to prevent an influx of gas or fluid into the wellbore;
- Preserving wellbore stability, prevent hole collapse and prevent shale destabilisation;
- Minimising formation damage by optimising downhole hydraulics;
- Transporting drill cuttings to the surface;
- Cooling and lubricating the drill bit and drill string; and
- Providing information to the drillers and geologists about what is happening downhole, the geology being drilled and the nature of the pore fluids.

A water-based muds (**WBM**) system will be utilised as part of the Kupe Phase 2 Development Drilling Programme and these will ultimately be deposited on the seafloor via two different pathways. The drilling fluids will either be attached to the drill cuttings (which are discussed further under deposition of drill cuttings in **Section 2.2.4**), or they will be batch discharged from the MODU either: 1) to freshen the mud system and bring the chemical and mechanical properties back into specification; or 2) at the end of a well when they cannot be reused. Beach is applying for a marine consent for this activity under sections 20(2)(e), (2)(f), and (2)(g) of the EEZ Act.

Drilling fluids can include products that are deemed to be 'harmful' under the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015 (**D&D Regulations**). At the time of lodging this consent application a preferred supplier for the drilling fluids has yet to be contracted and, as such, the list of substances is not finalised. Therefore, to avoid potential uncertainty with the fluids involved, Beach will be applying for a separate marine discharge consent for the discharge of any drilling fluids that are deemed to be harmful substances once they are known.

2.2.4 Deposition of Drill Cuttings

Drill cuttings are ground-up rock produced as the well is drilled. The cuttings can vary in size from 0.02 mm to 6 mm in diameter, with their texture ranging from clay to gravel depending on the nature of the rock being drilled.

Because the drilling of the development well(s) will occur within existing conductors at the Kupe WHP, all cuttings will be brought up to the MODU and none will be released/discharged directly at the seabed. On the MODU, WBM and cuttings are separated over a series of vibrating screens called shakers. The cuttings will be discharged to the surface of the sea at a height of approximately 10 m above the water.

The actual drilling process only comprises about 40% of the time that the MODU is on location as the drilling of the well is periodically halted for a variety of reasons throughout the campaign. These reasons include adding lengths of drill pipe, running casing and cementing it in place, pulling the drill string to change the bottom hole assembly or to replace the drill bit, installation and uninstalling the BOP and riser system, installing casing, cementing operations, pressure testing operations, repair of damaged equipment, retrieval of lost or stuck equipment, and logging of the well. During these periods (i.e. when there is no drilling) no cuttings will be generated or released from the MODU.

The maximum volume of cuttings produced for each development well is estimated to be 534 m^3. If a re-spud or sidetrack is required (discussed in **Section 2.2.10.2**) then an additional volume of up to 534 m^3 may be discharged, combining to give an anticipated maximum worst-case volume of cuttings for each development well of 1,068 m^3. As discussed above, all these cuttings will be discharged from the MODU to the surface of the sea.

Beach is applying for a marine consent for this activity under sections 20(2)(e), (2)(f), and (2)(g) of the EEZ Act.

2.2.4.1 Drill Cuttings Dispersion Modelling

Dispersal patterns for released drill cuttings can vary between locations due to a number of different factors, including water depth, release point, current speed and direction, wave action, and weather conditions at the time of discharge. For example, when released near the sea surface, drill cuttings will disperse over a greater area of seafloor and in a thinner layer compared to the cuttings deposited at the seabed close to the drill location.

As drill cuttings sink through the water column (where they are released at the sea surface), they undergo dispersion, dilution, dissolution, flocculation, and settling. Seawater density increases and water temperature decreases with increasing water depth and, as a result, the discharged cuttings particles may initially sink before accumulating at a depth where water density matches that of the sinking particles. The rate of mixing and dispersion of drill cuttings depends on the physical and chemical properties of the discharge and receiving water, the rate and frequency of the release, the level of natural turbulent mixing in the water column, and any stratification of the receiving waters.

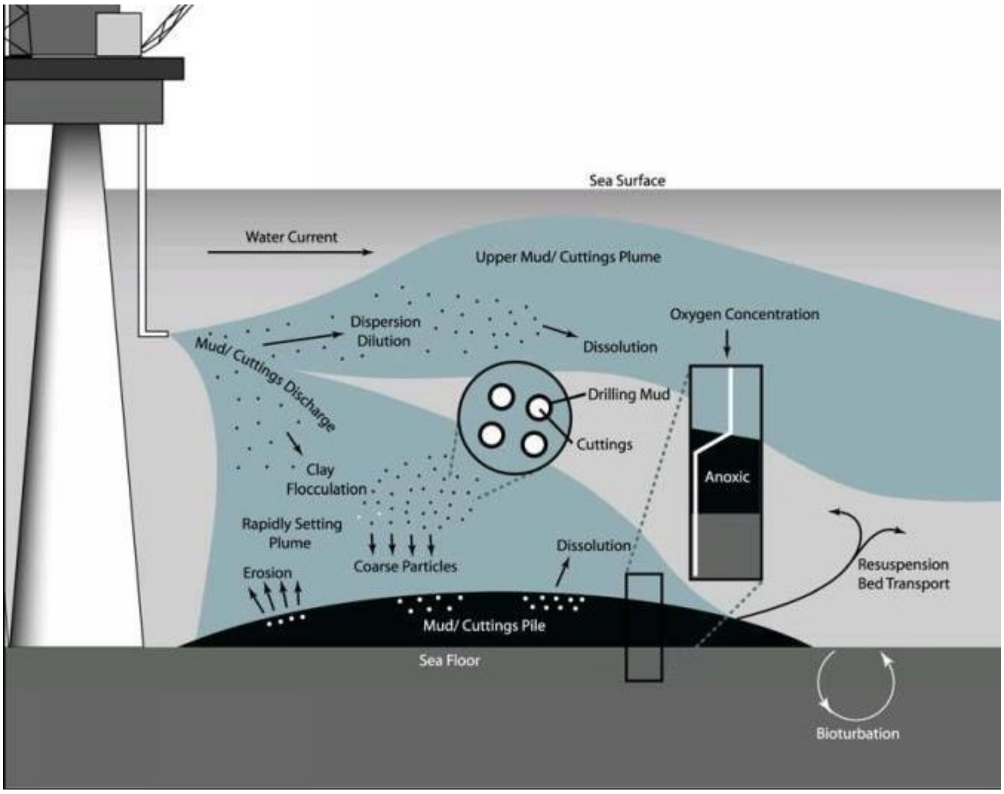
As cuttings are released into the sea, two plumes are generally formed (**Figure 4**):

- An upper plume containing fine-grained, unflocculated solids and dissolved mud components. This plume usually comprises around 10% of the mass of released solids. The concentration of suspended material in the upper plume reduces rapidly with time and with increasing distance from the release point (Bretaler *et al.*, 1988, cited in Hinwood *et al.*, 1994); and

- A lower plume that settles quickly towards the sea floor and contains larger-grained, dense particles including cuttings and flocculated materials such as clay/barium particles.

Figure 4 provides a useful indication of the processes that occur when drilling mud/cuttings are released to the sea from a MODU, including dissolution, dispersion, and deposition. It should be noted that while this figure shows the cuttings discharged below the sea surface, Beach proposes to discharge the cuttings above the water – but very similar pathways will result.

Figure 4 Typical dispersion and fate of drilling muds and cuttings following release to the ocean



Source: Neff, 2010.

Calypso Science Limited (**Calypso Science**) was commissioned to model the dispersal and deposition of drill cuttings from drilling the development wells using a particle-tracking model within hindcast ocean current flow fields for the South Taranaki Bight (**STB**). A highly conservative settling velocity threshold was used. The full methodology of the numerical modelling is provided in **Appendix B**.

This modelling has provided an indication of the dispersal pathways and potential deposition footprints associated with the release of drill cuttings.

The drill cutting deposition modelling provides for the planned drilling of two development wells as part of the Kupe Phase 2 Development Drilling Programme and contingent activities (i.e. a re-spud, **Section 2.2.10.2**) which includes additional deposition over and above that from the drilling of the initial development well. The modelling results have also been utilised to assess the effects of the drill cuttings on the benthic environment in **Section 7.2.6.2.2**. In addition, the predicted total suspended sediment (**TSS**) concentration in the water column in the vicinity of the Kupe WHP was modelled, with this information being used in the assessment of effects on the pelagic species presented in **Section 7.2.6.2.1**.

2.2.4.1.1 Depositional Thickness

The far-field dispersion of the drill cutting plumes and the subsequent depositional footprints were characterised using a stochastic approach whereby a simulation of 100 discrete drilling events occurred, randomly distributed over the previous decade.

Table 6 presents both the maximum distance at which the seabed receives drill cuttings above two deposition thresholds (1 and 6.3 mm[4]), and the spatial area that is covered by the drill cuttings above these depositional thresholds. The maximum extent at which the predicted depositional thickness exceeds 6.3 mm is approximately 0.3 km from the Kupe WHP for initial well and re-spud scenario. The maximum spatial area with greater than 6.3 mm depositional thickness for that same scenario is approximately 0.12 km^2. This is not to say that these two results relate to the same one drilling event out of the 100 discrete events modelled; it simply shows that one of those 100 events had a maximum excursion out to approximately 0.3 km, and one of the 100 drilling events had a maximum area of approximately 0.12 km^2.

For the purposes of this consent application, these maximum values are utilised for the assessments within **Section 7.2.6** to provide a worst-case assessment of the potential impacts from the deposition of drill cuttings on benthic communities.

Table 6 Maximum distance and area of drill cutting deposition for initial well and re-spud scenarios

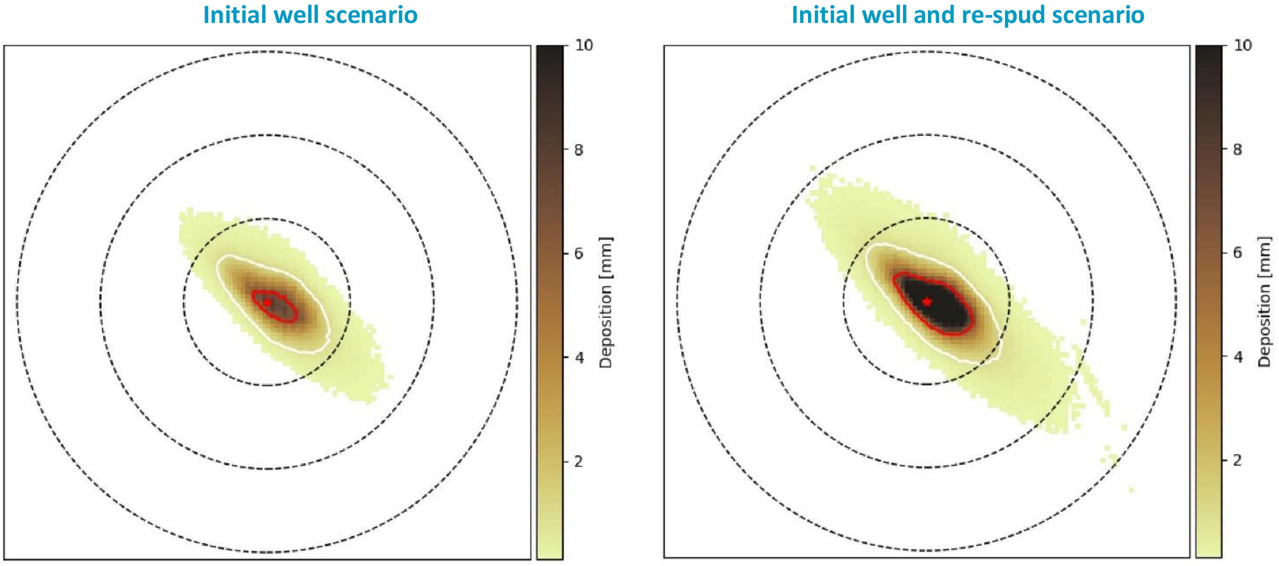
Deposition Thresholds		Initial Well Scenario		Initial Well & Re-spud Scenario	
		Distance (km)	Area (km^2)	Distance (km)	Area (km^2)
1.0 mm	Maximum	0.509	0.298	1.242	0.385
	Most probable *	0.353	0.147	0.431	0.212
6.3 mm	Maximum	0.270	0.081	0.302	0.122
	Most probable *	0.154	0.019	0.244	0.067

* The most probable statistic within this table is presented as 'P50' within Calypso Science, 2022a (**Appendix B**) which equates to the median value for the 100 stochastic runs. For the purposes of this consent application, this has been termed the most probable for ease of understanding.

Figure 5 provides a graphical representation of the median (i.e. the 'middle', or 'most probable' value for the depositional thickness fields computed from 100 discrete events simulated) for the two scenarios that were modelled, being the 'initial well' scenario and the 'initial well and re-spud' scenarios.

[4] A sediment deposition depth of 6.3 mm is used as a threshold for ecological effects on benthic communities, discussed in more detail in **Section 7.2.6.1.2**.

Figure 5 Median depositional thickness for the two scenarios modelled

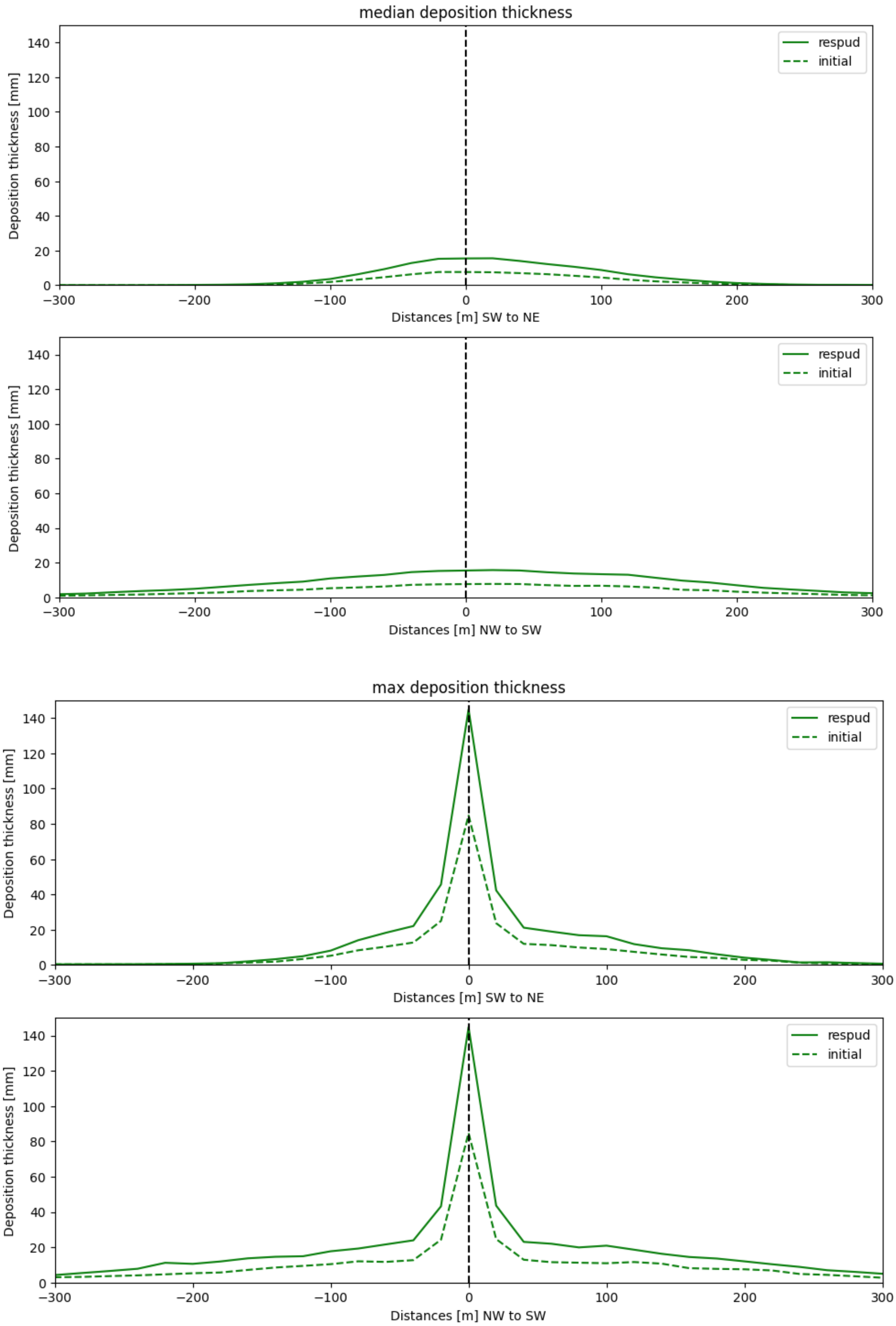


Source: Calypso Science, 2022a.

Note: Contours of 1.0 mm and 6.3 mm deposition thresholds are displayed in white and red respectively, while the dashed circles are centred over the release location and plotted every 400 m.

Figure 6 shows the most probable (median) and maximum modelled 'mounding' of the drill cuttings beneath and within 300 m of the Kupe WHP along the two major depositional axes for the 'initial well' and the 'initial well and re-spud' scenarios – the green dashed line shows the thickness of cuttings of drilling the initial well and the solid green line shows the thickness following the re-spud. The most probable (median) thickness for the initial well scenario is ~10 mm whereas for the re-spud scenario this increases to ~20 mm. The worst-case (maximum) thickness for the initial well scenario is 80 mm, whereas for the re-spud scenario this increases to 145 mm. The thickness of deposited cuttings decreases quickly away from the Kupe WHP, with the greatest thickness generally restricted to within ~100 m of the platform.

Figure 6 Depositional thickness within 300 m of the Kupe WHP



Source: Calypso Science, 2022a.

2.2.4.1.2 Other Depositions

During the drilling programme there will be times when deposition of material other than cuttings occurs on the seabed (e.g. WBM, milling swarf and cement).

For example, if sections of the steel casing need to be drilled through (milled) during cased hole sidetracking, milling swarf (metallic waste) is generated. Milling swarf is returned to the MODU entrained within the WBM where it is separated out using magnets located in the cuttings ditch. While most of the milling swarf will be recovered and sent to shore for disposal, a minor amount may be discharged to the sea with the cuttings. Discharged milling swarf is expected to act similarly to cuttings in terms of settling through the water column and onto the seabed following discharge (**Table 6**). However, due to the different size, shape, and surface area of the milling swarf compared with cuttings, swarf materials may settle at a slightly different rate (i.e. quicker and closer to the point of discharge).

2.2.5 Remotely Operated Vehicle Work

A ROV will be required to support the drilling activities of the Kupe Phase 2 Development Drilling Programme in terms of visual inspections. ROV activities are primarily observational, with most of these observations occurring at least 3 m above the seabed, therefore no disturbance to the seabed is anticipated. When not in use, the ROV will either be recovered to the deck of the support vessel or the MODU (dependent on its set up).

If, for any reason, the ROV has to settle on the seabed it may leave a small depression on the seabed; being up to a 6 m^2 footprint (depending on the type of ROV). In addition, the propulsion jets from the ROV thrusters may disturb fine surficial seabed sediments during any activities where the ROV is operating in close proximity to the seabed.

Beach is applying for a marine consent for ROV works under section 20(2)(a), (2)(e), (2)(g), (4)(a), and (4)(b) of the EEZ Act

2.2.6 Formation Evaluation

A range of formation evaluation techniques may be undertaken on each well to provide geological information and assess the presence of moveable hydrocarbons within the targeted reservoir sections, the quality of reservoirs encountered, and petrophysical properties of the drilled succession. This evaluation process runs in real time while drilling and in separate parcels at the end of some sections, depending on the information required and the methods utilised. The different methods of formation evaluation are described below and, while not all of these require a marine consent or a marine discharge consent, they are included for the sake of completeness.

2.2.6.1 Mudlogging

Cuttings returned to the MODU are monitored to establish the nature of the rocks being drilled. This ‘mudlogging’ monitors the efficiency of drilling operations and serves to detect any hydrocarbons being returned in the drilling fluids as the drill string goes through targeted reservoir sections of the well. In the event that hydrocarbons are observed in the drilling fluids and cuttings, further sampling will be undertaken to evaluate the hydrocarbon likely to be present within the reservoir.

Mudlogging does not require a marine consent.

2.2.6.2 Logging While Drilling

Logging While Drilling (**LWD**), which for the purposes of this consent application includes similar methods called 'measurement while drilling' and 'formation evaluation while drilling', is used to assist the drilling process and assess the rock types and formation fluids within the well. LWD helps to define potential reservoir, seal, and source rocks, and to detect the presence of hydrocarbons.

LWD utilises logging tools in the drill string, which transmit real-time formation measurements to the surface via the mud column, in addition to recording down-hole data. Within LWD tools there are sensors which employ the use of nuclear sources (to be used across the reservoir only) to ascertain certain properties of a formation to infer either density or porosity. If LWD data indicate that hydrocarbons are present in the reservoir, further evaluation may be carried out.

Each section of each well from below the conductor or the surface casing point may be logged using LWD tools to assist with correlation and initial formation evaluation and as insurance against unexpected loss of access to the wellbore for subsequent wireline operations.

LWD does not require a marine consent.

2.2.6.3 Wireline Logging

Wireline logging involves placing various geophysical and mechanical tools down the well on a cable (the wireline) which can provide a detailed assessment of the rock and fluid types within the wellbore in a stable downhole environment without disturbing the drilling process. As with LWD, wireline logging instrumentation may include tools which utilise nuclear sources to determine specific properties within the formation. Wireline logging will be focused on confirming the quality of reservoir and seal rocks, and the presence of hydrocarbons, what phase they are in (oil or gas), the depth of the hydrocarbon-water contact, and whether the hydrocarbons are likely to flow, particularly relating to the permeability of the reservoir and the saturation of the hydrocarbons. If moveable hydrocarbons are present and the volumes are calculated to be potentially commercially viable, the well is deemed a success.

Wireline logging includes specialised surveys and sampling, such as checkshot surveys, vertical seismic profiling, and Wireline Formation Testing (**WFT**) which are described in more detail below, including whether they trigger a requirement for marine consent under section 20 of the EEZ Act.

2.2.6.3.1 Checkshot Survey

There is a possibility that Beach will undertake a checkshot survey at the well location to determine the relationship between acoustic time and depth of key geological surfaces in the wellbore. A checkshot survey is form of seismic survey and the data it provides allows improved determination of rock velocity so that the conventional surface seismic data already gathered for the area can be more accurately converted from acoustic travel time to depth for the purpose of mapping subsurface structures.

To undertake a checkshot survey an acoustic source is lowered from a crane on the MODU to below the sea surface. A geophone is then placed at various depths within the wellbore which will receive the signal from the acoustic source to provide a relationship between one-way acoustic travel time and depth.

This activity does not require a marine consent under the EEZ Act because, under the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013 (**Permitted Activities Regulations**), seismic surveys are classified as permitted activities if the operator complies with the Department of Conservation (**DOC**) Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations (**Code of Conduct**). Beach will comply with the requirements of the Code of Conduct and will submit a Marine Mammal Impact Assessment for approval prior to any checkshot survey being undertaken if the source volume used in the checkshot survey triggers the requirements of a Level 1 or Level 2 seismic survey as defined in the Code of Conduct (i.e. > 151 cubic inches).

2.2.6.3.2 Sidewall Coring

If a well encounters a hydrocarbon column, sidewall core samples may be acquired on wireline to assess the reservoir rock properties, including porosity, and permeability. Samples would be collected from the reservoir using a Rotary Sidewall Coring Tool, where a coring tool is lowered into the well on wireline and a number of small cylindrical cores are taken from the borehole at desired depths. Different-sized cores can be recovered depending on hole size, ranging from just under 1-inch diameter by 2-inch long to 1.5-inch diameter by 2.5-inch long. Up to 50 cores can be taken without returning the tool to surface to reload.

Beach is applying for a marine consent for the removal of non-living material (such as rock) by the Rotary Sidewall Coring Tool under section 20(2)(d) and (2)(e) of the EEZ Act.

2.2.6.3.3 Vertical Seismic Profiling

A high-resolution acoustic survey may be required to more accurately correlate the well data to surrounding seismic data. Vertical Seismic Profiling (**VSP**) is used to acquire high-resolution rock velocity data and a near-wellbore seismic image through the drilled section. The information obtained from VSP is then compared with the results of existing conventional marine surface seismic data.

VSP is a much more detailed survey than a checkshot survey, primarily based on the fact that the geophones are more closely spaced to provide a higher-resolution image than that of a checkshot survey. In addition, a VSP uses the reflected energy contained in the recorded trace at each receiver position as well as the first direct path from source to receiver; whereas, a checkshot survey only uses the direct path travel time.

A VSP survey would be conducted after the completion has been installed in the well. The survey is undertaken by lowering an acoustic source into the water from the MODU or a support vessel, and the acoustic response recorded by optical fibre installed in the wellbore. The acoustic source may be moved in a line directly away from the MODU or in a pattern arrangement to acquire acoustic signals which are at an angle from the well, which mimics the seismic data which the VSP data are to be compared to.

There is a possibility that Beach may undertake VSP as part of the Kupe Phase 2 Development Drilling Programme. This activity does not require a marine consent under the EEZ Act because VSP is classified as a permitted activity under the Permitted Activities Regulations so long as it is undertaken in accordance with the Code of Conduct. Beach will comply with the requirements of the Code of Conduct and will submit a Marine Mammal Impact Assessment for approval prior to any VSP being undertaken if the source volume used in the checkshot survey triggers the requirements of a Level 1 or Level 2 seismic survey as defined in the Code of Conduct (i.e. >151 cubic inches)

2.2.6.3.4 Wireline Formation Testing

If a well encounters a hydrocarbon column, fluid pressures and samples may be acquired on wireline to assess fluid type, chemistry, and potential productivity. Samples would be collected from the reservoir using a WFT tool where a probe is inserted a short distance into the borehole wall to record formation pressures and to allow extraction of a small volume of formation fluids into a sample chamber within the WFT tool. Different-sized sample chambers can be run, holding either 1, 2.75, or 6 gallons (3.8, 10.4, or 22.7 litres) of formation fluid, or a multi-chamber WFT tool can be run with each chamber holding 450 litres of formation fluid for specialised pressure-volume-temperature analysis. The WFT makes real-time measurements at the probe module to discriminate between formation fluids and mud-filtrate. Fluids are extruded from the sample chamber until a formation fluid sample with an acceptably low level of filtrate contamination can be recovered.

A more sophisticated form of WFT sampling may be required if a larger zone of investigation is required than is possible using the single-point WFT probe. This would involve the use of a dual-packer WFT whereby expandable packers are inflated downhole to seal the borehole wall above and below the hydrocarbon-bearing reservoir zone. The fluids are then allowed to flow into the contained wellbore to be collected in the WFT chambers.

Beach is applying for a marine consent for the removal of non-living material (such as hydrocarbons) for WFT under section 20(2)(d) and (2)(e) of the EEZ Act.

2.2.6.4 Well Testing

Well testing will be undertaken at the platform / well location, after running the completion, as part of success-case operation. Prior to undertaking a well test, Beach is required to notify the Chief Executive of New Zealand Petroleum and Minerals at least 10 working days prior to commencement of operations, and further notification no later than 10 working days after the date on which the operations conclude, as per regulation 34D of the Crown Minerals (Petroleum) Regulations 2007.

Once the well has been completed, perforating instruments that were lowered into the well on wireline or drill pipe and set at the desired depth during the completion operations are fired electrically, by mechanical means or by hydraulic actuation to pierce multiple holes in the planned completion interval. The perforations create pathways by which the reservoir fluids can flow into the wellbore, resulting in test production being able to be established.

Hydrocarbons flow up the wellbore through the completion tubing string to the MODU, where samples are collected for analysis and the remainder are diverted to the flare booms where they are combusted. A well test can run for several hours or days, depending on the productivity information and sample types that are required.

The flare boom burner heads are specifically designed to ensure that the hydrocarbons burn in a manner where fall-out is minimised as far as is practicable.

While a 100% burn rate is expected, there may be a small volume of particulates and trace hydrocarbons that are not combusted. Any hydrocarbons that are not combusted will settle on the ocean surface. These small quantities of hydrocarbons will be readily dispersed and degraded by the high-energy receiving environment.

The main purpose of the well test is to remove completions fluids from the well, and to evaluate the fluid properties and well production capability prior to connecting the well into the existing gas infrastructure on the Kupe WHP. Fluid samples would be acquired at the surface separator to provide accurate compositional information and properties of the reservoir fluids.

The test equipment selection will be based on the best available environmental techniques with a view to minimising the environmental impact of well testing (for example, fall-out of hydrocarbons to sea from incomplete burning at the flare tip). The test facility will be designed in accordance with relevant specifications, standards[5], recommended industry practices, and design codes.

The test facility that will be used during the well test consists of the following main components and as seen in **Figure 7** and **Figure 8**):

- Flowhead (or production xmas tree);
- Emergency shutdown panel;
- Choke manifold;
- High pressure lines;
- Separator (fitted with oil, gas and water metering);
- Surge tank;
- Boom, including environmentally sensitive burner heads;
- Atmospheric storage tanks; and
- Filtration system.

The well stream comes to the surface via tubing which is connected to a flowhead (surface test tree or xmas tree) up to 25 - 30 m above sea level. The flowhead forms part of the barrier system for the well and is equipped with safety valves to control the well if it is required to be shut in.

From the flowhead the well stream is connected to suitably rated high-pressure lines to the well test facility. The high-pressure lines from the flowhead are terminated in the well test area on the MODU and go through an additional emergency isolation valve to the choke manifold. The choke manifold is equipped with block valves and an adjustable throttle valve (choke) that controls the flow rate.

The separator is equipped with an oil meter, a gas meter, and a water meter for the measurement of the produced quantities. It is possible to inject chemicals at various points in the well test system, including at the separator, for simplified treatment of hydrates and other flow assurance issues when required.

[5] Relevant standards for the well testing package include:
(i) Drawings (API 500);
(ii) Safety Systems (API RP 14C);
(iii) Calculations (API RP 14E, API 520);
(iv) Relevant Equipment API 6A PSL-3, ASME B31.3; and
(v) Relevant Equipment NACE MR 01-75.

Figure 7 Generic test facility

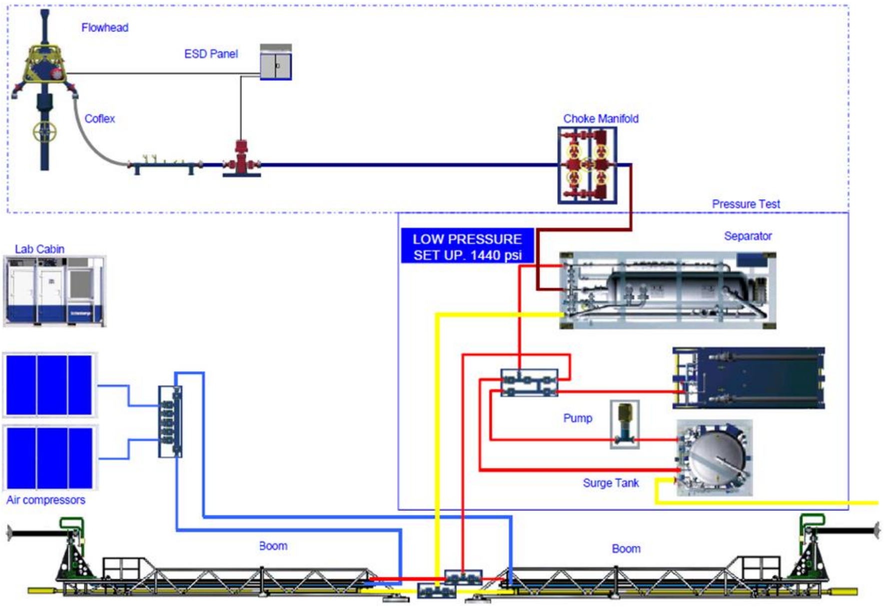


Figure 8 Typical offshore setup

Beach is applying for a marine consent for the well test under section 20(2)(d) and (2)(e) of the EEZ Act.

Any flaring undertaken during the Kupe Phase 2 Development Drilling Programme will comply with the Crown Minerals (Petroleum) Regulations 2007, including applying for a Flaring Consent under regulation 26 of those regulations if required.

2.2.7 Removal and Moving of the Jack-up Mobile Offshore Drilling Unit

Once drilling and testing/completions is complete the MODU will be moved away from the Kupe WHP. During this process, the support vessels will maintain lines to the MODU to ensure stability and control is maintained as it will be in close proximity to the Kupe WHP.

The removal of the MODU will involve the hull being lowered back into the water using the jacking system, followed by a pull-down operation being undertaken. A pull-down operation is when the hull is pulled down into the sea to provide net upward buoyancy force to facilitate the extraction of the legs out of the seabed. Once the legs are retracted and the MODU is floating it will be towed from the Kupe WHP using the support vessels.

Like the installation of the MODU, the extent of the seabed disturbance that will occur as a result of the removal of the MODU is directly correlated to the size of each spudcan and the number of legs on the MODU. The amount of disturbance will be the same as outlined in **Section 2.2.2.4** and presented in **Table 5**.

Beach is applying for a marine consent for the removal of the MODU under section 20(2)(a), (2)(e), (2)(f), (2)(g), and (4)(a) of the EEZ Act

2.2.8 Supporting Activities

The supporting activities that vessels and helicopters will undertake during drilling operations are discussed in the following sub-sections. These are activities which are instrumental in completing the Kupe Phase 2 Development Drilling Programme in a safe and efficient manner and minimising effects on the environment and existing interests. Support vessels and helicopters are required to transport food, fuel, water, drilling equipment, and personnel between the shore and the MODU.

The use of support vessels and helicopters during the Kupe Phase 2 Development Drilling Programme do not necessitate a marine consent under the EEZ Act but is described here for the sake of completeness.

2.2.8.1 Support Vessels

Up to three support vessels will be contracted as part of the Kupe Phase 2 Development Drilling Programme to provide assistance during drilling operations. Depending on the MODU Safety Case requirements, a support vessel (or vessels) may need to be in attendance in close proximity to the rig at all times throughout the Kupe Phase 2 Development Drilling Programme. These vessels will support the contracted MODU, with their duties including the transportation of equipment, supplies, and materials between Port Taranaki and the MODU, as well as positioning the MODU alongside the Kupe WHP.

When in attendance, these support vessels will also assist to enforce the 500 m Safety Zone (discussed in greater detail in **Section 3.4.2**) by intercepting any unauthorised vessels entering this area to ensure the security of the MODU and the Kupe WHP, and the safety of personnel on board, as well as the safety of any intercepted persons.

2.2.8.2 Helicopters

During the Kupe Phase 2 Development Drilling Programme several crew changes will take place utilising helicopters out of New Plymouth Airport. The flight paths for the helicopters will typically be in a direct line between the Airport and the Kupe field, but will deviate as necessary with the weather conditions at the time.

The use of helicopters in the offshore oil and gas industry is common, with most of the operating installations in the Taranaki Basin requiring helicopter landings several times a week. Helicopter landings at the Kupe WHP occur occasionally but are not regularly scheduled as the platform is unmanned. The helicopter movements for the Kupe Phase 2 Development Drilling Programme will not cause vibrations in a manner that is likely to have an adverse effect on marine life so no marine consent requirement is triggered under section 20(4)(b) of the EEZ Act.

2.2.9 Environmental Monitoring

Post-drill benthic monitoring is proposed to be undertaken for the development wells drilled as part of the Kupe Phase 2 Development Drilling Programme to monitor the effects from the drilling activity on the benthic marine environment and the subsequent recovery.

The activities included within the environmental monitoring programme involve the disturbance of the seabed and the removal of non-living material through the use of benthic survey equipment such as Van-Veen grab samplers. The use of benthic survey equipment can disturb the seabed in a way that will adversely affect those individual marine species that are removed as part of the captured seabed sample. No sampling equipment will be permanently deployed on the seabed.

An Environmental Monitoring Plan (**EMP**) is proposed to be prepared as a requirement of the proffered conditions (**Appendix A**) and will provide the details of the proposed monitoring approach that will be undertaken after drilling each well. It is worth noting that the pre-drill monitoring for the first development well will be undertaken under the Permitted Activities Regulations due to the timing of the proposed drilling operations and the processing of this consent application. The EMP will be consistent with the document entitled “Recommendations for an Offshore Taranaki Environmental Monitoring Protocol: Drilling- and production-related discharges” (**OTEMP**) (Johnston *et al*., 2014), being a protocol that was developed through consultation with industry, Maritime New Zealand (**MNZ**), and the EPA.

The EMP will describe the sampling methodology that will be followed for the Kupe Phase 2 Development Drilling Programme. The locations of the sample stations within the EMP will be based on the expected zones of influence from the drilling activities as defined by depositional modelling studies of the drill cuttings and fluids (see **Section 2.2.4.1**)

The monitoring stations will be located at specified distances along the major and minor axes of deposition to monitor effects from the Kupe Phase 2 Development Drilling Programme and the subsequent recovery over time following drilling activity.

Post-drill monitoring will be carried out for up to a maximum of three years following the completion of drilling activities, with the post-drill results compared to those of the pre-drill survey in order to assess the potential environmental effects of the drilling activities and to track the recovery of benthic communities and sediment quality over time. In order to allow direct comparisons, pre- and post-drill monitoring would be carried out following a standard procedure (as set out in the EMP) at the same set of sampling stations and in the same season[6] each year to reduce any seasonality influences.

[6] ‘same season’ in this context is defined to be within a maximum of six weeks before or after the date of completion of the post-drill survey fieldwork.

Monitoring stations are proposed to be arranged on a cardinal axis design with alignment of the axes determined from the deposition modelling results. Stations will be located at sites most likely to receive deposited cuttings based on the modelling simulations run for the dispersion and deposition of drill cuttings from the development well drilling and a far-field control (or reference) monitoring station would also be included. The control station would be located approximately 6 km along the minor depositional axis, in similar water depth and sediment type and away from possible recent or historic drilling influences in the area. The control station would be assessed to monitor wider temporal changes occurring in the environment that could confound or overshadow the ability to detect any impacts related to the drilling activities from naturally-occurring environmental changes.

OTEMP recommends the use of double Van-Veen grab samplers for collection of seabed sediments and marine fauna, with triplicate samples taken from each station. Each deployment of the grab sampler disturbs an area of seabed of approximately 0.21 m^2 (0.32 m x 0.64 m) and removes approximately 0.026 m^3 of sediment. The collection of triplicate samples during a 'typical' monitoring programme (e.g. 21 sample stations) would disturb approximately 13.23 m^2 of seabed and remove approximately 1.62 m^3 of sediment per well location. However, approximately 90% of the sediment removed by the grab sampling is not retained (due to sub-sampling and sample sieving) and is deposited back over the side of the survey vessel close to where it was collected.

Either a towed imaging array (**TIA**) or an ROV would be utilised to obtain semi-quantitative epibenthic data through seafloor imagery, with each deployment of the imaging system (TIA or ROV) planned to cover approximately 200 m of horizontal distance across the seabed. This would result in approximately 1.2 km of seabed being assessed.

The TIA is towed by the survey vessel at approximately 0.5 knots, either on two narrow skids/runners, each approximately 40 mm wide, or held just above the seabed (in calm conditions with good visibility and presence of sensitive/fragile habitats or subsea infrastructure). Based on the deployment of six benthic imagery tows, the approximate distance covered and area of the array in contact with the seabed (assuming worst-case scenario of full contact throughout all tows), a total of approximately 96 m^2 is disturbed per survey. In cases where multiple stations can be videoed during a single deployment of the system, the total area of seabed disturbed could be fractionally greater than 96 m^2 if the vessel's drift/tow direction enables multiple imagery locations to be covered as part of a single deployment, with the TIA pulled along or slightly above the seabed between stations. When towed, the TIA's lower skids/runners leave shallow indentations in the soft mud sediments typically encountered at the sites, usually less than 10 mm deep. However, if an ROV is utilised for this monitoring, the ROV will typically fly slightly above the seabed and will not result in any direct disturbance. There is no removal of material from the seabed during TIA tows or ROV operations.

Beach is applying for a marine consent for environmental monitoring under section 20(2)(a), (2)(d), (2)(e), (2)(f), (2)(g), (4)(a), and (4)(b) of the EEZ Act

2.2.10 Contingent Activities

There are various contingent activities that are not specifically planned to be undertaken; however, they are necessary to include within this consent application to allow Beach the ability to adapt to the conditions present at the well sites during drilling operations. While the activities outlined in **Sections 2.2.1** to **2.2.9** provides a degree of flexibility, the following activities may also be required in exceptional circumstances, and are therefore applied for out of an abundance of caution.

Sidetracking, re-spudding, the contingent use of explosives, and excess cement disposal are not planned as a part of the Kupe Phase 2 Development Drilling Programme and will only be used as a last resort in response to unavoidable complications relating to the drilling of the wells. These activities are described in more detail in the following sections.

2.2.10.1 Sidetracking

Sidetracking is part of the original well. It uses the existing surface and seabed equipment and part of the previously drilled original well. A contingent sidetrack is generally classed as one of the following:

- A geological sidetrack, which will be required if the original wellbore misses the proposed geological target; or
- A mechanical sidetrack, which is required if the original wellbore is compromised or has stuck equipment in it that cannot be removed. In this scenario the well must be diverted around the stuck equipment within the original wellbore.

The sidetrack would commence with drilling from a kick-off point some distance above the top of the zone of interest and, once the required offset has been achieved (in the order of a few tens of metres from the original borehole), the drilling assembly may be changed to a steering assembly before drilling to the desired geological target or reservoir.

Beach is applying for a marine consent for sidetracking under section 20(2)(a), (2)(d), (2)(e), (2)(f), (2)(g), and (4)(b) of the EEZ Act.

2.2.10.2 Re-spudding

In the event that either of the proposed wells have to be abandoned before they reach their targets, the well may have to be re-drilled; this is referred to as a re-spud. The following factors are examples of situations where a re-spud may be required:

- Stuck drilling equipment downhole that cannot be dislodged; or
- Lost top hole and intermediate hole sections due to major fluid loss, or stuck pipe event; or
- The 22” hole section unexpectedly deviating beyond an acceptable limit due to failure or unfavourable ground conditions, increasing the risk of collision with the other Kupe WHP wells and leaving no safe margin for the well trajectory correction.

Re-spudding involves the re-drilling of a well from one of the other available conductor slots at the Kupe WHP to the original well location. The re-spud would be approximately the same well design as the initial well but would take into account all factors that led to the original site being abandoned.

The total volume of drill cuttings released during the course of this well would increase based on the duplication of drilling activities. As can be seen from the examples noted above, the interval of the well that needs to be re-drilled can vary from a minimal amount (e.g. if the wellhead cannot be installed level) to close to total re-drill (if a problem is encountered at a deeper point in the well near the target depth). In the worst-case scenario, where a well needs to be re-spudded having drilled down to a point just above the primary target, the volume of cuttings duplicated may be approximately 534 m^3, resulting in a combined cuttings volume of 1,068 m^3 needing to be discharged (previously discussed in **Section 2.2.4**). As the Kupe Phase 2 Development Drilling Programme is utilising the existing conductor slots at the Kupe WHP, there is a limit to the potential re-spudding that can occur. This is because there are three existing conductor slots at the Kupe WHP, which limits the potential for re-spud to one well as this re-spud would also utilise the existing conductor slots.

Beach notes that over 200 wells have been drilled offshore in New Zealand and, of those wells, only 14 are known to have required re-spudding, of which nine occurred in the Taranaki Basin (where over 180 wells have been drilled offshore). In order to maintain a conservative approach, the deposition modelling that has been undertaken has included the potential for a re-spud, based on a worst-case scenario where the initial well was almost drilled to target depth.

Beach is applying for a marine consent for re-spudding under section 20(2)(a), (2)(d), (2)(e), (2)(f), (2)(g), and (4)(b) of the EEZ Act

2.2.10.3 Contingent Use of Explosives

Other than the planned use of explosives for the development well tie-in (**Section 2.2.3.2**), explosives (such as directional charges) may be required for various sub-surface applications but will only be used in exceptional circumstances as a contingency and would be designed by a specialist to ensure it is an appropriate solution given the situation. Reasons for explosive use may include:

- To sever and recover the drill string in the event that the drill string gets stuck and conventional methods cannot free the string; or
- To perforate a casing to allow the placement of remedial cement if the cement behind the casing is lost.

Depending on the specific situation, running explosives in the hole will be performed on wireline or on drill pipe. Any use of explosives would be specifically designed by a specialist to ensure it is an appropriate solution given the situation, which includes only using the minimum sized charge to achieve the objective required.

Beach is applying for a marine consent for contingent use of explosives under section 20(4)(c) of the EEZ Act.

2.2.10.4 Excess Cement Disposal

On very rare occasions cement batches may be prepared onboard the MODU but are ultimately deemed unsuitable for use at the required point in the well (e.g. the cement is not weighted or setting correctly). In such situations the batch of approximately 15 m^3 of cement may need to be discarded. Unused or excess cement is required to be immediately pumped out of the tanks and sent overboard to prevent it from hardening within tanks, pumps, and pipelines. If the cement is left to harden this would lead to logistical issues, safety concerns, and high costs associated with trying to clean out/remove the set cement and fix the affected equipment.

While this activity has not been required during any other drilling campaign in the past, it is possible that it could occur during the Kupe Phase 2 Development Drilling Programme.

There are numerous cement jobs associated with the drilling of any well. There is a possibility that any of these cement jobs could result in a cement batch which is unsuitable for use and needs to be released to the sea. All practicable steps will be implemented during the planning and execution of the planned Kupe Phase 2 Development Drilling Programme to ensure that the cement prepared is appropriate for use and that this release does not occur. In any case, the discharge of excess cement batches will be recorded.

The disposal of cement would result in deposition on the seabed, as the heavier components of the cement tend to form a convective descent plume that entrains the majority of the cement components and pulls them downwards towards the seabed relatively quickly upon disposal to the ocean.

Beach is applying for a marine consent for the disposal of excess cement under section 20(2)(e), (2)(f), and (2)(g) of the EEZ Act.

2.3 Discharge of Harmful Substances from MODU Deck Drains

A MODU will be selected that is capable of drilling the proposed wells for the Kupe Phase 2 Development Drilling Programme and that meets Beach's environmental protection requirements which are detailed in the following sections – this includes the minimum environmental and operational requirements for the deck drain layout and treatment system discussed in **Section 2.3.1** and Beach's Environmental Policy.

Any MODU that Beach utilises for its Kupe Phase 2 Development Drilling Programme will require the use, and associated storage, of various harmful substances. All harmful substances will be handled and used in accordance with relevant legislation and best practice. However, normal use of these harmful substances may conceivably lead to occasional drips and other minor spills on the decks of the MODU which may then enter the deck drains even after cleaning – that is, residual amounts of harmful substances may remain on the decks after clean-up of any conceivable spills. As such, it is not possible for Beach to guarantee the absolute absence of trace amounts of harmful substances being entrained in water that runs off the deck and into the deck drains and subsequently discharged to the sea. A marine discharge consent is being sought for this activity under section 20B of the EEZ Act.

For the purposes of this consent application an example MODU has been used to provide an indication of the potential volumes of discharge that may occur from its deck drains and the potential concentrations of harmful substances contained within such a discharge. If any other MODU is used then the only difference relevant to this consent application is the potential volume of discharge, which is dependent on the size of the decks which in turn dictates runoff (discharge) volumes. The assumptions made in this consent application reflect a worst-case discharge scenario.

2.3.1 Typical MODU Deck Drain Layout and Treatment System

Beach is yet to contract a MODU to drill the wells of the Kupe Phase 2 Development Drilling Programme. Beach has, and will, impose strict minimum environmental and operational requirements during the MODU selection process. MODU suppliers will need to show they are, and will remain, fully compliant with these requirements prior to those MODU operators progressing to the next stage in the contracting process. This consent application is made on the basis of a 'typical' MODU deck drain system which reflects the minimum environmental and operational requirements, which are further described in the subsections below.

2.3.1.1 Deck Drainage System Design

The deck drain system onboard a MODU is designed to manage the risk of harmful substances discharging to the marine environment due to the lack of containment to 'As Low As Reasonably Practicable' (**ALARP**). Open deck areas have coamings on their peripheries that act as bund walls to prevent any rainwater, deluge water, or washwater from discharging directly over the sides of the MODU into the sea.

Deck areas are identified as either 'hazard' or 'non-hazard' areas, the former being areas where the presence of harmful substances is possible and the latter being areas where their presence is very unlikely.

2.3.1.1.1 Hazard Areas

Areas of the MODU deck such as the drill floor, mud treatment room, cement unit house, shale shaker room, well test area, moon pool area, and pipe rack area are defined as 'hazard' areas and drains from these areas are routed to a closed drainage water treatment system. This closed system is made up of multi-chambered settlement tanks which discharge through an Oily Water Separator (**OWS**) fitted with an inline Oil-in-Water (**OIW**) monitor. The OWS is not designed to remove harmful substances if they are in a dissolved state; however, any substances that have adhered to particles may be collected within the settlement tanks. Those which float may be removed through the OWS.

The OIW monitor has an automated alarm which initiates the closing of the overboard valves in the event OIW concentrations exceed 15 parts per million (**ppm**) and the water is then redirected back to the settlement tanks and OWS where further separation occurs until such time as the discharge stream has an OIW content of less than 15 ppm. Once the water is below the 15 ppm OIW threshold, it is allowed (under D&D Regulations) to be discharged into the sea as a permitted activity.

Any oil that is retained following treatment by the OWS is transferred to Intermediate Bulk Containers (or similar storage containers) or storage tanks for later transportation to shore for disposal at a facility authorised to accept such material. Discharges to sea from the OWS, and oil returned to shore, are recorded in the MODU's oil record book as required by regulation 23 of the D&D Regulations.

2.3.1.1.2 Non- Hazard Areas

Some MODUs are designed to route drainage from the remaining non-hazard areas directly overboard (i.e. not via a water treatment system). Non-hazard areas are clearly demarcated so they can be clearly identified. To eliminate the risk of any potential discharges of harmful substances from non-hazard areas, no harmful substances are permitted to be handled or stored in non-hazard areas.

2.3.1.2 Storage of Harmful Substances

Any MODU selected for the Kupe Phase 2 Development Drilling Programme will have a 'sack store' for the storage of all drilling-related harmful substances. The sack store is not open to the elements. Any additional storage space required will be in covered bunded pallets (**Figure 9**) within bunded hazard areas to ensure the containers of harmful substances are not directly exposed to any rainwater. Bunds, coamings, and hard covered bunded pallets for hazardous areas will contain, as a minimum, one full volume of the maximum container size that is stored in that area.

No ecotoxic substance (i.e. any substance classified as harmful in accordance with the D&D Regulations) will be stored or handled in a non-hazard area which drains directly to the sea.

Figure 9 Covered and bunded pallets

2.3.1.3 Cleaning and Maintenance

The deck drains and deck areas will be cleaned and maintained periodically utilising high-pressure water blasters or steam. No harmful substances will be used as a part of routine maintenance operations on deck drains. If a degreasing agent or other cleaning product is required, a substance will be selected which is not classified as harmful. It is possible that any harmful substances that remain on the deck following an unplanned spill of harmful substances could become entrained in the cleaning water – the amounts of such harmful substances are expected to be extremely small.

The drainage water treatment system is made up of multiple chambers of settlement tanks. Any heavy solids suspended in the water which pass through this system may settle and accumulate in the bottom of the tanks. Periodically the settlement tanks will be taken out of service and either pumped out or dug out depending on the sediment in the bottom of the tanks. Any solids collected will be shipped to shore for disposal at a facility authorised to accept such material.

2.3.1.4 Direct Overboard Discharge

Under exceptional circumstances the deck drain treatment system could be by-passed. There are two situations when this could occur – during deluge and during extended periods of intense rainfall.

The deluge system is a safety critical element activated by the detection of fire or heat by the automated monitoring system onboard the MODU. The deluge system pumps large volumes of seawater and generally has two main functions: it can be used to prevent the spread of a fire or be used as a heat shield for cooling purposes (for example to minimise the potential for a pressure vessel to explode). Deluge water is pumped so quickly and in such large volumes that much of it may bypass the deck drain water treatment systems outlined in **Section 2.3.1.1**. Deluge would only ever occur in emergency situations or for cooling purposes during well testing where large volumes of water are sprayed to shield the MODU from the heat generated from the burner system. The likelihood of harmful substances being present in discharges from the deck drains at ecotoxic concentrations under these scenarios is very low, and massive dilution would be occurring over very short timeframes.

The second scenario where the deck drain treatment system could be bypassed is during extended high intensity rainfall events. During these circumstances the rates of runoff from the decks could exceed the capacity of the deck drainage system to the extent that the stability of the MODU is put at risk. Under this scenario a decision would be made by the Offshore Installation Manager to discharge water from the decks directly overboard – it is very unlikely that this type of discharge would contain any harmful substances as the 'first flush' (i.e. the initial rain falling on the deck) would entrain any harmful substances and would pass through the treatment system.

The valves that allow the discharge of the contents of the deck drain system directly overboard (bypassing the OWS) are locked shut under normal operational conditions and managed under the locked open / locked closed isolation register. These valves can only be unlocked and opened by authority of the Offshore Installation Manager under the Permit to Work[7] system. The likelihood of an intense prolonged rainfall event resulting in runoff rates that exceed the hydraulic capacity of a typical OWS treatment system is extremely remote. For any harmful substances to be discharged directly overboard during such a by-pass event would require two extremely remote events to occur simultaneously – that is, a spill of a harmful substance (which is a remote occurrence) would need to coincide with a prolonged intense rainfall event that exceeds the hydraulic capacity of the treatment system (also a very remote occurrence). Whilst theoretically possible, the likelihood of these two events occurring simultaneously is considered to be so remote to not warrant consideration. Further, any harmful substance discharged would receive significant dilutions due to the large amount of runoff that would occur during such rainfall events.

Any direct overboard discharge from the hazard areas would be recorded in the MODU oil record book as required by regulation 23 of the D&D Regulations.

Beach intends to select and contract a MODU with a deck drainage system capable of processing all anticipated volumes of rainwater and deluge during the Kupe Phase 2 Development Drilling Programme.

2.3.2 Systems and Procedures

In addition to the physical systems that will be in place, there are other systems and procedures which are proposed and required by other regulations that will reduce the risk of harmful substances entering the deck drains. The following systems and procedures will be implemented as part of industry best practice in relation to the oil and gas industry as referred to in sections 59(2)(h) and (i) of the EEZ Act.

[7] Permit to Work is a core element of a safe system of work that, along with risk assessment and isolation planning, enables reduction of health, safety and environmental risks to ALARP.

2.3.2.1 Beach Environmental Policies

Beach has a Health, Safety and Environment Management System which has been developed considering Australian/New Zealand Standard ISO 14001:2004 Environmental Management Systems. The Health, Safety and Environment Management System is based on the continual improvement methodology of 'plan-do-check-act'. The elements of the continual improvement loop are executed through a set of standards which interpret, support, and provide further details to the requirements of the HSE policy.

Beach is committed to conducting operations in an environmentally responsible and sustainable manner. Beach has an Environmental Policy which states that, to achieve this objective, Beach will:

- Comply with relevant environmental laws, regulations, and the Beach Health, Safety and Environment Management System which is the method by which Beach identifies and manages environmental risk.
- Establish environmental objectives and targets, and implement programs to achieve them that will support continuous improvement;
- Identify, assess and control environmental impacts of our operations by proactive management of activities and mitigation of impacts;
- Ensure that incidents, near misses, concerns and complaints are reported, investigated and lessons learnt are implemented;
- Inform all employees and contractors of their environmental responsibilities including consultation and distribution of appropriate environmental management guidelines, regulations and publications for all relevant activities;
- Efficiently use natural resources and energy, and engage with stakeholders on environmental issues; and
- Publicly report on our environmental performance.

2.3.2.2 Assurance Tasks

As part of best practice, assurance tasks will be implemented on the MODU to confirm that all systems are meeting performance standards. Such assurance tasks include:

- Planned maintenance of the deck drainage system (including OWS and OIW monitor);
- Regular calibration of the OIW in-line monitor;
- Regular water quality checks when water is discharged to ensure calibration processes are working effectively, completed by competent personnel as specified in respective operational procedures. If the MODU does not have the facilities to conduct these checks, then the water samples will be sent onshore for analysis; and
- Stock management and maintenance of a harmful substance register, as required for the Emergency Spill Response Plan (**ESRP**).

Additionally, daily checks will be made to ensure there has been no loss of containment of any substances in the covered bunded pallets, sack store, bunded areas, and peripheral coaming and that tidy housekeeping of these areas is in place.

Daily monitoring of the OWS and OIW are also a requirement for the MODU to comply with International Oil Pollution Prevention Certificates under Marine Protection Rule Part 131.

All hazard and non-hazard decks will be checked for cleanliness or any loss of containments prior to any deck-washing or any planned operation of the deluge system.

2.3.2.3 Training, Competency and Drills

All personnel on the MODU will be suitably trained and assessed for competency in the correct procedures for notification, containment, isolating, cleaning, disposing, and reporting of any loss of containment to deck of a harmful substance.

2.3.2.4 Spill Kits

If a loss of containment of a harmful substance to deck occurs, the substance will be captured and cleaned up using one or more of the spill kits that are located around the MODU.

Appropriately rated spill kits will be placed in close proximity to all stored harmful substances located on the MODU. Operational procedures will be in place to ensure that appropriate spill kits are nearby for the types of substances stored at each location. Likewise, if any spill kits are used, they will be replenished as part of daily inspections.

Should a spill kit be used to clean up a loss of containment event for a substance, the spent spill kit contents will be sealed inside a suitable container and taken onshore to facility authorised to accept such waste material as specified on the respective Safety Data Sheet (**SDS**) and in accordance with the garbage management plan required under regulation 29 of the D&D Regulations.

As per **Section 2.3.2.3**, all personnel on board the MODU will be trained to use these spill kits. All details about spill kits including contents and locations will be provided in the ESRP and Oil Spill Contingency Plan (**OSCP**) for the MODU.

2.3.2.5 Helicopter Refuelling

In exceptional circumstances or emergency situations (such as during a medical evacuation) refuelling of helicopters may be required on board the MODU. No harmful substances will be stored on the helideck.

2.3.3 Potential Harmful Substances in Deck Drain Discharges

2.3.3.1 Selection of Harmful Substances

The selection of harmful substances that will be used and stored on the MODU is driven by operational requirements of the MODU, the design of the well to be drilled, and the geology of the formation being drilled. Wherever practicable, the least harmful substance that is technically capable of performing the specific role will be selected.

All harmful substances to be used as part of the Kupe Phase 2 Development Drilling Programme will have SDSs available that outline the required emergency procedures. This will help to ensure that the use of these substances will be in accordance with the relevant group standard[8] requirements under the Hazardous Substances and New Organisms Act 1996, and the controls and relevant regulations under the Health and Safety at Work Act 2015 enforced by WorkSafe. These requirements are summarised in **Section 3.4.8**.

[8] https://www.epa.govt.nz/industry-areas/hazardous-substances/group-standards/types-of-group-standards/

2.3.3.2 Specific Harmful Substances

At the time of lodging this consent application Beach is unable to confirm exactly which specific harmful substances will be stored and used during the Kupe Phase 2 Development Drilling Programme because it has yet to contract a specific MODU to undertake the drilling. However, in the absence of that specific information, it is considered appropriate to base the assessment of effects for the discharge of trace amounts of harmful substances to the sea from the MODU deck drain system using a harmful substance that is typically used on various MODUs – this is considered to be the 'best (currently) available information'. However, it is important to note that the actual harmful substances that may be used will depend on which MODU is ultimately selected for the drilling.

The most ecotoxic harmful substance typically stored and used on a MODU is a product marketed as SODIUM HYPOCHLORITE POTABLE GRADE (hereafter referred to as '**sodium hypochlorite**'), which is used for for treating the potable water supply of the MODU (this product more commonly known and referred to as 'bleach' or 'chlorine bleach'). Sodium hypochlorite is classified under United Nations Globally Harmonised System of Classification and Labelling of Chemicals, 7th revised edition, 2017 (**GHS 7**) as Acute Category 1 (H400). While there will be other harmful substances that will be stored and used on the MODU, including some that will be used for drilling activities, none are likely to be more ecotoxic than sodium hypochlorite. The potential effects associated with discharging sodium hypochlorite are assessed in this consent application and, because it is likely to be the most ecotoxic substance that could possibly be discharged from the deck drains, it represents the worst-case scenario. However, it is important to note that sodium hypochlorite has been used in this consent application as an 'example substance'. It may be that this substance, or any other harmful substance onboard the MODU, is never spilled onto the decks and therefore never reaches the deck drain system or discharged to the sea.

As discussed in **Section 3.3**, prior to any drilling commencing Beach must prepare an ESRP and submit this to the EPA for approval under regulation 24 of the D&D Regulations. The ESRP will contain information on all the harmful substances that will be stored on the MODU, including their SDSs, and information on the prevention, mitigation, and control of any spills.

There will be other harmful substances stored and used on the MODU for general operations (e.g. disinfectant, air freshener, paint etc.); however, these have not been included in the current assessment. Those types of substances will be stored in areas (i.e., inside the accommodation block, or specific chemical stores) where if a loss of containment occurred, they would not enter the deck drains and therefore there is no risk of them being discharged into the sea.

Details on the discharge volumes and concentrations (of sodium hypochlorite), including the potential adverse effects on the environment from this discharge, are discussed in **Section 7.3**.

3 Legislative Framework

This is a combined application for a marine consent and a marine discharge consent to undertake activities associated with the development drilling within the Kupe field restricted by sections 20 and 20B of the EEZ Act, respectively. The following sections describe the requirements within the EEZ Act and the D&D Regulations. In addition, information is presented on the relevant Marine Management Regimes (**MMRs**) that may have the effect of avoiding, remedying, or mitigating the adverse effects on the environment or existing interests associated with the proposed activities.

3.1 Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012

3.1.1 Purpose

The EEZ Act came into force in 2013 to provide a comprehensive environmental consenting regime for activities within New Zealand's EEZ and continental shelf. Section 10 of the EEZ Act outlines its purposes and states:

(1) The purpose of this Act is –

(a) to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf; and

(b) in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter.

*(2) In this Act, **sustainable management** means managing the use, development, and protection of natural resources in a way, or at a rate, that enables people to provide for their economic well-being while –*

(a) sustaining the potential of natural resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of the environment; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

An assessment of whether the proposed activities meet the purposes of the EEZ Act is contained within **Section 10**.

3.1.2 Section 20 Restrictions

Section 20 of the EEZ Act lists a number of activities that cannot be undertaken within the Exclusive Economic Zone (**EEZ**) or in, or on, the continental shelf unless the activity is a permitted activity or authorised by a marine consent or sections 21, 22 or 23 of the EEZ Act.

A number of the activities associated with the Kupe Phase 2 Development Drilling Programme are restricted by section 20 of the EEZ Act and are not classified as permitted nor currently authorised by a marine consent. The specific proposed activities restricted by section 20 of the EEZ Act are described in detail within **Section 2.2**.

3.1.3 Section 20B Restrictions

Section 20B of the EEZ Act restricts the discharge of harmful substances from structures and submarine pipelines into the sea or into or onto the seabed of the EEZ unless the discharge is a permitted activity or authorised by a marine (discharge) consent or sections 21, 22 or 23 of the EEZ Act.

This consent application seeks authorisation for the discharge of trace amounts of harmful substances through ‘offshore processing drainage’ (referred to in this consent application as the ‘deck drains’ or ‘deck drain system’) as outlined within **Section 2.3**. This discharge is from a structure (a MODU) and is restricted by section 20B of the EEZ Act as it is not a permitted activity or authorised by sections 21, 22 or 23 of the EEZ Act.

In addition to the above, the Kupe Phase 2 Development Drilling Programme will involve the discharge of harmful substances during the drilling (i.e. drilling fluids and operational substances) that are restricted by section 20B of the EEZ Act. However, as discussed in **Section 2.2.3.5**, the preferred supplier of the substances (including those that are potentially harmful) has not been finalised at the time of lodging this consent application. Therefore, Beach will be applying for a separate marine discharge consent for the discharge of these harmful substances once they are known to avoid potential uncertainty with the drilling fluids involved.

3.1.4 Information Requirements

As required by section 38 of the EEZ Act, an application for a marine consent or marine discharge consent must include an IA prepared in accordance with section 39 of the EEZ Act. Section 39 of the EEZ Act sets out what information must be included within the IA; **Table 1** summarises how these requirements are met in this document.

Sections 59, 60, and 61 of the EEZ Act set out matters which the marine consent authority must take into consideration and principles it must apply when making a decision on an application for a marine consent or marine discharge consent; **Table 2**, **Table 3**, and **Table 4** summarise how these requirements are met in this document.

Importantly, section 61(1)(b) of the EEZ Act states that a marine consent authority must base its decisions on the ‘best available information’, being the best information that, in the particular circumstances, is available without unreasonable cost, effort, or time. The information presented in this consent application comprises the best available information.

3.2 Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015

The D&D Regulations set out the provisions for the discharge of harmful substances, including from offshore structures. The D&D Regulations provide classifications for different types of discharges of harmful substances, including activity statuses for some activities (i.e. permitted or prohibited) and processing pathway (i.e. non-notified).

Regulation 4 of the D&D Regulations provides the meaning of a 'harmful substance' as:

(a) a substance that is ecotoxic to aquatic organisms and is hazardous for the purposes of the Hazardous Substances (Minimum Degrees of Hazard) Notice 2017;

(b) oil;

(c) garbage;

(d) sediments from mining activities other than petroleum extraction.

Although regulation 4(a) of the D&D Regulations states that a harmful substance is one that 'is hazardous for the purposes of the Hazardous Substances (Minimum Degrees of Hazard) Notice 2017', this 2017 notice has been revoked and replaced by the Hazardous Substances (Hazard Classification) Notice 2020 (**the Notice**) which came into force on 30 April 2021[9]. Part D of the Notice requires that any enactment that refers to the 2017 notice must be treated as referring to the Notice.

The purpose of the Notice is to establish a hazard classification system for hazardous substances and gases under pressure by reference to the GHS 7, and by adopting classification categories for certain substances that are ecotoxic to the terrestrial environment.

If a substance is ecotoxic to aquatic organisms under the categories for aquatic ecotoxicity that New Zealand has adopted under GHS 7, then it is a harmful substance for the purpose of regulation 4 of the D&D Regulations. These categories under GHS 7 are:

- Hazardous to the aquatic environment acute (Category 1);
- Hazardous to the aquatic environment chronic (Category 1);
- Hazardous to the aquatic environment chronic (Category 2);
- Hazardous to the aquatic environment chronic (Category 3); and
- Hazardous to the aquatic environment chronic (Category 4).

New Zealand has elected not to adopt the GHS 7 categories 'hazardous to the aquatic environment - acute Category 2' and '- acute Category 3'. As such, substances that are currently classed as hazardous under GHS 7 only by virtue of being in these two categories (as a result of the characteristics and ecotoxicity) are not 'harmful substances' for the purpose of regulation 4 of the D&D Regulations.

[9] https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/epa-notices-for-hazardous-substances/epa-notices-no-longer-in-force/

Regulation 16 of the D&D Regulations classifies discharges of harmful substances from petroleum extraction activities as either discretionary or non-notified discretionary activities. The discharge of harmful substances from deck drains (offshore processing drainage) is covered by regulation 16. Regulation 16(1) reads as follows (emphasis added):

> *(1) The discharge of harmful substances described in regulation 4(a) and (b) from offshore processing drainage, displacement water, and production water is classified as a discretionary activity under the Act, unless subclause (2) or (3) applies.*

All water which runs off a MODU, incidental to its drilling activities, either through the hazardous or non-hazardous deck drains is captured by the definition of 'offshore processing drainage'.

Regulations 16(2) and 16(3) of the D&D Regulations are not relevant to this discharge stream as the discharge is not as a result of a test flow of an exploration well and the MODU is not an 'existing structure'. Therefore, under regulation 16(1) of the D&D Regulations the discharge of harmful substances from offshore processing drainage is classified as 'discretionary'.

As discussed in **Section 2.3**, the handling and use of harmful substances may result in occasional drips and other minor spills of harmful substances on the decks of the MODU may occur and these may then enter the deck drains even after cleaning – that is, residual amounts of harmful substances may remain on the decks after clean-up of any conceivable spills. As such, it is not possible for Beach to guarantee the absolute absence of trace amounts of harmful substances being entrained in water that runs off the deck and into the deck drains and subsequently discharged to the sea.

3.3 Other Environmental Protection Authority Regulatory Approvals Required

In addition to this consent application, the activities associated with the Kupe Phase 2 Development Drilling Programme will require additional approvals under the EEZ Act, including a marine discharge consent for the discharge of harmful substances associated with drilling fluids, cementing, and other incidental discharges, along with an ESRP which is required to be submitted to (and approved by) the EPA.

In addition to the ESRP, although not specifically an 'approval' as such, the pre-drill monitoring requirements for the initial development well outlined within **Section 2.2.9** are proposed to be undertaken under the Permitted Activities Regulations. As part of the process under the Permitted Activities Regulations, consultation will be undertaken with parties identified by the EPA, and an initial environmental assessment and sensitive environments contingency plan will be provided prior to these activities commencing.

Beach acknowledges that the activities which are the subject of this consent application cannot commence until all other required approvals have been obtained. In addition, all processes and practices to avoid, minimise, or mitigate the effects of a spill of harmful substances on board the MODU(s) will be the subject of the ESRP, which must be approved by the EPA before any activities can commence.

3.4 Other Marine Management Regimes

Section 39 of the EEZ Act states that an IA must specify any measures required by another MMR and any measures required by or under the Health and Safety at Work Act 2015 that may have the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests. Further, section 59(2)(h) of the EEZ Act states that a marine consent authority must take into account the nature and effect of other marine management regimes when considering applications.

Section 7 of the EEZ Act defines what an MMR means and includes a list of MMRs that may be relevant to any particular activity. The MMRs that may be relevant to this consent application (i.e. those that may include measures required by, or under, them which may have the effect of avoiding, remedying, or mitigating the adverse effects of the proposed activities on the environment or existing interests) are the:

- Biosecurity Act 1993;
- Continental Shelf Act 1964;
- Marine Mammals Protection Act 1978
- Maritime Transport Act 1994;
- Resource Management Act 1991;
- Submarine Cables and Pipelines Protection Act 1996; and
- Wildlife Act 1953.

These MMRs are discussed in the following sections, along with the Health and Safety at Work Act 2015.

3.4.1 Biosecurity Act 1993

The Biosecurity Act 1993 provides the legal framework for the Ministry for Primary Industries, and others, to help keep harmful organisms out of New Zealand. This is achieved through pre-border entry risk management and standard setting, border management, readiness and response, and long-term pest management.

The Craft Risk Management Standard – Biofouling on Vessels Arriving to New Zealand (**CRMS**) has been issued under the Biosecurity Act 1993. The CRMS requires a vessel that arrives in New Zealand waters to have a 'clean hull' which is when no biofouling of live organisms is present other than that within the thresholds provided in the CRMS.

3.4.2 Continental Shelf Act 1964

The Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006 came into force on 1 March 2007. These regulations were made pursuant to section 8 of the Continental Shelf Act 1964 and defines a 'Safety Zone' that extends from each point of the outer edge of the Kupe WHP to a distance of 500 m. The effect of this Safety Zone is that a ship must not enter the Safety Zone unless it is engaged in constructing or servicing the Kupe WHP, associated submarine pipelines, or associated offshore facilities. Restricting access to this zone around the Kupe WHP reduces the potential introduction of additional health and safety risks by unauthorised persons during operations.

3.4.3 Marine Mammals Protection Act 1978

The Marine Mammals Protection Act 1978 provides for the protection, conservation, and management of marine mammals. This Act provides for the establishment of marine mammal sanctuaries, within which activities known to harm particular marine mammal species can be restricted and strictly controlled by the Minister of Conservation. The closest marine mammal sanctuary to the Kupe Impact Assessment Area (**IAA**) (discussed further in **Section 4.1**) is the West Coast North Island Marine Mammal Sanctuary (**WCNI MMS**) which was established to protect the nationally critical Māui's dolphin and is bounded by the Coastal Marine Area (**CMA**)/EEZ boundary located approximately 0.7 km to the northeast of the Kupe IAA. The WCNI MMS places restrictions on commercial and recreational set net fishing, seismic surveying, and seabed mining; however, it is silent on all other activities that could potentially occur in these coastal waters.

Under this Act, the Marine Mammal Protection Regulations 1992 (**MMPR**) include rules and guidelines to boat users on how they should interact with marine mammals at sea in order to prevent adverse effects on, and interference with, marine mammals. Compliance with the MMPR during the Kupe Phase 2 Development Drilling Programme will serve to reduce the likelihood of marine mammal ship strike, thereby assisting in the avoidance of potential effects on the environment.

3.4.4 Maritime Transport Act 1994

The Maritime Transport Act 1994 regulates the maritime activities within New Zealand waters to enable the implementation of New Zealand's obligations under international maritime agreements and conventions. This is achieved through various maritime rules and marine protection rules which are administered by MNZ. These rules cover a wide range of activities, including, but not limited to:

- Procedures relating to ship operations;
- Health and safety of ship's personnel;
- Navigation safety;
- The management of operational waste from vessels and offshore platforms; and
- Oil pollution prevention and responding to oil spills.

Of particular relevance to the Kupe Phase 2 Development Drilling Programme is the requirement for an OSCP. Marine Protection Rules: Part 131 requires offshore installations (i.e. a MODU) to not be operated without an approved OSCP. The OSCP supports an efficient and effective response to an oil spill at sea and also ensures certain pollution prevention equipment and arrangements on board the MODU meet international performance standards and maintenance requirements.

Further, Marine Protection Rules: Part 103A (which gives effect to Regulation 26 of Annex I of the International Convention for the Prevention of Pollution from Ships (**MARPOL**)) require ships to have shipboard oil pollution emergency plans / oil spill contingency plans. These plans are designed to assist personnel in dealing with an unexpected or probable discharge or escape of oil and to mitigate its effects.

3.4.5 Resource Management Act 1991

Although the CMA boundary is close to the IAA (i.e. approximately 700 m, as detailed in **Section 4**, **Figure 10**), the actual and potential effects from the Kupe Phase 2 Development Drilling Programme will be more limited than the maximum extent of the IAA. As can be seen in **Section 2.2.4**, the maximum spatial extent of the deposition of drill cuttings is approximately 1.2 km from the Kupe WHP; therefore, any potential effects will not be near or in the CMA.

There is a possibility that the MODU contracted by Beach for the Kupe Phase 2 Development Drilling Programme will arrive and/or leave New Zealand waters on a Heavy Lift Vessel. The offloading (float-off) and later loading (float-on) of a MODU within the CMA may trigger the requirement for a resource consent under the Resource Management Act 1991 (**RMA**). Sheltered coastal waters of an adequate depth are required in order for the float-off/float-on operation to be undertaken safely. If this requirement is triggered and a resource consent is necessary for this to occur, then Beach will apply for the required resource consent from the respective regional council prior to the arrival of the MODU.

The New Zealand Coastal Policy Statement 2010 (**NZCPS**) was developed to provide policies to achieve the purpose of the RMA in relation to the coastal environment of New Zealand. The consideration of the provisions of the NZCPS comes down to the potential effects that an activity may have within the CMA waters. Due to the spatial extent of the effects from the activities for which consent is sought (see **Section 2.2.4**), it is considered that no weighting should be given to the provisions within the NZCPS for this marine consent application under the EEZ Act.

3.4.6 Submarine Cables and Pipelines Protection Act 1996

The Submarine Cables and Pipelines Protection (Kupe Gas Project) Order 2008, made pursuant to section 12(1) of the Submarine Cables and Pipelines Protect Act 1996, defines a ‘Protected Area’ around the Kupe pipeline.

The effect of this Protected Area is that no ships, except ships being used for research by the Ministry of Fisheries[10] (provided the research is carried out without directly or indirectly attaching any of the ship to the seabed) or ships being used to construct, repair, maintain or service the Kupe WHP, cables or pipelines connected to the Kupe WHP or facilities associated with the Kupe WHP or those cables or pipelines, may enter the area. Other vessels may transit through the Protected Area, but no fishing may occur nor can any vessel anchor within the area.

3.4.7 Wildlife Act 1953

The Wildlife Act 1953 deals with the protection and control of wild animals and birds, as well as the management of game with a requirement for permits to deal with certain wildlife. Part 1 of this Act provides protection of most species of wildlife (including mammals, birds, reptiles, and amphibians), native or introduced, and states that no one may kill or have in their possession of any such bird or animal unless they have a permit. This part of the Act also provides protection to a small number of terrestrial invertebrates and marine species which are listed in Schedules 7 or 7A of the Act (if they are not listed, they are unprotected).

[10] Note, the Ministry of Fisheries has since been superseded by the Ministry for Primary Industries; however, the Submarine Cables and Pipelines Protection (Kupe Gas Project) Order 2008 still references the Ministry of Fisheries.

The protection of those marine species declared to be animals (Schedule 7A of the Wildlife Act 1953) provides a mechanism for avoiding adverse effects of the Kupe Phase 2 Development Drilling Programme on the environment. An assessment of the likelihood of encountering these protected marine species is contained within **Section 4.3.3.2**. The protection of animals under the Wildlife Act 1953 has been considered when determining potential adverse effects, including the development of the proffered conditions.

3.4.8 Health and Safety at Work Act 2015

The Health and Safety at Work Act 2015 is the principal legislation for managing health and safety at work in New Zealand. The primary set of regulations under this Act relevant to this consent application is the Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016 (**HSWPEE Regulations**).

The HSWPEE Regulations contain a number of measures that can have an effect of avoiding, remedying, or mitigating adverse effects on the environment or existing interests, including:

- The requirement for a ‘Safety Case’ to be submitted to, and approved by, WorkSafe. A Safety Case must identify hazards that have the potential to cause multiple fatalities on or near the MODU, describe how the hazards are controlled, and describe the safety management system in place to ensure the controls are effectively and consistently applied;
- The requirement to ensure wells are designed, constructed, operated, maintained, suspended, and abandoned in a way that risks from the wells are reduced to a level that is ALARP;
- The requirement for a well examination scheme that requires an independent and competent person to examine all wells; and
- The requirement for reporting of all notifiable incidents.

A Safety Case will be required under the HSWPEE Regulations for the MODU as it meets the definition of a ‘non-production installation’. Part 5 of HSWPEE Regulations states that a MODU will need to either have a current certificate of fitness or a recognised verification scheme. A certificate of fitness demonstrates that the MODU, and all equipment necessary for its safe operation, are appropriately designed, in good working order, and in a good state of repair. A recognised verification scheme can apply to a MODU and is an alternative to a certificate of fitness. A verification scheme demonstrates that all safety-critical elements of the MODU are documented, suitable, in good working order, and in a good state of repair.

Regulation 72 of the HSWPEE Regulations requires a drilling contractor to prepare an emergency response plan and submit a copy to WorkSafe for a non-production installation (i.e. a MODU).

4 Existing Environment

4.1 Introduction

Section 39(1)(b) of the EEZ Act requires an IA to describe the current state of the area where it is proposed that the activity will be undertaken and the environment surrounding the area. This is commonly referred to as the 'existing environment' and, for the purposes of this consent application, an IAA has been defined as shown in **Figure 10**.

The Kupe IAA extends out to a radius of 5 km from the Kupe WHP, where the drilling will occur, to ensure that the largest spatial extent, plus a significant buffer, of all actual and potential impacts from the drilling activity is covered. The activity with the greatest spatial extent is the deposition of the drill cuttings, which extends out to approximately 1.2 km from the Kupe WHP in a re-spud scenario as discussed in **Section 2.2.4**.

In October 2021 Beach commissioned SLR Consulting NZ Limited to undertake a baseline environment survey in the vicinity of the Kupe field to describe the benthic biota, determine the physiochemical characteristics of sediment, and assess whether there were any sensitive environments present or protected species within and around the Kupe field, called the 2021 Kupe Baseline Survey. This survey provides information of the benthic environment observed and has provided the basis for the descriptors of the benthic environment, including sensitive environments and protected species. The locations of the sampling effort are shown in **Figure 11**.

Figure 10 IAA for the Kupe Phase 2 Development Drilling Programme

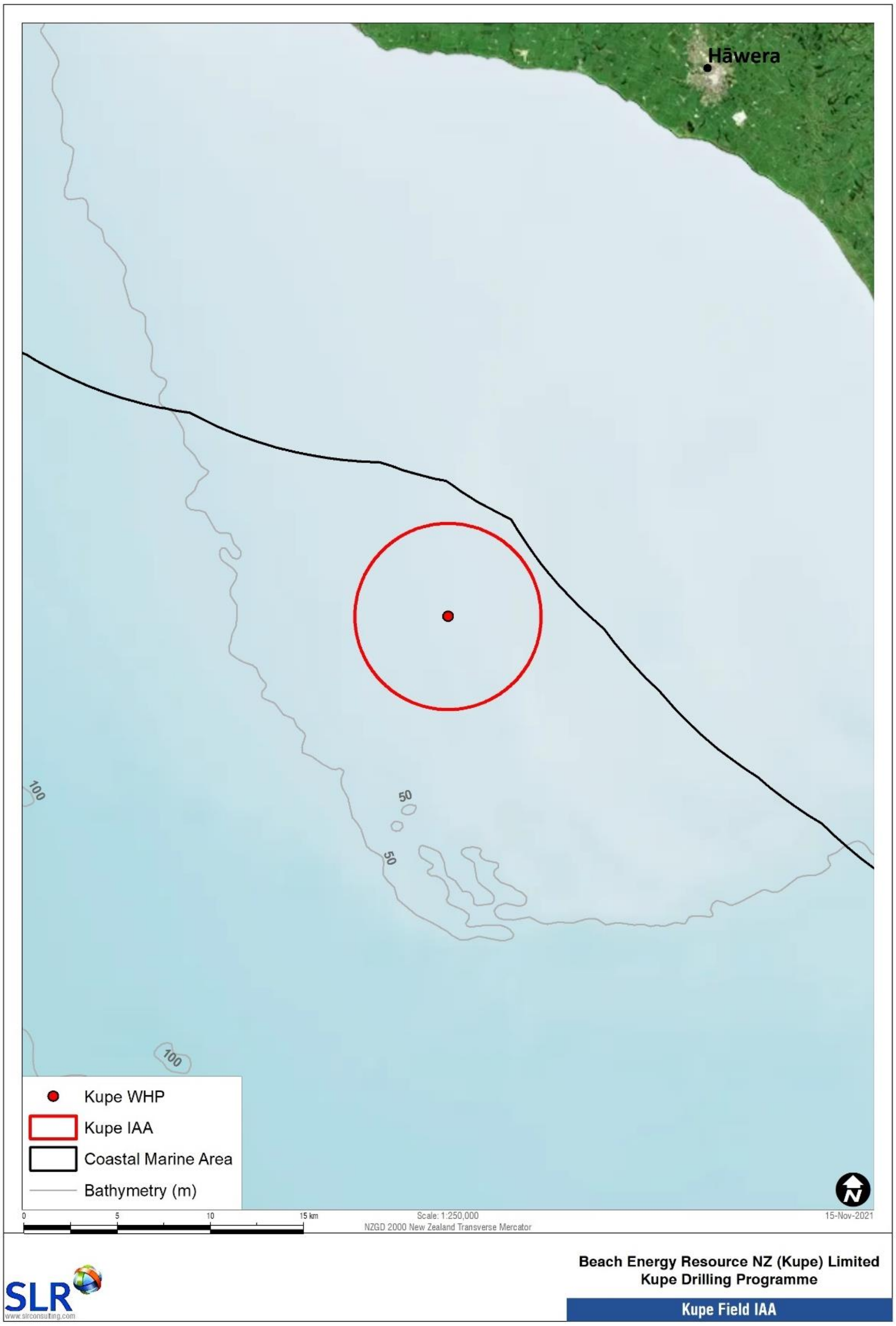
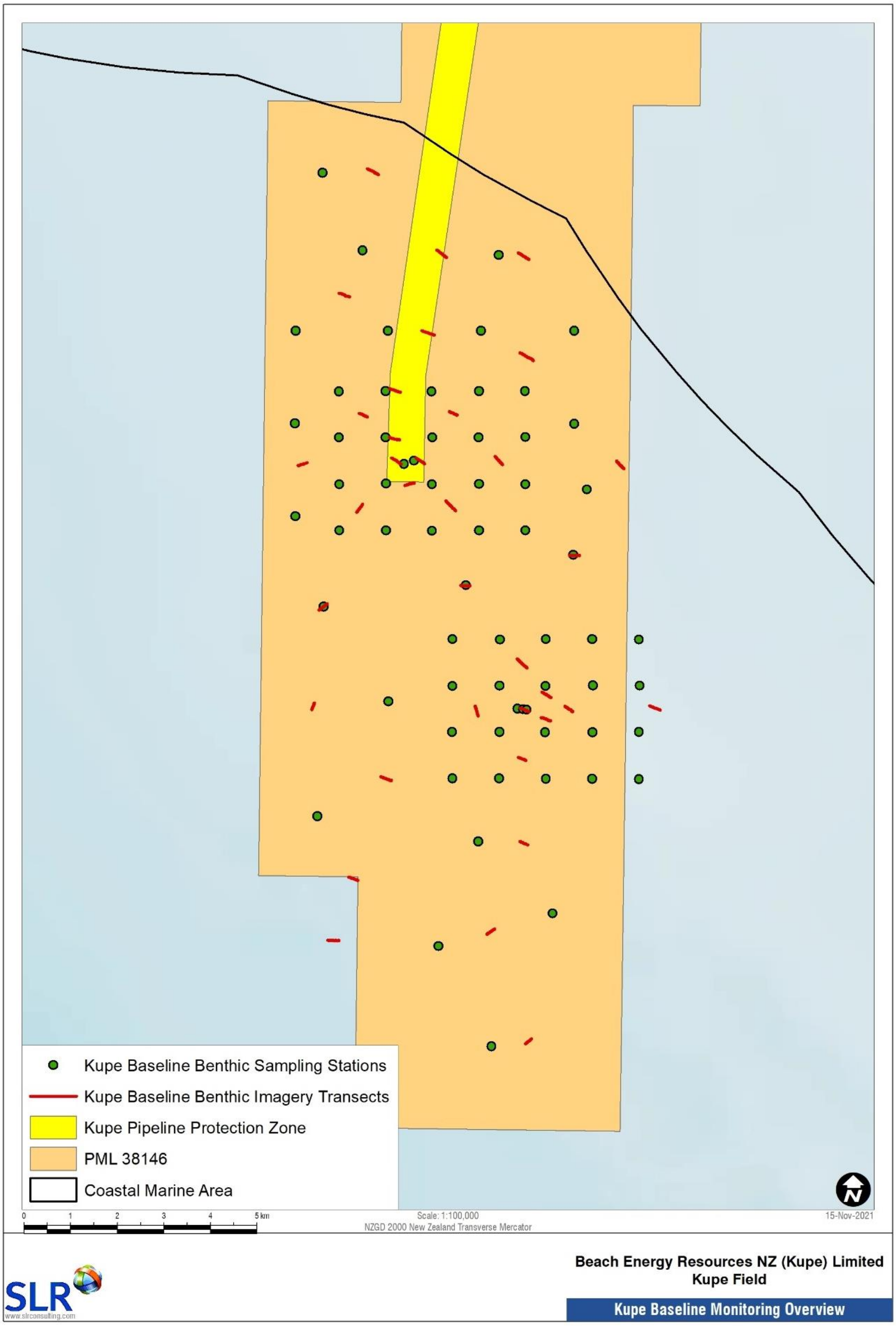


Figure 11 Overview of the 2021 Kupe Baseline Survey Locations



4.2 Physical Environment

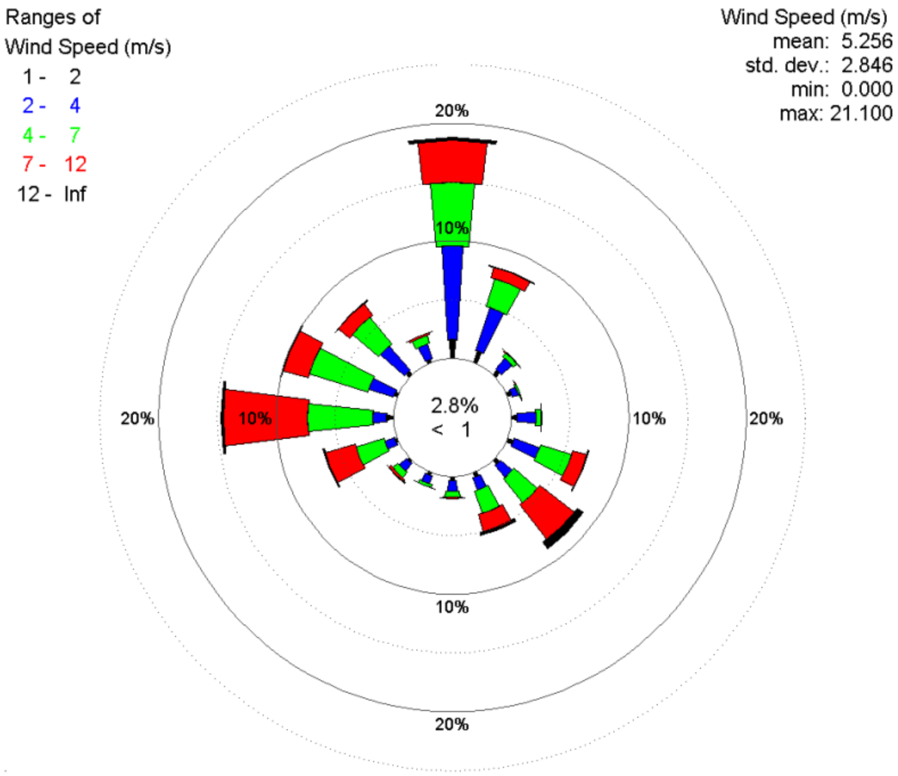
4.2.1 Meteorology

New Zealand's climate varies from the warm subtropical upper North Island to cool temperate in the lower South Island (NIWA, 2021a). Three key features determine New Zealand's climate: prevailing winds, the ocean, and the mountain ranges (Te Ara, 2021a). Due to its location within the southern hemisphere temperate zone and the roughly south-west to north-east orientation of the country, New Zealand's weather systems mainly arise from its exposure to prevailing westerly airflows (Macara, 2018), known as the roaring forties and furious fifties (Te Ara, 2021a). Low-pressure systems usually separate two high pressure systems, which, as they move east across the country, usually bring a regular weather sequence for approximately a week before the low-pressure system develops bringing unstable wet and windy weather (Macara, 2018).

Taranaki is considered one of the windiest regions in New Zealand (Chappell, 2014). Within this climatic zone, the most settled weather occurs in summer and early autumn, with winter months the most unsettled time of the year (NIWA, 2021a).

Onshore winds measured at the Hawera Aerodrome (which is 98 m above sea level) over an 8-year period (January 2004-July 2012) were summarised in MacDonald *et al.*, (2015) and showed a mean wind speed of 19.1 km/h with winds predominantly coming from the north, west, and southeast directions (**Figure 12**). Maximum wind speeds over this period reached 76 km/h during a southerly gale.

Figure 12 Onshore wind rose for Hawera automated weather station between January 2004 and July 2012



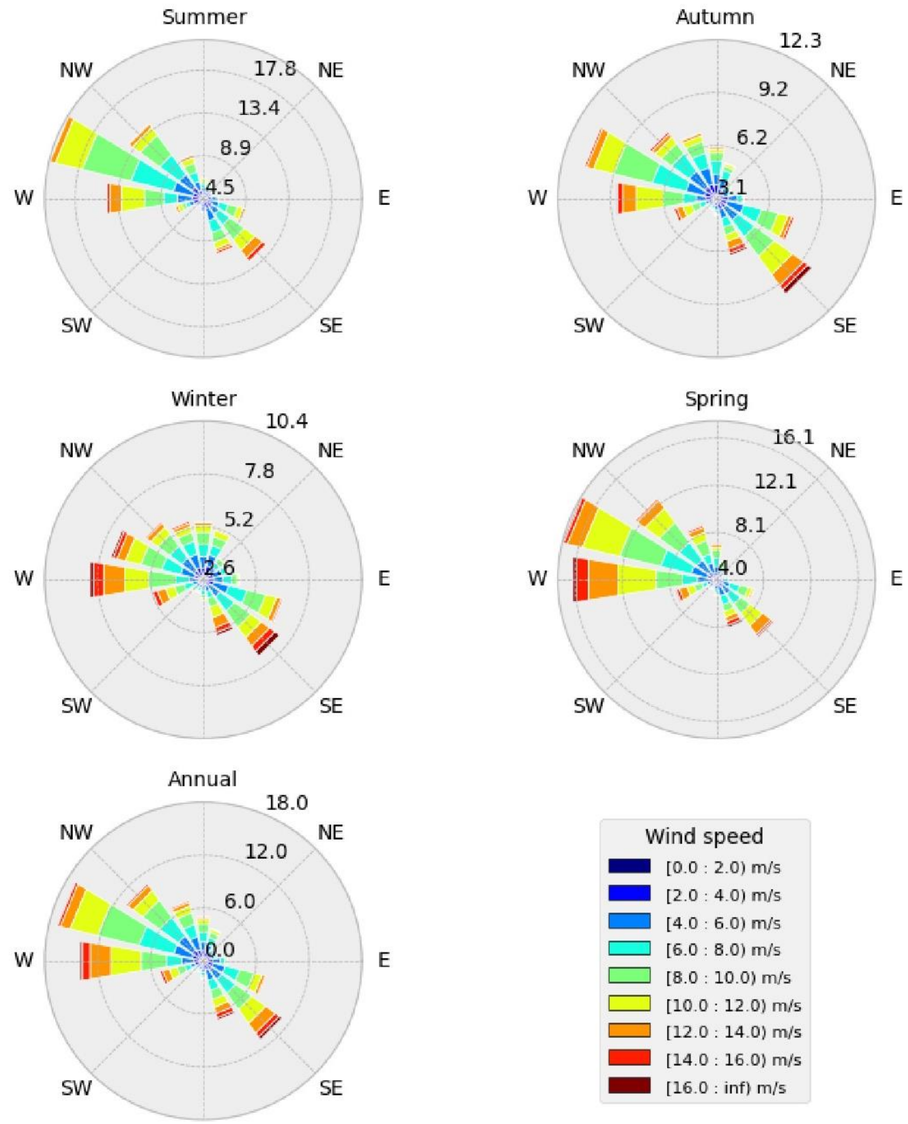
Source: MacDonald *et al.*, 2015

As part of the modelling undertaken for the Kupe Phase 2 Development Drilling Programme (**Section 2.2.4.1**) a summary of the metocean conditions in the Kupe IAA was undertaken and is presented in **Table 7**, which shows that the wind is often above 25 km/hr (i.e. 7 m/s). The predominant direction of the wind is from the W-NW direction, and from the SE (refer **Figure 13**), with little seasonal variation.

Table 7 Monthly and annual mean and max modelled wind speeds at the Kupe WHP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean (m/s)	7.45	6.78	7.07	7.46	7.69	8.00	8.07	6.99	8.57	8.20	7.84	6.99	7.59
Max (m/s)	18.20	21.11	22.96	20.87	18.16	18.56	20.32	17.00	19.06	19.34	16.41	18.57	22.96

Figure 13 Seasonal wind roses for the Kupe WHP



Source: Calypso Science, 2022b

Note: Bars on the wind roses indicate the direction from which wind is coming from

Periods of high rainfall occur in Taranaki when a slow-moving anticyclone lies to the east of New Zealand, allowing warmer moist northerly air from the tropics to flow over the country. Heavy rain can occur if these conditions are associated with slow-moving fronts lying north-south near Taranaki, or when depressions move across the region.

When the airflow over New Zealand is from the northeast, rainfall in Taranaki tends to be scattered and light until the next frontal zone crosses the region. In Taranaki, westerly airstreams are associated with periods of unsettled showery weather. In these situations, a belt of high pressure lies to the north of the country, while to the south migratory depressions move steadily eastwards. The westerly airstream frequently contains rapidly moving cold fronts bringing periods of heavier showers to western New Zealand. Rain frequency and intensity increases inland towards Mount Taranaki (Chappell, 2014).

There is currently no rainfall monitoring and recording equipment capturing publicly available information at any of the offshore installations in the Taranaki Basin. Rainfall records for onshore sites across the Taranaki region are recorded by the Taranaki Regional Council (**TRC**). Rainfall statistics were accessed from the TRC for its monitoring station at the Hawera Aerodrome, located close to the coast approximately 16 nautical miles (**NM**) north-east of the Kupe WHP and these are presented in **Table 8**. The mean annual rainfall at this site for the period 1981-2010 is 1,141 mm, with the mean monthly totals ranging from 73 mm (in February) to 120 mm (in June).

Table 8 Mean monthly rainfall statistics for TRC weather monitoring station at Hawera Aerodrome between 1981 and 2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean Rainfall (mm)	76.2	73.2	82.6	83.2	97.9	119.5	119.2	98.8	94.1	110.2	93.8	92	1,140.7

Source: NIWA Cliflo, 2021

4.2.2 Air Quality

Tonkin & Taylor (2015a; 2015b) stated background levels of air contaminants are low in the STB, with marine aerosols in the form of naturally occurring salt spray making up the majority of background fine particulates. The offshore nature of the Kupe WHP suggests that the conclusions reached by Tonkin & Taylor (2015a; 2015b) are applicable for the Kupe field. Although, the Kupe IAA is further offshore than the location assessed by Tonkin & Taylor (2015a; 2015b) and therefore less land-based pollutants are expected.

Air quality in the Taranaki region is generally considered to be ‘excellent’ on account of the windy, exposed nature of the coast, absence of heavy industry, and low population/vehicle numbers (TRC, 2011; TRC, 2021). The air quality within the Kupe field is expected to be high compared to populated areas of Taranaki such as cities and towns due to its offshore location away from any major sources of air contaminants.

4.2.3 Currents

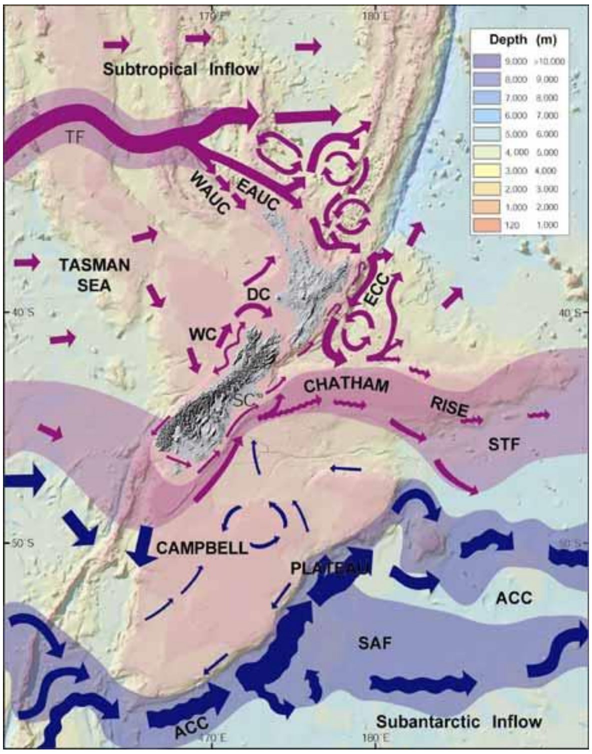
New Zealand's coastal current regime is dominated by three components: wind-driven flows, low-frequency flows, and tidal currents. The net current flow is a combination of these three components, which is often further influenced by the local bathymetry.

New Zealand lies in the pathway of eastward-flowing currents driven by winds that blow across the South Pacific Ocean (Brodie, 1960; Te Ara, 2021b). As a result, New Zealand is exposed to the southern branch of the South Pacific subtropical gyre driven by the southeast trade winds to the north and the Roaring Forties westerly winds to the south (Gorman *et al.*, 2005; Te Ara, 2021b).

The main ocean currents around New Zealand are illustrated in **Figure 14**. The eastward flow out of the Tasman Sea splits into two currents across the top of the North Island: the West Auckland Current flowing from Cape Reinga towards Kaipara, and the East Auckland Current flowing from North Cape towards the Bay of Plenty (Brodie, 1960; Heath, 1985; Stanton, 1973). As the West Auckland Current travels south, it is met in the North Taranaki Bight by the north-flowing Westland Current. The Westland Current flows from the west coast of the South Island up to the west coast of the North Island where it weakens and becomes subject to seasonal variability. As a result of local weather conditions and seasonality, the convergence zone of the two currents is highly variable (i.e. the northern limit of the Westland Current and the southern limit of the West Auckland Current) (Brodie, 1960; Ridgway, 1980; Stanton, 1973).

Seasonal variation in the West Auckland Current and Westland Current results in varying temperatures and salinity off the Taranaki coastline. During winter, the West Auckland Current extends further south, bringing warmer waters. In contrast, the West Auckland Current is weaker in the summer months and the Westland Current dominates, bringing colder waters (Ridgway, 1980; Stanton, 1973).

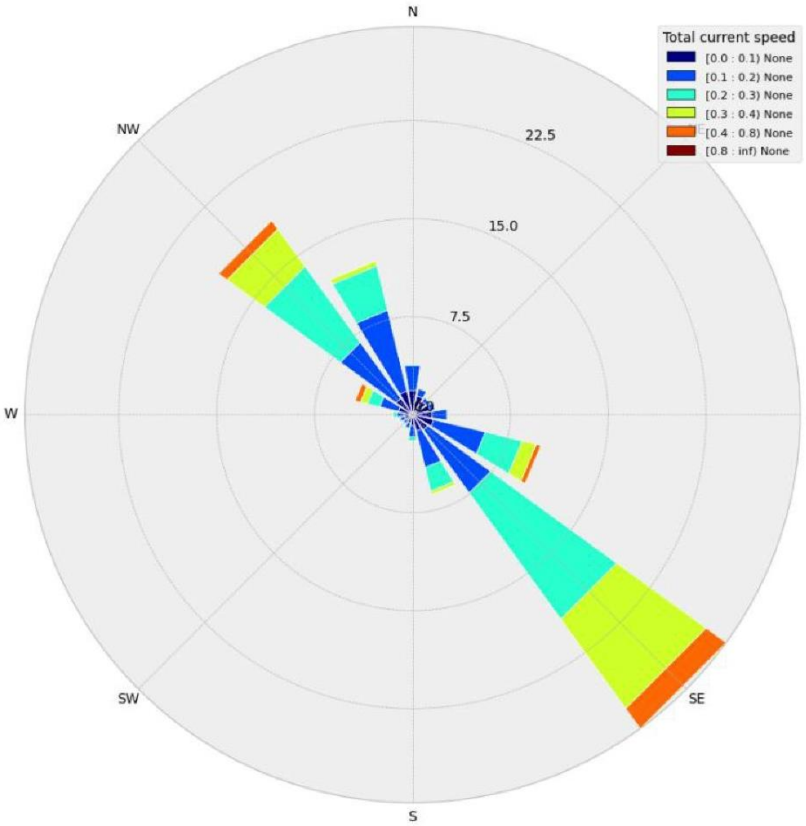
Figure 14 Ocean circulation around the New Zealand coastline



Source: Te Ara, 2021b

As part of the dispersion modelling commissioned by Beach, currents are an integral part in the way in which the cuttings disperse within the water column prior to settling on the seabed. This modelling has shown that the predominant depth averaged current direction within the Kupe IAA is in a NW – SE direction as seen in **Figure 15**. The summary statistics of the depth-average current speeds are provided in **Table 9**, which show that the mean depth averaged current speeds throughout the year are typically 0.20 m/s, with the maximum ranging from 0.59 to 0.79 m/s.

Figure 15 Kupe WHP annual depth-averaged current rose



Source: Calypso Science, 2022a

Note: Bars on the current rose indicate the direction of current is going to

Table 9 Monthly and annual mean and max modelled depth averaged current speeds at the Kupe WHP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean (m/s)	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.20	0.21	0.20	0.20	0.20	0.20
Max (m/s)	0.69	0.74	0.79	0.64	0.63	0.59	0.74	0.54	0.74	0.70	0.61	0.61	0.79

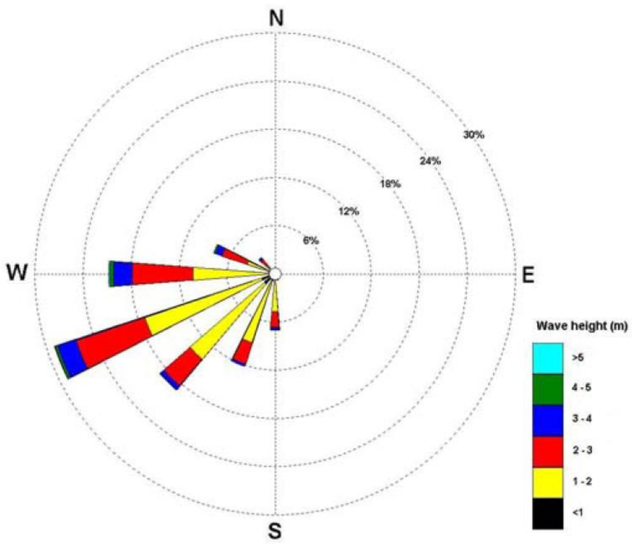
4.2.4 Waves

The offshore Taranaki region is considered to have a high-energy wave climate due to its exposure to long-period swells originating from the Southern Ocean and locally generated seas (Hume *et al.*, 2015). The majority of the wave energy arrives from the west and southwest, with southerly/south-easterly waves able to rapidly rise. In general, wave height in the Taranaki Bight shows a seasonal cycle, with mean significant wave heights peaking in late winter (August and September) and lowest in late summer (MacDiarmid *et al.*, 2015), although large-wave conditions can arise at any time of the year.

The largest waves are found off the western end of Cape Egmont, with wave height decreasing further south as a result of the north-western tip of the South Island providing shelter from the prevailing south-westerly swells (MacDiarmid *et al.*, 2015). Significant wave heights in excess of 8 m can occur in the STB during stormy conditions, particularly in the winter and early spring (MacDiarmid *et al.*, 2015). Wave hindcasting undertaken by Gorman *et al.* (2003) (as referenced in ASR, 2004a) covering the period 1979-1999 showed mean annual significant wave heights of 1.92 m at the Kupe WHP, with the smallest mean wave heights in February (1.53 m) and greatest in August (2.21 m). Most wave energy arrived from the west/southwest quarter with a median direction of 245°.

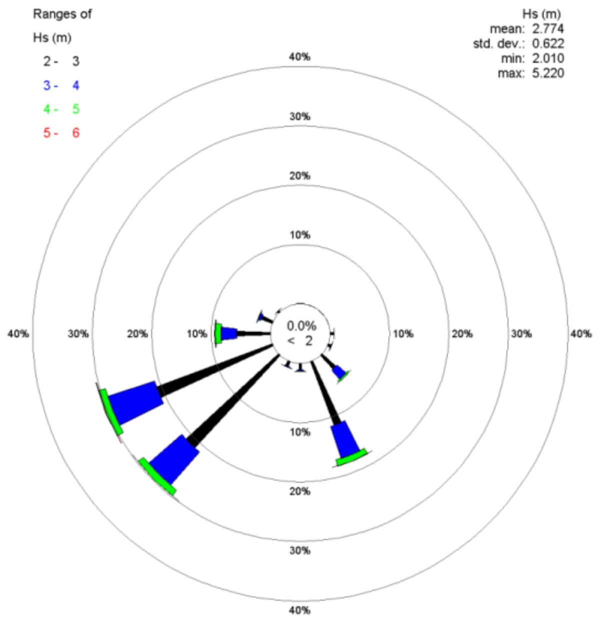
Direct measurements of waves in the STB were made by MacDonald *et al.* (2015) at a number of stations including one within the central portion of the Kupe IAA (site 7 in MacDonald *et al.* (2015)) and generally agreed with the results of the hindcasting model in Gorman *et al.* (2003) (as referenced in ASR, 2004a). Results at this monitoring location showed that between September 2011 and February 2012 large waves (up to 5.2 m) predominantly came from the southwest (**Figure 16**), followed by smaller proportions of large waves from the southeast and west. Mean wave heights of all waves with significant wave height (H_s) greater than 2 m was 2.8 m.

Figure 16 Hindcast wave rose for the Kupe WHP over the period 1979-1999



Source: Gorman *et al.* (2003) (as referenced in ASR, 2004a)

Figure 17 Wave rose for waves measured within the Kupe IAA for H_s greater than 2 m



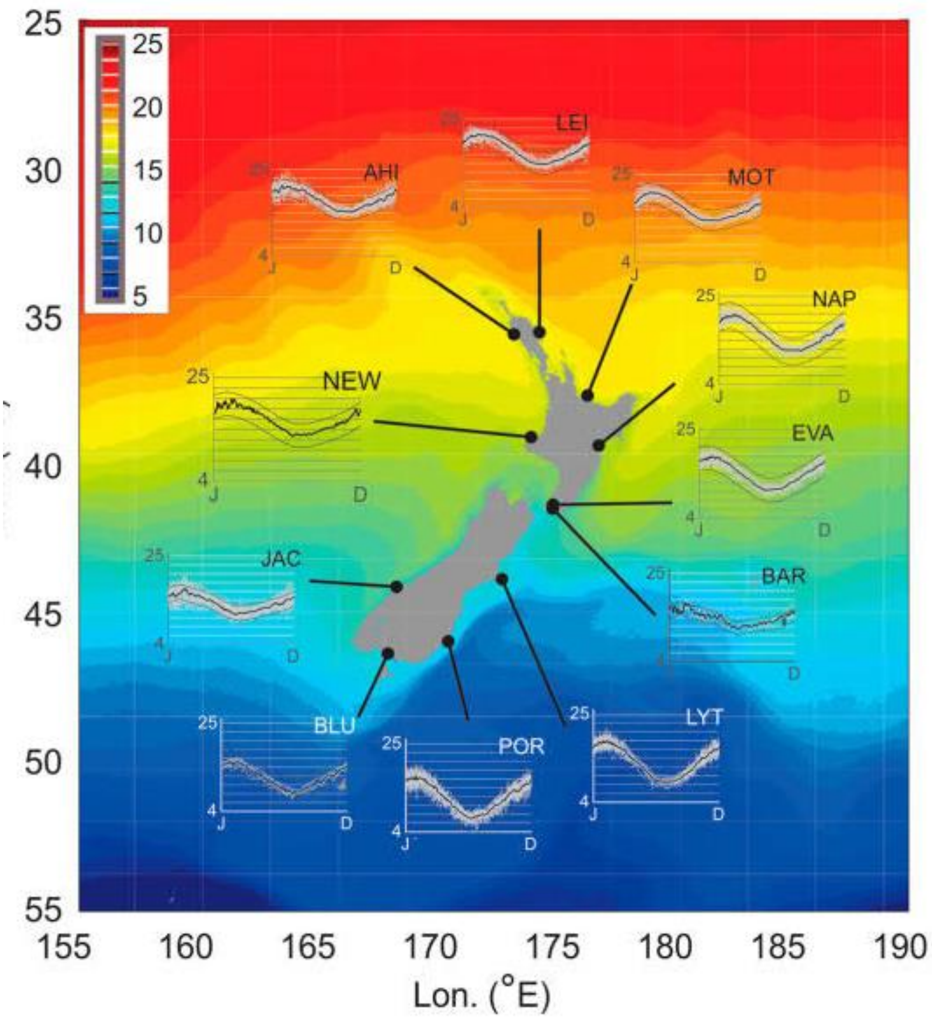
Source: MacDonald, *et al.* (2015).

4.2.5 Thermoclines and Sea Surface Temperature

Sea surface temperatures in New Zealand waters generally show a north-to-south gradient, with warmer waters being found in the north, cooling towards the south (Te Ara, 2021c).

The sea surface temperature in the offshore region typically ranges from approximately 15 °C in winter through to 22 °C in summer (Stevens *et al.*, 2019). The average sea surface temperature of the Taranaki Bight is approximately 15 °C as seen in **Figure 18**. The inshore surface temperatures are more highly variable, depending on location, with New Plymouth ranging from 18-20 °C in summer and 12-14 °C in winter. Near seabed water temperatures in the offshore portion of the STB remains more constant around 13.5 °C, with a narrower range (12.5-14.4 °C), and influences from the upwelling of cold water off the back of Farewell Spit (ASR, 2004a). This temporal pattern was confirmed within the Kupe IAA through monitoring by MacDonald *et al*. (2015) who found that, although there tended to not be large vertical differences in water temperature, water temperature ranged from 12.6 to 19.7 °C between early September and the end of March. Thermal stratification of the water column in the Kupe and Western Cook Strait areas does occur in the spring and summer months (ASR, 2004a), but breaks down as the water cools in autumn and due to significant vertical mixing during storm events.

Figure 18 Regional sea surface temperatures averaged over 2003 – 2015



Source: Stevens *et al*., 2019

4.2.6 Water Quality

The following general assumptions regarding the water quality within the Kupe IAA can be made based on knowledge of the offshore Taranaki region:

- The IAA is within the area of influence from riverine inputs (i.e. dilution and sedimentation);
- The IAA has fresh seawater inputs derived from the Tasman Sea; and
- Nutrient concentrations are expected to be highest towards the inshore end of the IAA due to riverine inputs from the land but could also be higher towards the offshore end of the IAA due to the influence of the Kahurangi Upwelling to the southwest.

As there are no discharges occurring from the Kupe WHP, there is no water quality testing currently being undertaken. Therefore, the following discussion on water quality within the Kupe IAA has been based on the work done in relation to the Trans-Tasman Resources Limited (**TTRL**) applications to mine iron sand at a location very close to the Kupe WHP.

Mean surface suspended sediment concentrations (**SSC**)[11] in the STB were estimated from remote sensing (Pinkerton *et al.*, 2013) during studies for TTRL. This work showed a wide band of elevated SSC along the south Taranaki coast reaching out to 20 km from the shore, being at its widest over the Patea Shoals area. The remote sensing estimated the SSC to range from ~10 mg/L near the coast to 0.7 mg/L in the offshore environment. In addition to this remote sensing, Hadfield (2013) modelled the estimated SSC to be ~20 mg/L in the coastal band and ~0.3 mg/ L in the offshore area. Similar results were seen with optical readings of nearshore surface SSC (MacDonald *et al.,* 2015) which were made at a number of stations in the STB showing concentrations ranging from 1-2 mg/L to 80 mg/L.

Mud-sized fractions of the SSC were also monitored during two periods at stations within the Kupe IAA (site 7 and site 10 in MacDonald *et al.* (2015)) as part of studies completed in relation to the TTRL applications. The near-surface SSC at site 7 (near the centre of the Kupe IAA) showed considerable variability, with peak SSCs occurring just after significant rainfall events and/or after times of large wave heights. This indicates that riverine inputs of sediment were reaching this location and large waves may have also been resuspending seabed sediments. The offshore site (site 10) showed much lower mud-sized fractions of SSC, and reduced temporal variability, with small peaks coinciding with periods of significant rainfall. These results indicate that riverine influences are being pushed out to this offshore extent, albeit at reduced amounts, likely from settlement of some proportion of the SSC carried by the plume.

The IA produced by TTRL noted the median surface SSC around the project site (which is very close to the Kupe WHP) are typically 0.4 mg/L, with the 99th percentile SSC being 2.7 mg/L, and the median near bottom SSC being typically less than 1 mg/L, with the 99th percentile SSC being less than 10 mg/L (TTRL, 2016).

4.2.7 Ambient Noise

Hildebrand (2009) defines ambient noise in the ocean as the sound field against which signals must be detected. In the marine environment, ambient noise is generated by numerous sources, including:

- Biological – marine organisms (e.g. cetacean vocalisations, echolocations, drumming of the swim bladder by fish, snapping shrimp feeding behaviours);
- Physical – meteorological, oceanographic processes and natural seismic events (e.g. breaking waves, rain, lighting strikes, earthquakes); and
- Anthropogenic – shipping traffic, marine construction, seismic surveys, drilling.

Noise from ships (e.g. from propellers, machinery, and the passage of the hull through water) is the dominant anthropogenic sound in marine waters (Gordon & Moscrop, 1996) and adds to the constant natural ambient noise level in the marine environment (Parsons *et al.*, 2004). In general, older vessels produce more noise than more modern vessels, and larger vessels produce more noise than smaller vessels (Gordon & Moscrop, 1996).

Fish utilise sound for navigation and selection of habitat, mating, and communication; marine mammals use sound as a primary means of underwater communication and navigation, and toothed whales (in particular) use echolocation to locate and track the presence of prey (Hildebrand, 2009).

Examples of noise levels from various anthropogenic sources in the marine environment are provided in **Table 10**. All the size classes of vessels presented in **Table 10** transit New Zealand waters, including some vessels larger than those presented. Anthropogenic noises that overlap in space, time, and frequency with marine fauna can represent potential stressors to individuals and populations (Warren *et al*., 2021).

[11] SSC is the same as TSS.

Table 10 Examples of anthropogenic noise sources in the marine environment

Source	Frequency (kHz)	Source level	Reference
Fishing trawler	0.1	158 dB re 1 µPa	Malme *et al.*, 1989
Tanker (135 m length)	0.43	169 dB re 1 µPa	Buck & Chalfant, 1972
Tanker (179 m length)	0.06	180 dB re 1 µPa	Ross, 1976
Super tanker (266 m length)	0.008	187 dB re 1 µPa	Thiele & Ødegaard. 1982
Super tanker (337 m length)	0.007	185 dB re 1 µPa	Thiele & Ødegaard. 1982
Super tanker (340 m length)	0.007	190 dB re 1 µPa	Thiele & Ødegaard. 1982
Containership (219 m length)	0.033	181 dB re 1 µPa	Buck & Chalfant, 1972
Containership (274 m length)	0.008	181 dB re 1 µPa	Ross, 1976
Freighter (135 m length)	0.041	172 dB re 1 µPa	Thiele & Ødegaard. 1982
Semi-sub MODU	0.001 to 4	154 dB re 1 µPa	University of Maryland, 2000
Drillship	0.6	185 dB re 1 µPa	University of Maryland, 2000
Jack-up drilling rig	0.002 to 1.4	120 dB re 1 µPa	Todd *et al.* 2020b

Two studies are of interest with regard to ambient noise in Taranaki waters; Warren *et al.* (2021) characterised the soundscape of central New Zealand, including the waters of the STB, via the deployment of four hydrophones (South Taranaki, Cook Strait, Kaikoura, and Wairarapa) from June to December 2016, and McPherson *et al.* (2019) modelled anthropogenic noise on the west coast of the North Island from July 2014 to June 2015.

Warren *et al.* (2021) found that:

a. Sound levels in the STB were highest below 100 Hz, ranging from 75 to 97 dB re 1µPa^{2}Hz^{-1};

b. Noise from wind, rain, tidal activity, and wave activity (across a broad range of frequencies) consistently increased ambient sound levels - where increasing sound levels correlated to an increase in condition intensity (e.g. high winds caused higher sound levels than light winds etc);

c. Earthquake noise was frequently detected in central New Zealand;

d. Pygmy blue whale calls were abundant in the STB, especially in autumn;

e. Calls from humpback whales, Antarctic blue whales, and Antarctic minke whales were recorded from the STB during migration periods in winter and spring;

f. An unidentified biological 'chorus' with seasonal and daily patterns was detected at all hydrophone locations, possibly representing sounds produced by planktivorous fish; and

g. Shipping noise (persistent tonal sound) was constantly present and seismic survey noise was detected during survey periods, both these sources overlap in frequency with baleen whale calls.

McPherson *et al.* (2019) found that:

a. Noise propagated further in winter, as cooler water temperatures in winter supported longer range propagation and lower attenuation rates;

b. New Plymouth had the highest vessel traffic levels along the entire west coast, and these high levels of broad-band frequencies extend south from New Plymouth into the STB. The overall vessel traffic numbers and associated sound level was lowest in winter. However, seasonal differences were less apparent for commercial shipping categories, i.e. bulk carriers, container ships, tankers and vehicle carriers, compared to fishing vessels;

c. Noise contributions from the Floating Production Storage and Offloading vessels 'Umuroa' and 'Raroa' were prominent in the Taranaki soundscape, particularly during operation. Noise contributions of platforms (Māui Platform Alpha, Māui Platform Bravo, and Kupe) were less prominent;

d. Seismic survey design has a significant effect on soundscape effects, with sparse line spacing being advantageous with regard to lowering the soundscape influence; and

e. Modelling results showed that for March, at 2 and 12 NM offshore in the STB (the receivers closest to the Kupe WHP), the mean broad-band sound level was 96.68 and 99.78 dB re 1µPa, respectively, and was predicted to be above the 'baseline quiet noise level' (92.3 dB re 1µPa) >95% of the time, i.e. the soundscape is driven by anthropogenic noise for >95% of the time. The conclusions were similar for the month of July where the mean broad-band sound levels were even higher at 102.45 and 105.05 dB re 1µPa at 2 and 12 NM offshore, respectively, and still exceeding the 'baseline quiet noise level' for >95% of the time. The exceedances of the baseline quiet noise level appear to be based on these locations being subject to relatively high vessel traffic densities passing through the STB.

4.2.8 Bathymetry and Geology

New Zealand is surrounded by a gently sloping continental shelf, extending from the coast out to a water depth of 100 – 160 m. Beyond this, the gradient of the seabed steepens as the sea floor transitions into the continental slope. The continental slope descends relatively rapidly from the edge of the shelf down to depths of more than 4,000 m. At the foot of the slope the seaward gradient flattens out into ocean basins – wide, undulating but relatively flat zones lying at depths of 4,000 – 5,000 m (Te Ara, 2021d).

The surface of the continental shelf is predominantly flat although punctuated by local banks and reefs, whereas the slope is irregular with large marine valleys, called submarine canyons. These canyons occur where the slope is relatively steep (e.g. off Kaikoura) and generally run from the edge of the continental shelf to the foot of the continental slope (Te Ara, 2021d). There are no submarine canyons located near the Kupe IAA.

The width of New Zealand's continental shelf varies. In the North Taranaki Bight the shelf is broad, narrowing around Cape Egmont before widening again across the STB (MacDiarmid *et al.*, 2015). The Taranaki continental shelf has a 150 km wide opening to the Tasman Sea, occupying approximately 30,000 km², and slopes gently towards the west with an overall gradient of <0.1° (up to 0.5° locally) (Nodder, 1995).

There are eight sedimentary basins underlying New Zealand's continental shelf with known or potential hydrocarbons present (**Figure 19**). To date, commercial quantities of oil and gas have only been produced from the Taranaki Basin; however, non-commercial hydrocarbon discoveries have been made in the offshore East Coast, Canterbury, and Great South basins (NZP&M, 2014).

The Kupe IAA sits near the eastern edge of the Taranaki Basin which lies at the southern end of a rift that developed sub-parallel to the Tasman Sea rift that now separates Australia from New Zealand. The Taranaki Basin occupies the site of a late Mesozoic extension on the landward side of the Gondwana margin and covers approximately 330,000 km². The structure of the basin is controlled by movements along the Taranaki, Cape Egmont, and Turi fault zones (NZP&M, 2014).

Basement rocks in the Taranaki Basin originate from a number of different terranes. Crustal slabs can comprise sedimentary, plutonic, and volcanic rocks. The terranes around New Zealand are grouped into the Paleozoic (540 – 300 million years ago) Western Province, and the Permian to early Cretaceous (300 – 100 million years ago) Eastern Province. At the boundary between these two provinces is a zone of volcanic arc rocks which form the western section of the Taranaki Peninsula (Morton & Miller, 1968).

Figure 19 New Zealand's sedimentary basins

Source: NZP&M, 2014

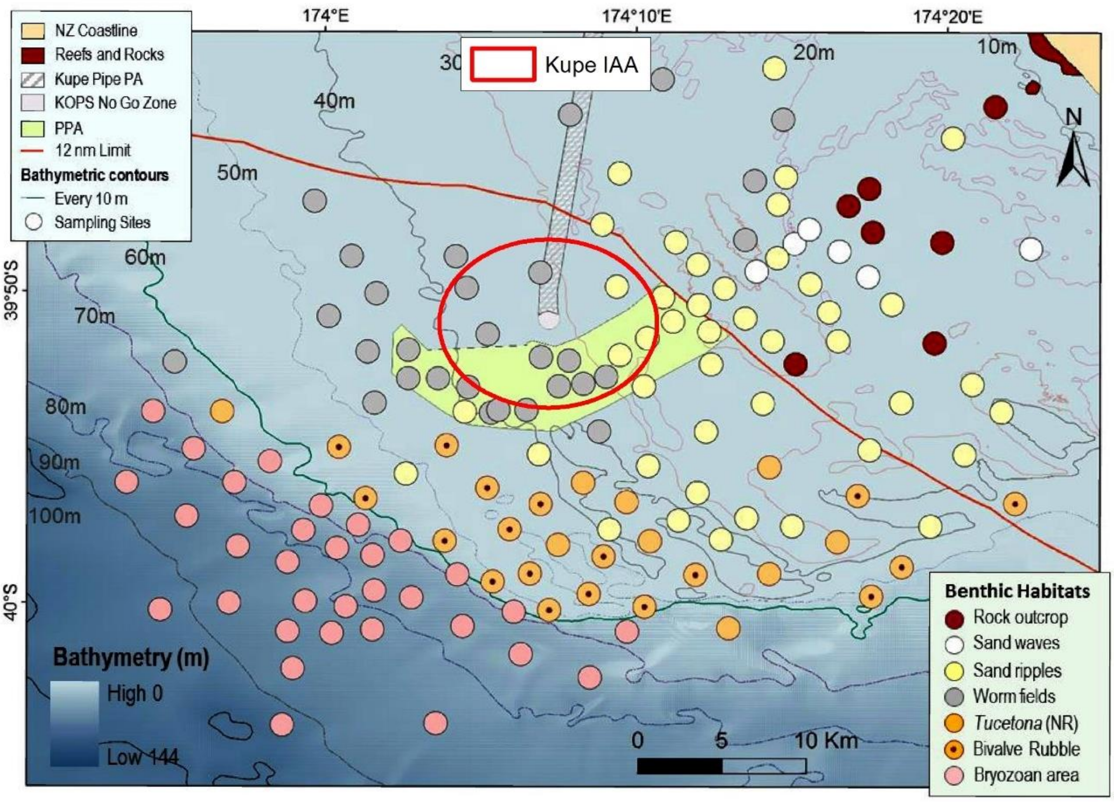
At the finer scale, water depths within the Kupe IAA range from approximately 30 m at the inshore (northern) boundary to approximately 40 m at the offshore boundary. The seabed within, and close, to the Kupe IAA is generally flat, with occasional small rocky outcrops, with sandy areas showing dynamic rippled bedforms (MacDiarmid *et al.*,2015).

4.2.9 Seafloor Sediments and Substrate

Forrest and Johnson (2011) found that samples collected in the vicinity of the Kupe pipeline, but away from those areas of artificial substrates (such as rock berms, grout bags, concrete mattresses etc.) were dominated by rippled sandy sediments, being made up of >90% sand sized particles. Beaumont *et al*. (2015) undertook extensive sampling across the broader Patea Shoals area (the general area offshore from Patea) in 2011 and 2012 utilising seabed sampling (cores, grabs, and dredge) and benthic imagery (video and stills) to describe benthic flora and fauna and characterise the seabed habitats present. The survey classified major habitat types (**Figure 20**) including:

- Rock outcrop;
- Sand waves;
- Sand ripples;
- Wormfields;
- *Tucetona* (bivalve beds);
- Bivalve rubble; and
- Bryozoan area.

Figure 20 Seabed habitats classified by Beaumont *et al.* (2015) across the Patea Shoals



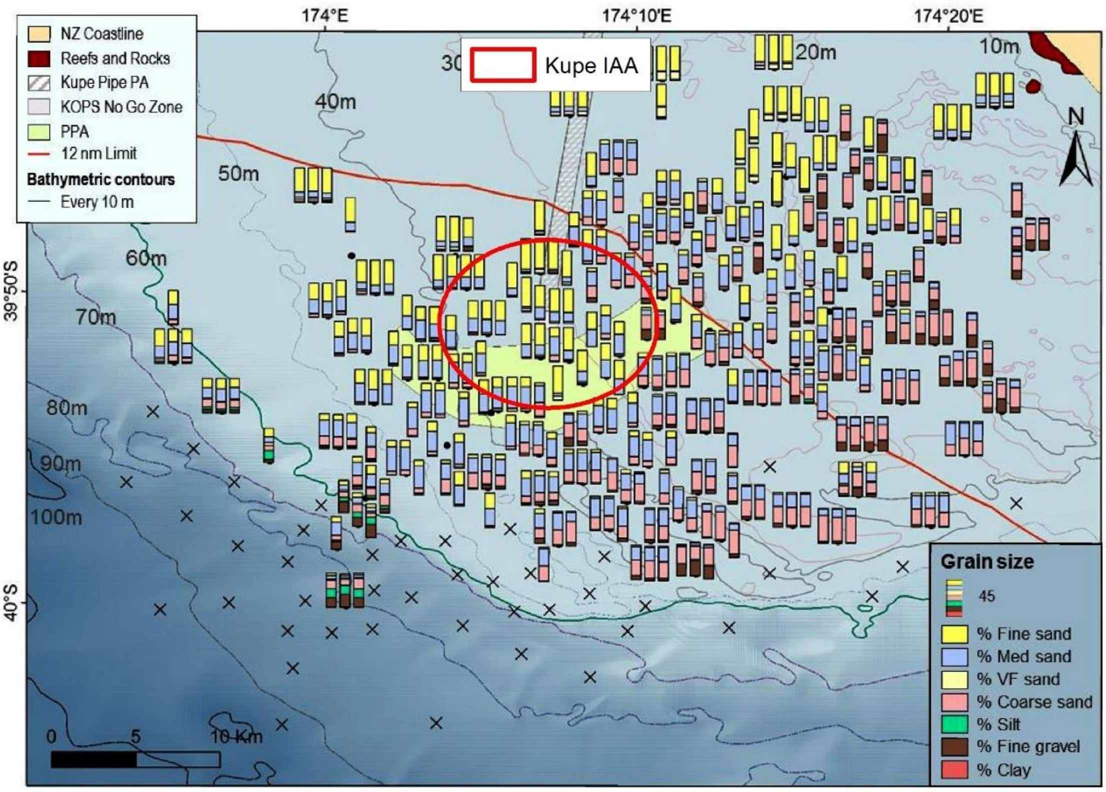
Source: Adapted from Beaumont *et al.*, 2015

Note: The Kupe IAA does not appear as a circle because it has been inserted over a georeferenced figure utilising WGS 84 coordinate system.

Rippled sands were the most common habitat type encountered across the survey area (53% of all sites, and 72% of all inner to mid-shelf areas in a depth range of 15 – 50 m) (**Figure 20**). Areas of rock outcrop were also identified over 7 km away to the east/northeast of the Kupe IAA, although these areas were mostly small amounts of bedrock, boulders, cobbles, and rubble/gravel that were surrounded or partially covered by rippled sands. On the mid-shelf, only rippled sands and wormfield habitats were observed - characterised by high but locally patchy densities of infaunal tubeworms that were visible at the seabed. The highest occurrence of wormfield habitats was in depths of 20 – 70 m (Beaumont *et al*., 2015) which includes the depth range within the Kupe IAA.

Sediment cores collected by Beaumont *et al.* (2015) revealed a general trend of finer sand in the north and a greater proportion of coarse sand and gravels (including shell debris) in the south (**Figure 21**). Further offshore (water depths 40 – 80 m) seabed sediments were a mixture of finer silts combined with coarser sand and fine gravels. In the deeper waters offshore of the Patea Shoals (which includes the outer portions of the Kupe IAA), the seabed was characterised by bivalve rubble, including live dog cockles (*Tucetona laticostata*) and bivalve shell-debris, and bryozoan rubble habitats (**Figure 20**); however, it is noted that these habitats or species were not observed within the IAA portion of the Patea Shoals.

Figure 21 Sediment grain size distribution across the Patea Shoals



Source: Adapted from Beaumont *et al*., 2015

Note: The Kupe IAA does not appear as a circle because it has been inserted over a georeferenced figure utilising WGS 84 coordinate system.

Med = medium; FV = very fine. X indicates where no core sediment sample was collected. PPA in this figure depicts the location of the Trans-Tasman Resources Limited Permit Area.

4.3 Biological Environment

4.3.1 Microphytobenthos

Microphytobenthos is the term given to a diverse range of unicellular eukaryotic algae, diatoms, cyanobacteria, and flagellates that live in/on the uppermost few millimetres of seabed sediments within the photic zones of the ocean where they are able to photosynthesise. Unlike macroalgae taxa, microphytobenthos can be present where there is not a hard substrate for attachment (Huettel *et al.*, 2014) (such as rocky reef).

Benthic algal species are generally limited to the sufficiently well-lit parts of the ocean (the photic zone) in order to receive the required amounts of sunlight for photosynthesis to occur. However, some species of algae have the ability to survive in deeper, more poorly illuminated areas (Markager & Sand-Jensen 1992). In very clear waters some species of Foliose macroalgae have been found in depths as deep as 157 m (with just 0.06% surface light levels) and other species such as crustose algae have been found as deep as 268 m (with just 0.0005% of surface light) (Littler *et al.*, 1985; Markager & Sand-Jensen 1992). Benthic microphytobenthos (particularly diatoms) have been recorded to occur as deep as 191-222 m off the coast of the USA (Cahoon *et al.*, 1992; McGee *et al.*, 2008).

Modelling undertaken of the STB for the TTRL project used 0.1% of surface irradiation as a conservative estimate of the light-limited extent of microphytobenthos production (Cahoon *et al.*, 2015; Cahoon, 2016). Based on the light extinction equation used in this modelling (a negative exponential), the 0.1% light level as a limit for microphytobenthos, and a light extinction coefficient of 0.1, the depth limit for microphytobenthos in the modelled area was calculated to be 69 m (Cahoon, *pers. comm.*, 2021). Therefore, based on the water depths of the Kupe IAA (~30-40 m), it is likely microphytobenthos communities would be present. Cahoon *et al.* (2015) found that, while there have been no direct measurements of microphytobenthos in the area close to the Kupe IAA, their presence in similar environments elsewhere and the presence of sediment interface features in images of the seabed habitats in the area (e.g., colour, sediments coherence) were consistent with microphytobenthos presence.

4.3.2 Benthic Invertebrates

A baseline monitoring survey was conducted within the Kupe IAA in October 2021 where triplicate grab samples were collected from 65 sampling stations to assess diversity and abundance of benthic communities (SLR, 2022). A total of 131 different species/groups were identified from the sampling programme and were dominated by benthic crustacea. Bryozoans of the family Catenicellidae were commonly found in the grab samples and, although only fragments were found in the samples, they can form small colonies which characterise the epifaunal benthic community. Where bryozoans were found, the most dominant benthic crustacea associated with the bryozoans included Cumacea (i.e. hooded shrimp), Cirolanidae (i.e. pill bugs), amphipods (i.e. side swimmers), and ostracods (i.e. seed shrimp) (SLR, 2022). Other abundant epifauna taxa observed from the samples included polychaete worms (Sigalionidae), free-living tunicates (*Eugyra* sp. and *Molgula* sp.) (SLR, 2022).

The baseline monitoring results indicate that, generally, for sampling stations at or near (on the western and southern sides) already present infrastructure, including the Kupe WHP and associated pipeline (**Figure 11**), the mean number of taxa and total abundance of taxa was greater in comparison to those sampling stations further away (towards the east and south) from that infrastructure. However, statistical interpretation of monitoring results generally noted no significant difference in species diversity between monitoring stations around the existing infrastructure or further away (SLR, 2022).

Five sampling stations located southwest of the Kupe WHP were found to have higher abundances of the sabellid tube worm (*Euchone* sp.), along with Maladanidae worms, compared to the other sample stations. The Maladanidae worms had built tubes on the available shell hash present on the seafloor. These results are consistent with the NIWA survey (Beaumont *et al*., 2015) and could be considered as a worm field; however, these are a different genus compared to the 'Chaetopteridae worm field' category listed under Schedule 6 of the Permitted Activities Regulations. Based on the deposition modelling results, these areas of higher worm abundance are not located within the dominant dispersal pathway (northwest-southeast) from any released drill cuttings (refer to discussion in **Section 2.2.4.1.1** and **Figure 5**).

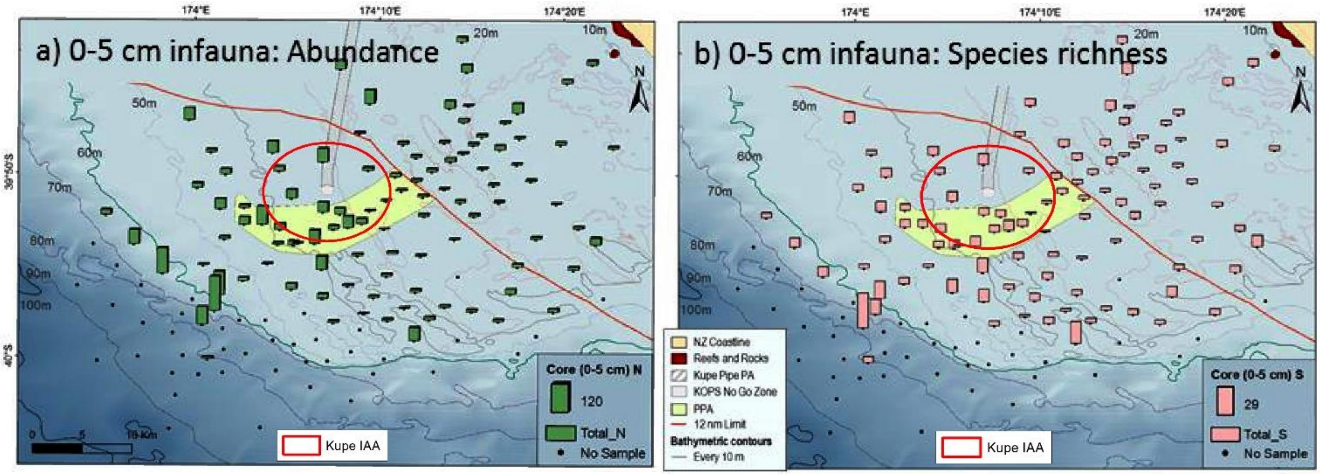
NIWA conducted a sampling programme in 2011 and 2012 across the broader Patea shoals to assess benthic communities present in this aera (Beaumont *et al*., 2015). A number of the NIWA sampling stations overlapped with the Kupe IAA (**Figure 22**), where a total of 430 species/groups of macrofauna taxa were identified from the 331 core samples collected. These taxa were dominated by polychaete worms (48% of total macrofauna numbers), non-decapod crustaceans (23%), molluscs (10%), bryozoans (9%), and foraminifera (8%). Of the polychaete worms, the sabellid tubeworm (*Euchone* sp.) was numerically dominant, contributing to 15% of the total macrofauna sampled.

Macrofauna communities were most diverse and abundant in the samples from the offshore biogenic habitats (**Figure 22**), while mid-shelf areas showed lesser diversity, although abundances remained high due to patchy areas of dense *Euchone* sp. wormfields (**Figure 23**). Increased abundances of polychaete worms in the soft subtidal sediments were also noted in earlier seabed surveys along the Kupe pipeline and inshore of the Kupe WHP, particularly the presence of large numbers of *Euchone* sp. (ASR, 2004a, 2004b, 2004c; Forrest and Johnson, 2011).

The seabed around the Kupe WHP is described as relatively flat, with rippled sand sediments (Beaumont et al, 2015; SLR, 2022), which support relatively depauperate epifauna communities due to the more mobile sediments found compared to the more stable biogenic habitats that are present further offshore (**Figure 20**).

Further offshore to the south, over 3 km from the Kupe IAA (**Figure 20**), the seabed was classified as bivalve and bryozoan rubble which supported highly diverse assemblages of epifauna including large bivalves (*Tucetona laticostata*), coralline algae, annelid worms, encrusting invertebrates, bryozoans (branching and foliose), sponges, colonial ascidians, brachiopods and foraminifera, along with more motile taxa such as gastropods, holothurians, decapods, nudibranchs and ophiuroids.

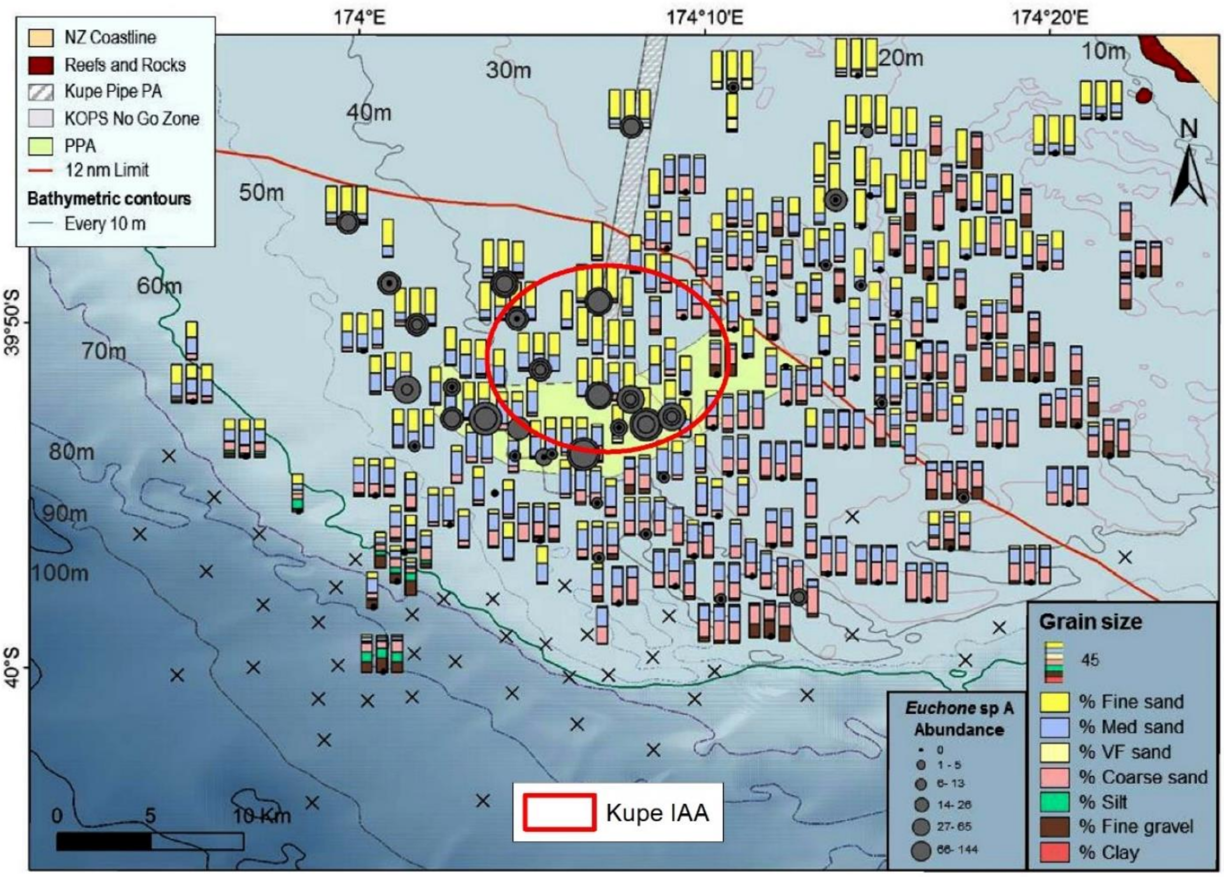
Figure 22 Infauna taxa abundance and richness in surface sediment cores from across the Patea Shoals



Source: Adapted from Beaumont *et al.*, 2015

Note: Kupe IAA appears skewed as it has been inserted over a georeferenced figure utilising WGS 84 coordinate system.

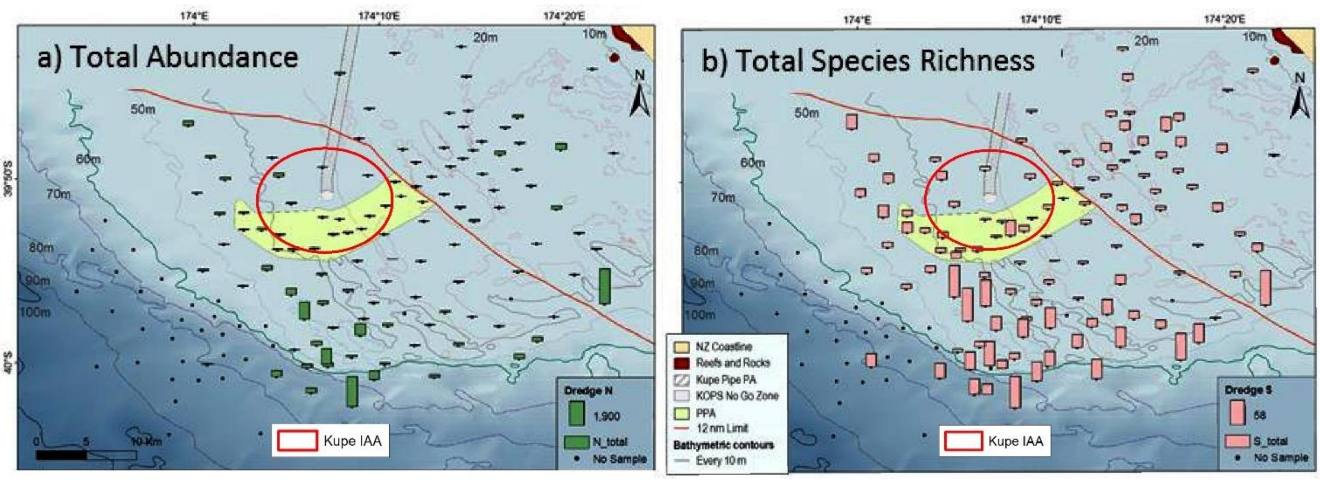
Figure 23 Particle size distribution and abundance of Sabellid polychaete *Euchone* sp. across the Patea Shoals



Source: Adapted from Beaumont *et al.*, 2015

Note: Kupe IAA appears skewed as it has been inserted over a georeferenced figure utilising WGS 84 coordinate system.

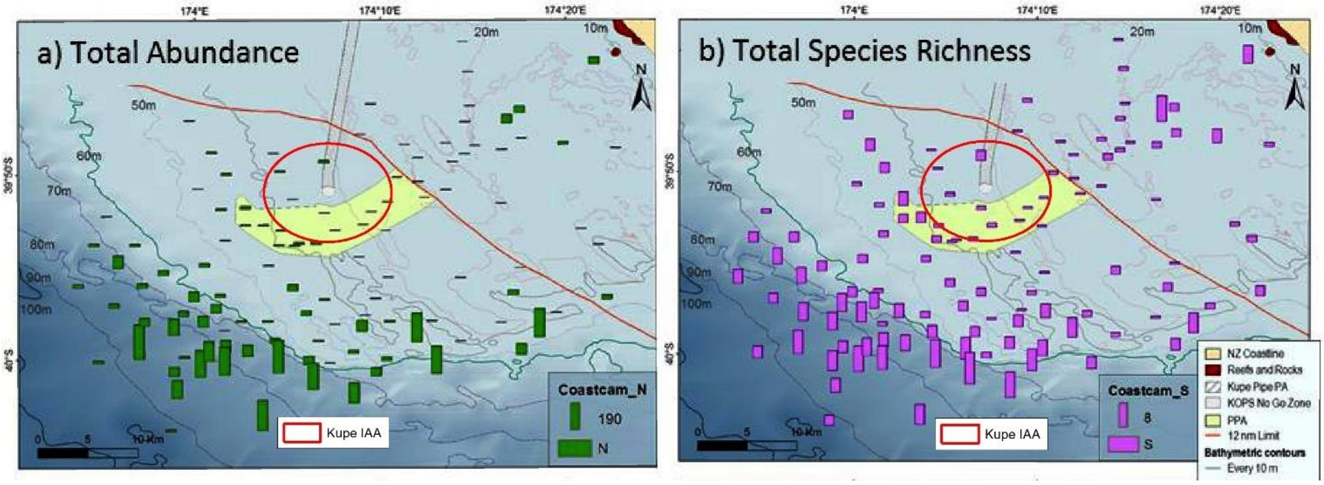
Figure 24 Total abundance and species richness (per 250 m²dredge tow) of epibenthic assemblages across the Patea Shoals



Source: Adapted from Beaumont *et al.*, 2015

Note: Kupe IAA appears skewed as it has been inserted over a georeferenced figure utilising WGS 84 coordinate system.

Figure 25 Total abundance and species richness (per 10 minute/300 m benthic imagery tow) of epibenthic assemblages across the Patea Shoals



Source: Adapted from Beaumont *et al.*, 2015

Note: Kupe IAA appears skewed as it has been inserted over a georeferenced figure utilising WGS 84 coordinate system.

Of particular note from Beaumont *et al.*, (2015) is that species that were found to occur across the mid-shelf area where the Kupe WHP is located "*were either ubiquitous across the region and/or were typically mobile deposit feeders and small scavengers, phoxocephalid amphipods and other small crustaceans that are capable of recovery from regular natural disturbance such as burial and/or relocation (i.e. opportunistic early colonists (Lundquist, 2012))*". This would appear to indicate that macrofauna and epifauna communities in the areas surrounding the Kupe WHP would likely show some reasonable level of tolerance to deposition of particles such as that which occurs down-current of drilling activities.

4.3.3 Sensitive Environments and Protected Species

The term 'sensitive environments' has been used, including by the EPA, to describe rare and vulnerable ecosystems and habitats of threatened species in relation to the benthic environment. An example of this concept can be seen in the conditions of EEZ400011 for the Ports of Auckland Limited marine dumping consent which utilised the meaning given to sensitive environments as a definition of rare and vulnerable ecosystems and habitats of threatened species.

The Wildlife Act 1953 also provides useful context when determining potentially rare and vulnerable ecosystems and habitats of threatened species in its protection of certain species, including those marine species declared to be animals under Schedule 7A of that Act.

Based on the above, the following sections outline sensitive environments and protected species, which in turn can be read as being rare and vulnerable ecosystems and habitats of threatened species.

4.3.3.1 Sensitive Environments

The Ministry for the Environment (in consultation with the National Institute of Water and Atmospheric Research) has defined several marine biogenic and geological environments as 'sensitive' in order to provide guidance for operators planning to conduct activities within the EEZ in accordance with Permitted Activities Regulations (MacDiarmid *et al*., 2013a). Schedule 6 of the Permitted Activities Regulations describes 13 sensitive biogenic environments which include:

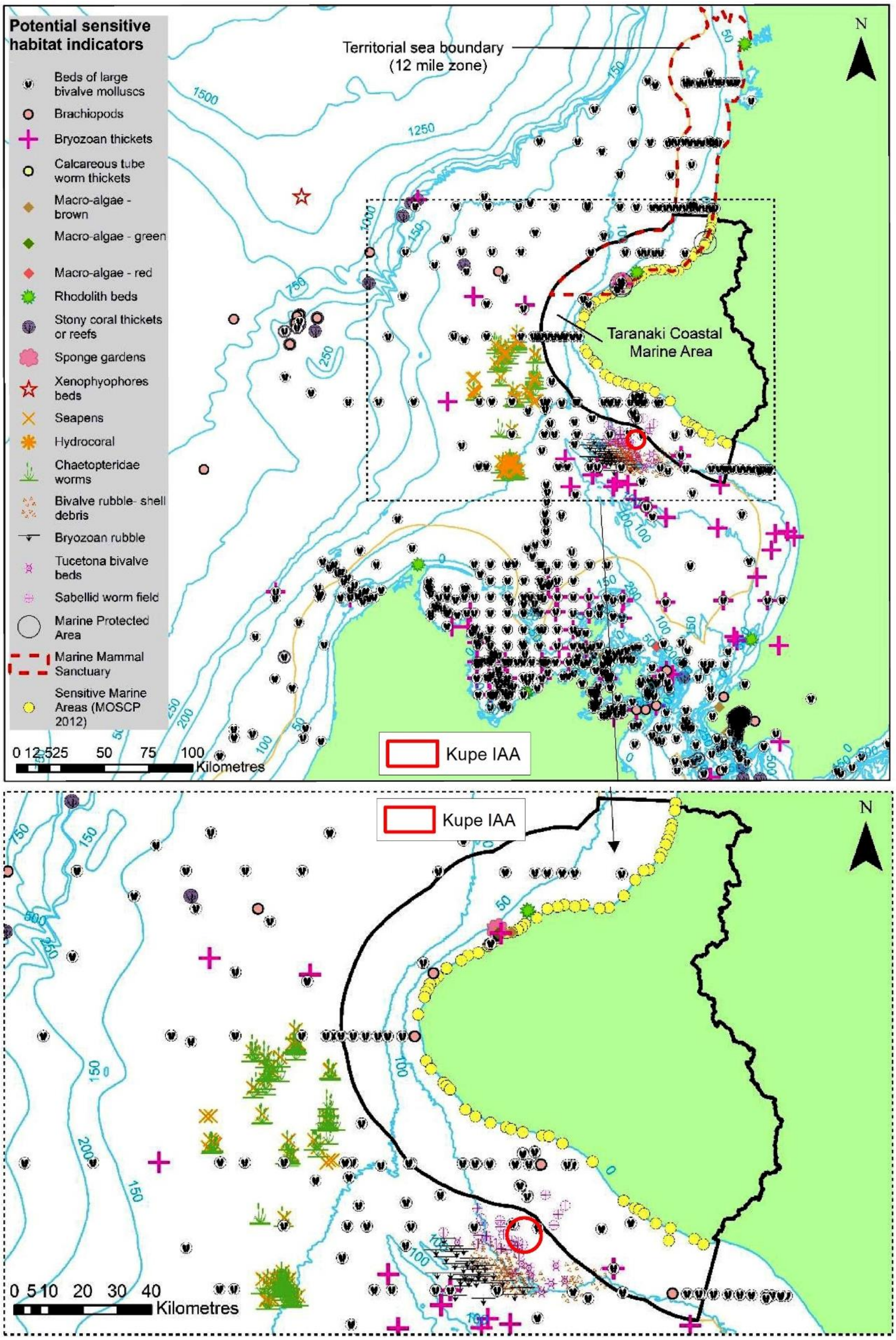
- Stony coral thickets or reefs;
- Xenophyophore beds;
- Bryozoan thickets;
- Calcareous tube worm thickets;
- Chaetopteridae worm fields;
- Sea pen fields;
- Rhodolith (maerl) beds;
- Sponge gardens;
- Beds of large bivalve molluscs;
- Macro-algae beds;
- Brachiopods;
- Deep-sea hydrothermal vents; and
- Methane or cold seeps.

The 'sensitivity' of an environment is defined as the tolerance of a species or habitat to damage from an external factor combined with the time taken for its subsequent recovery from damage sustained as a result of the external factor. The rarity of a particular habitat was also taken into account when considering its tolerance; an external factor is more likely to damage a higher proportion of a population or habitat as rarity increases; therefore, a rare habitat has a lower tolerance rating (MacDiarmid *et al.*, 2013a).

No characteristic sensitive environments were found above, or near, trigger thresholds within the Kupe IAA during the 2021 Kupe Baseline Survey (SLR, 2022).

In addition to the above, a report commissioned by the TRC (Johnston, 2016) includes maps showing the possible locations of sensitive environments (as defined by the Permitted Activities Regulations) within the Taranaki CMA but also in 'vicinity of the Taranaki CMA', including the area around the Kupe IAA. **Figure 26** shows the locations the sensitive environments identified by Johnston (2016) – it should be noted that the maps also show potential sensitive habitat indicators that are not included in the Permitted Activity Regulations. The scale of the mapping and the size of the indicator icons makes it difficult to determine whether any sensitive environments are identified as being within the Kupe IAA, however it appears that there may be two icons indicating the presence of beds of large bivalve molluscs in the IAA.

Figure 26 Records of possible sensitive marine habitat indicators within the Taranaki region



Source: Adapted from Johnston, 2016.

The Proposed Regional Coastal Plan for Taranaki (**PRCP for Taranaki**) has described several areas with trigger species or habitats that may meet the criteria for a sensitive environment. These areas are located at the North/South Traps and the Project Reef, which are located 28 km and 17.5 km away from the Kupe IAA, respectively. A summary of these areas is provided below:

- Bryozoan thickets – dense assemblages have been observed at Project Reef and the North and South Traps;
- Macro-algae beds – there are dense stands of kelp at Project Reef and the North and South Traps; and
- Sponge gardens – dense sponge assemblages have been observed at Project Reef and the North and South Traps.

Furthermore, Beaumont *et al*. (2015) surveyed the broader Patea Shoals area in 2011/2012 and through seabed cores, dredge tows, and benthic imagery where they recorded live and dead beds of the large bivalve mollusc *Tucetona laticostata,* three species of brachiopod, live bryozoans, and trigger species of sponge throughout the area. The survey also revealed dense (but patchy) wormfields of the sabellid tubeworm *Euchone* sp., like what was observed in the Kupe baseline survey (SLR, 2022); however, as noted above, this genus is not the 'Chaetopteridae worm field' category listed under Schedule 6 of the Permitted Activities Regulations.

It is important to note that Beaumont *et al*. (2015) and the PRCP for Taranaki have not made an assessment against the sensitive environment criteria, but are merely reporting on presence of taxa characteristic of a sensitive environment (for Beaumont *et al.* (2015)), or describing the general values within an identified area (i.e. within the PRCP for Taranaki).

4.3.3.2 Protected Species

Nine species of fish are listed as protected under Schedule 7A of the Wildlife Act 1953, although only two of these, the white shark and basking shark, may be present within and around the Kupe IAA. Further specific details on protected fish species are provided in **Section 4.3.4.1**.

The following invertebrate taxa are protected under Schedule 7A of the Wildlife Act 1953:

- Black corals (all species in the order Antipatharia); and
- Hydrocorals – all species in the family Stylasteridae.

Gorgonian corals and stony corals are also protected under the Wildlife Act 1953.

Gorgonian corals (all species in the order Gorgonacea) – gorgonian octocorals are now in the order Alcyonacea following taxonomic changes (Bayer, 1981; McFadden *et al.*, 2006), an order that also includes unprotected soft corals. Stony corals also incorporate the cup-corals which are known to occur widely in offshore areas around New Zealand.

Two species of habitat forming stony corals have been found in the vicinity of the STB – *Goniocorella dumosa* and *Madrepora oculata*. *Goniocorella dumosa* is traditionally found around 400 m depth on slopes and rises (MacDiarmid *et al.*, 2013a), but the single recorded observation west-northwest of Cape Egmont was in 50 – 100 m range, indicating it could potentially be present near the Kupe IAA. The zigzag coral *Madrepora oculata* is listed as 'threatened' and 'nationally vulnerable' ('D' status, '1/1 status, decreasing 30-70%) (Freeman *et al.*, 2010) and listed under the Wildlife Act 1953. A record for this species was made in ~130 m water depth southwest of Grahams Bank.

Neither of these taxa or any gorgonian corals were observed across the broader Patea Shoals area by Beaumont *et al.* (2015). However, the solitary stony cup coral taxa Flabellidae was recorded within the deeper Bryozoan rubble habitat to the south of the Kupe IAA in 2011/2012. This particular taxon is not known to be 'thicket' or 'reef' forming but would still be classified under the protection of the Wildlife Act 1953.

No protected species were found or observed within the Kupe IAA during the 2021 Kupe Baseline Survey (SLR, 2022).

4.3.4 Fish

The fish assemblages in the STB are represented by various demersal and pelagic species that are widely distributed from north to south and from shallow coastal water to beyond the continental shelf edge. A large proportion of New Zealand's fish are categorised as 'widespread' (approximately 30% of described species), in that they occur across all three major oceans or in the Pacific and Atlantic oceans; however, there is also a large proportion of fish that are classified as endemic (approximately 22% of described species in New Zealand) (Roberts *et al.*, 2015). The waters of the STB, and the Kupe IAA within this, are considered to lie in the 'neritic zone' (i.e. the relatively shallow part of the ocean that extends from the intertidal zone out to the shelf break or approximately 200 m water depth), where the fish present are generally highly mobile or do not have fixed territories, and often school (Roberts *et al*., 2015).

Appendix C provides a list of the main fish species that could potentially be present within and surrounding the Kupe IAA, including an indication of depth distribution and the habitat each species is found in.

Species presence in the STB and depth distributions were determined based on the information contained within Roberts *et al*. (2015) which represents the most recent state of fish taxonomic knowledge in New Zealand and describes all known fish species found in New Zealand waters. The present total (as of 2013) for the number of fish species within New Zealand's EEZ is 1,262 (Roberts *et al.*, 2015), therefore, **Appendix C** is not intended to be an exhaustive total but does list the main fish species potentially present. No attempt at determining likelihood of occurrence has been made.

A total of 13 fish taxa were captured in core samples and dredge tows completed across the Patea Shoals area in 2011/2012 (Beaumont *et al.*, 2015) including opalfish, clingfish, flatfish blue cod, tommy fish, pipefish, silver conger eel, leatherjacket, weedfish, and red gurnard, along with the lancelet *Epigonicthys hectori*.

During the 2021 Kupe Baseline Survey various species of fish were observed in the video imagery, including kingfish, blue cod, tarakihi, and triplefin (SLR, 2022).

4.3.4.1 Protected Fish Species

There are nine species of fish listed as protected under Schedule 7A of the Wildlife Act 1953 and, of these, the white shark and basking shark have the greatest potential to be present in the STB. In addition to the protection offered under the Wildlife Act 1953, the great white sharks and basking sharks are also protected under the Fisheries Act 1996, prohibiting New Zealand flagged vessels from taking these species from all waters, including beyond New Zealand's EEZ.

White sharks are considered 'Nationally Endangered' under the New Zealand Threat Classification (Duffy *et al*., 2018). Although white sharks occur widely throughout New Zealand waters (Francis *et al*., 2015), their total abundance is relatively low (280 – 650 adults within the single eastern Australian and New Zealand population (Hillary *et al*., 2018)). Little is known of their New Zealand habitat use, although juveniles and adults are known to occur in shallow coastal waters such as large harbour and estuaries (DOC, 2021a), while sub-adults and adults also utilise waters of the open ocean and around offshore islands and banks.

White sharks are relatively common along New Zealand's northwest coast (Duffy *et al*., 2012), and sightings of white sharks in Taranaki waters have been recorded throughout most months of the year (C. Duffy in RNZ, 2019). A large (5 – 6 m) female white shark nicknamed the 'Taranaki Terror' or 'Mrs White' was first sighted in Taranaki waters in 2004 and was regularly sighted for several years around areas such as the Sugar Loaf Islands. Sightings of a large white shark off the New Plymouth breakwater in 2016 suggested that the shark continued to use Taranaki waters at this time or is not the only large white shark to occur in the region (Reive, 2016). Furthermore, in July 2020 a 2.8 m juvenile white shark was accidentally caught in a set net off New Plymouth (Keith, 2020).

Basking sharks have a 'Nationally Vulnerable' threat classification (Duffy *et al*., 2018). Sightings have been made within the Taranaki region, with most sightings occurring within a few kilometres off the coast during spring and summer suggesting an increase in abundance in inshore waters during warmer seasons (Francis & Duffy, 2002).

During the 2021 Kupe Baseline Survey there were no observations of any fish species that are covered by Schedule 7 of the Wildlife Act 1953 (SLR, 2022).

4.3.4.2 Spawning, Pupping, and Nursery Habitats

Areas utilised by fish for spawning and pupping (i.e. the birth of live young) may be disproportionately important to fish populations as any disruption to spawning or pupping activity may result in a reduction in recruitment, i.e. reduced number of juveniles surviving (Morrison *et al.*, 2014). Spawning activities can include single pairs, localised small groups of fish, or large spawning aggregations. Large aggregations may involve large-scale migrations (transient aggregations) or short-distance movements of local fish (resident aggregations) (Morrison *et al*., 2014).

Knowledge of spawning and pupping areas of New Zealand's fishes is typically limited; detailed information on spawning activity is only well known for a few commercially important species such as orange roughy, hoki, and snapper and is restricted to small areas/regions of a species' distribution rather than its full range (Morrison *et al*., 2014). Data on the presence of spawning and pupping locations usually relies on reported catch of spent or ripe-running females from research trawls (Hurst *et al.*, 2000a).

Hurst *et al*. (2000b) provides a New Zealand-wide review of areas of importance for spawning, pupping, or egg-laying for New Zealand coastal fish (i.e. found in depths less than 200 m) based on the collation and interpretation of data from research trawl surveys and observer records (Morrison *et al*., 2014). Based on this analysis, the STB may be a spawning area for lemon sole, New Zealand sole, rig, sand flounder, yellow-belly flounder, and yellow-eyed mullet. Golden mackerel with running-ripe gonads also indicate probable spawning in the STB, while blue cod, john dory, kahawai, kingfish, and sea perch possibly reproduce in the region based on the presence of small juveniles. Blue mackerel with spent gonads also occur in the STB (Hurst *et al*., 2000b as referenced in MacDiarmid *et al*., 2015).

Morrison *et al*. (2014) adds to the review undertaken by Hurst *et al*. (2000b) and further identifies barracouta, common warehou, golden mackerel, red gurnard, school shark, and trevally as potential spawners in the STB.

Table 11 presents details on the species that potentially spawn in the STB (based on information contained in Hurst *et al*. (2000a) and Morrison *et al.* (2014)) and an indication on spawning/nursery habitats and season (following Morrison *et al*. (2014).

Table 11 Fish species potentially spawning in the STB

Species	Spawning/nursery habitat	Likely spawning season
Barracouta	Widespread around New Zealand on west and east coasts of both islands. Adults undertake extensive alongshore migrations between feeding and spawning areas.	Late winter/spring (July/August – September/October).
Blue cod	Spawning aggregations reported from inshore and mid-shelf waters. Suggested that fish spawn locally on or adjacent to reef systems. Very small cod are thought to be associated with biogenic habitats such as bryozoans or other reef substrates.	Late winter to spring.
Blue mackerel	Anecdotal evidence suggests that juveniles are seasonally abundant in inshore waters, while larger fish occur further offshore.	November – April
Blue warehou	Undertake substantial spawning migrations. Ripe-running fish have been recorded in water depths of 50 – 300 m. Young are often found in small schools in the shallow waters of harbours and bays or confined to waters of less than 75 m depth.	Winter – early spring.
Jack mackerel (*T. declivis*)	Small Jack Mackerel often found in association with floating objects. Distribution of juveniles are consistent with known spawning areas and the distribution of adults, i.e. in water depths to 150 m. Juveniles are mainly caught in inshore and mid-shelf areas.	Spring and summer months.
John dory	Do not form large aggregations. Juveniles most abundant in 50 – 100 m water depth. There is no indication of habitat associations of small fish from trawl survey data but fishers suggest juveniles may be more abundant with biogenic structure such as bryozoans.	Summer.
Kahawai	Unknown but thought to be associated with the seabed in deeper offshore waters. Juveniles often caught in estuarine beach surveys, particularly in estuaries with clear sand substrates. Juveniles also may be found in sheltered sandy embayments on the open coast.	Probably occurs around February.
Kingfish	Spawn across a range of habitats, from estuaries out to deep water.	Spring – summer.
Lemon sole	Migrates from deep water to spawn, with smaller individuals occurring in shallower inshore areas (9-15 m water depth) and large individuals in deeper waters (30 m water depth). Not found in estuarine habitats as juveniles.	June – December/January
New Zealand sole	No information on spawning is available but juveniles have been caught in all areas where the species has been recorded.	Eggs have been recorded from autumn to spring.
Red gurnard	Possible offshore migration for spawning. Juveniles often observed in benthic imagery from offshore Taranaki areas.	Throughout the year with a peak between December and February.
Rig	Aggregate annually in shallow coastal waters. Pregnant females enter estuaries and harbours to give birth, or young enter these areas shortly after being born in nearby coastal waters.	Spring – Summer

Species	Spawning/nursery habitat	Likely spawning season
Sand flounder	Juveniles seasonally abundant in sheltered estuaries and harbours and are generally confined to the shallow tidal flats along the shores near stream mouths.	Variable and may occur over most of the year in some locations.
School shark	Aggregates in inshore waters during warmer months and disperses across the shelf and upper slope during autumn and winter. Preferred pupping grounds have been described as along shallow (usually sandy) coastlines or in harbours and estuaries.	Spring – Summer
Sea perch/Jock Stewart	Recent research suggests tube worm beds act as important nursery habitat.	Throughout much of the year
Trevally	Juveniles found in less than 50 m water depth in STB, although defined spawning grounds have not been identified in New Zealand.	Summer.
Yellow-bellied flounder	Adults move offshore to spawn. Spawning takes place in water depths of 18 – 27 m. Juveniles are exclusively limited to sheltered harbours and estuaries.	Winter – Spring
Yellow-eye mullet	Eggs are spawned close to shore. Larvae and juveniles are most abundant in open water and around drift algae. Juveniles increase in abundance towards the upper areas of estuaries.	Late December – mid March.

Source: All species have been identified in Hurst *et al.* (2000a) as potentially spawning in the STB, with the exception of barracouta, blue warehou, Jack mackerel (*T. declivis*), red gurnard, school shark, and trevally which were identified in Morrison *et al*. (2014).

Seasonality and habitat information is as referenced in Morrison *et al*. (2014).

4.3.4.3 Freshwater Eels

There are two main species of freshwater eel found within New Zealand waters: the endemic long-finned eel (*Anguilla dieffenbachii*) and the short-finned eel (*A. australis schmidtii*). Long-finned eels are classified under the New Zealand Threat Classification System as 'Declining', and short-finned eels as 'Not Threatened'. Long-finned and short-finned eels are commercially harvested and have been commercially caught within the STB (Cashmore, 2017). Although considered a freshwater species, long-finned and short-finned eels have a catadromous life history and carry out oceanic spawning at great distances from their typical freshwater habitat (Jellyman, 2012).

While very little is known of the specifics during the marine component of the long-finned and short-finned eel life cycle, three distinct migrations have been observed in New Zealand:

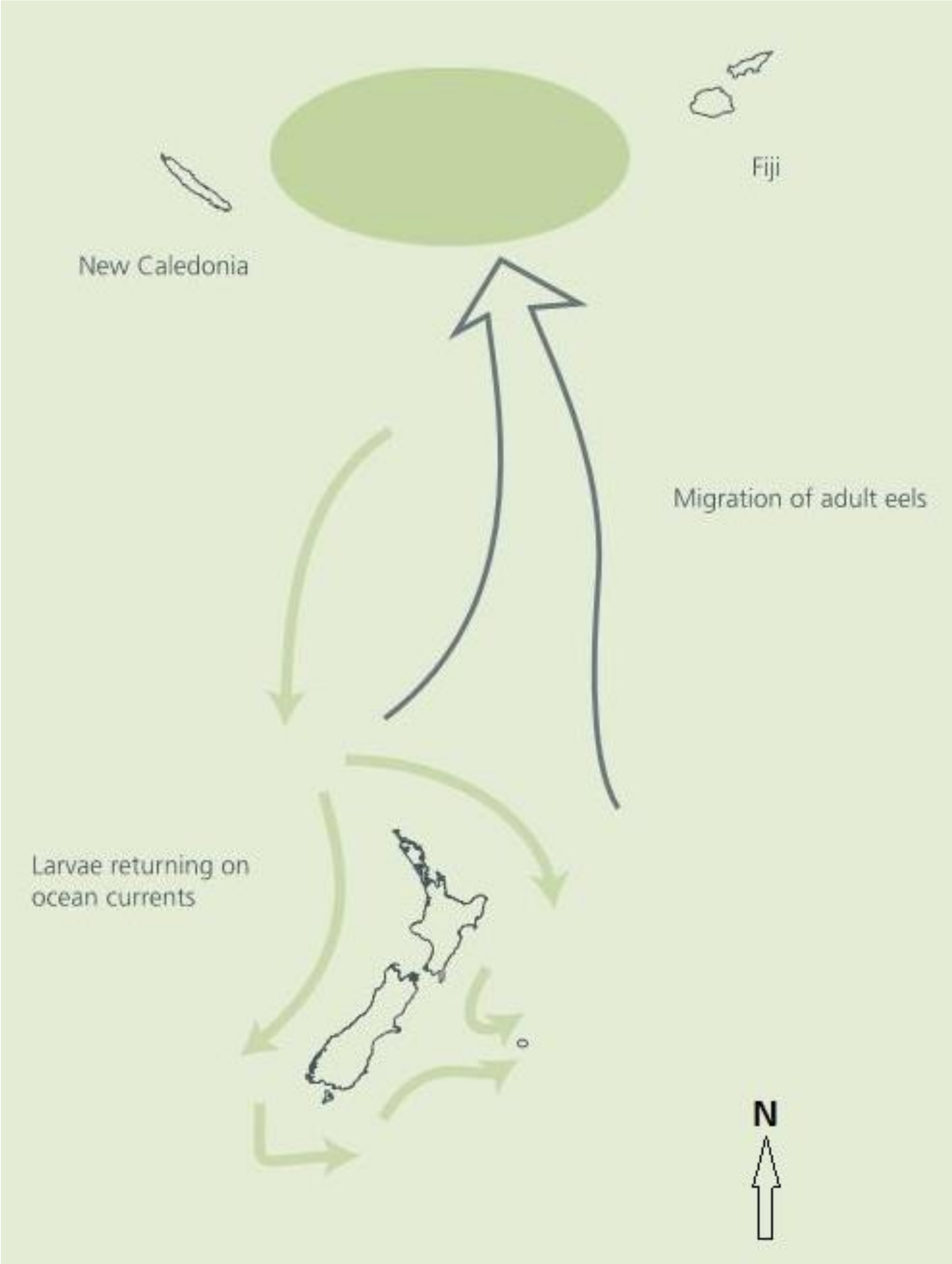
- Elvers (i.e. juvenile two-year-old eels) move from marine habitats into freshwater habitats from October to December. The elvers move at night, during floods, or on overcast days (Jellyman, 1977) during which time they find suitable cover and feeding grounds in the lower reaches of streams. Here they remain for the next four to five years (Cairns, 1950);
- Following the influx of the elvers, the four- to five-year-old eels begin an upstream migration. This migration occurring in January (Cairns, 1950); and
- The third migration involves the movement of sexually mature adult eels (known to Māori as tuna heke or tuna whakaheke) to spawning grounds. This migration occurs in February and March, with the majority of eels having migrated by April, and is thought to be influenced by the lunar cycle (Cairns, 1950; Todd, 1981). Mature females begin by moving to brackish waters where they join the mature males. First to enter the sea are short-finned males followed by short-finned females (Cairns, 1950; Todd, 1981). Long-finned eels show a similar pattern with their migrations occurring after that of the short-finned eel (Cairns, 1950; Todd, 1981). The adults move to the sub-tropical Pacific Ocean and although the exact location and migration route is not known (as eel spawning has never been observed), deep ocean trenches near Fiji and New Caledonia are thought to be important spawning grounds (Jellyman & Tsukamoto, 2002; 2005). Short-finned and long-finned eels are semelparous; they breed only once at the end of their life (NIWA, 2021b), resulting in no return of the large adults to New Zealand following breeding.

A fourth, unobserved migration occurs involving the leptocephalus young (transparent leaf-shaped eel larvae). The leptocephalii reach New Zealand waters by drifting on ocean currents. Once they reach New Zealand coastal waters they morph into eel-shaped 'glass eels' and move into river mouths and estuaries (Te Ara, 2021e). Glass eels are generally sedentary during their first year in fresh water (Jellyman, 1977). Following a year spent in river mouths and estuaries the glass eels commence their freshwater life-cycle as elvers.

Freshwater eels live the majority of their lives in freshwater systems where they grow and mature into fertile adults. At this stage, the adult eel undergoes physical changes before carrying out a single migration in autumn to Pacific Ocean spawning grounds. While the exact locations of the eel spawning grounds are currently unknown, Tonga is thought to be an important area for spawning. The eel migrations from freshwater habitats occur at night during dark phases of the moon, with movement also triggered by high levels of rainfall and river flow.

The specific migration routes of freshwater eels are largely unknown; however, the longfin eels are believed to migrate from New Zealand to spawning grounds by various routes. A general overview of migration pathways is shown in **Figure 27**.

Figure 27 Longfin eel migration pathways



4.3.5 Cephalopods

All cephalopods consist of a mantle, head, and eight arms (and two long tentacles in the case of some squid). There are four groups of cephalopods represented in New Zealand waters: squid, octopus, vampire squid, and cuttlefish. There are 42 species of octopus recognised from New Zealand waters, 68% of which are endemic (O'Shea, 2013), and over 85 species of squid and other related groups. Cephalopods are present within the STB, with high abundances in areas under the influence of the Kahurangi Upwelling (MacDiarmid *et al*., 2011).

There are no cephalopod species listed as threatened under the New Zealand Threat Classification which have been identified as potentially present within and in close proximity to the Kupe IAA (Freeman *et al*., 2014).

MacDiarmid *et al.* (2011) and Beaumont *et al*. (2015) reported the presence of two species of octopus in the STB; the New Zealand/common octopus (*Pinnoctopus cordiformis*) (MacDiarmid *et al.,* 2011) and the closely related midget octopus (*Octopus huttoni*) (Beaumont *et al*., 2013). *P. cordiformis* is harvested throughout the STB by hand gathering and potting at coastal reefs (MacDiarmid *et al*., 2013b), with the largest catches in the 50 – 100 m depth range (MacDiarmid *et al*., 2011). *O. huttoni* is a small, cryptic species found in water depths from 0 - >300 m (Donlon *et al*., 2019).

The New Zealand squid fishery appears amongst the top five fisheries (by export volume) in New Zealand and focuses on two species of arrow squid: Gould's arrow squid (*Nototodarus gouldi*), and Sloani's arrow squid (*N. sloanii*). Both species of arrow squid are present throughout the STB (Bagley *et al.*, 2000; Hurst *et al*., 2000a) and are a commercially caught species (MacDiarmid *et al*., 2011). Immature arrow squid (of both species) have been caught in research trawls throughout the STB (Hurst *et al*., 2000a), indicating that spawning activities may occur. Bobtail squid (*Sepioloidea* sp.) were also reported within the STB (Bagley *et al.,* 2000; Beaumont *et al*., 2015), as were broad squid (*Sepioteuthis australis*) (Anderson *et al*., 1998). *S. australis* were reported in research trawls from shallower depths (i.e. less than 100 m water depth) (Anderson *et al*., 1998).

4.3.6 Marine Mammals

This section describes the marine mammal species that have been reported from the entire STB. This spatial scale has been used here because: 1) marine mammals have extensive home-ranges; and 2) oil spill trajectory modelling suggests that a condensate spill from the proposed wells has the potential to affect a substantial portion of the STB (see **Section 7.8.1.1**). In addition, and to gain a more comprehensive understanding of how frequently species occur in and around the Kupe field itself, this assessment further interrogated the available data to pinpoint those sightings that were recorded in and around PML 38146 (including a 20 km buffer).

The STB supports a diverse assemblage of marine mammals and on account of this has been designated as an Important Marine Mammal Area (**IMMA**) by the International Union for Conservation of Nature (**IUCN**). The WCNI MMS also occurs in coastal waters here, as does the TRC Important Marine Mammal and Seabird Area, described in **Section 4.3.7.4**.

4.3.6.1 South Taranaki Bight Important Marine Mammal Area

The STB IMMA is shown in **Figure 28** and the summary of the IMMA as presented by the Marine Mammal Protected Areas Taskforce (IUCN, 2021) is as follows:

> *"The South Taranaki Bight mostly comprises shallow shelf waters (~100-120m) and is strongly influenced by a nutrient-rich upwelling system. Over 35 different marine mammal species have been documented within the region including at least eight species or subspecies with IUCN threatened or vulnerable status (e.g., Māui dolphins, Antarctic blue whale – both 'critical' Hector's dolphin, pygmy blue whale, Oceania sub-population humpback whale, sei whale – all four 'endangered', fin whale, sperm whale – both 'vulnerable'). New Zealand pygmy blue whales are a genetically distinct and isolated population with year-round presence in the region, which is a critical foraging ground. Hector's dolphins and Māui dolphin occur in the coastal waters of the South Taranaki Bight. The IMMA which is used as a migratory corridor for humpback, blue, and southern right whales, and includes colonies of New Zealand fur seals. The South Taranaki Bight region has relatively high levels of anthropogenic activities."*

IMMAs are defined as discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation. It is important to note that IMMAs are areas identified as important for a marine mammal population but do not offer protection of a population such as would be provided by a Marine Mammal Sanctuary or Marine Reserve.

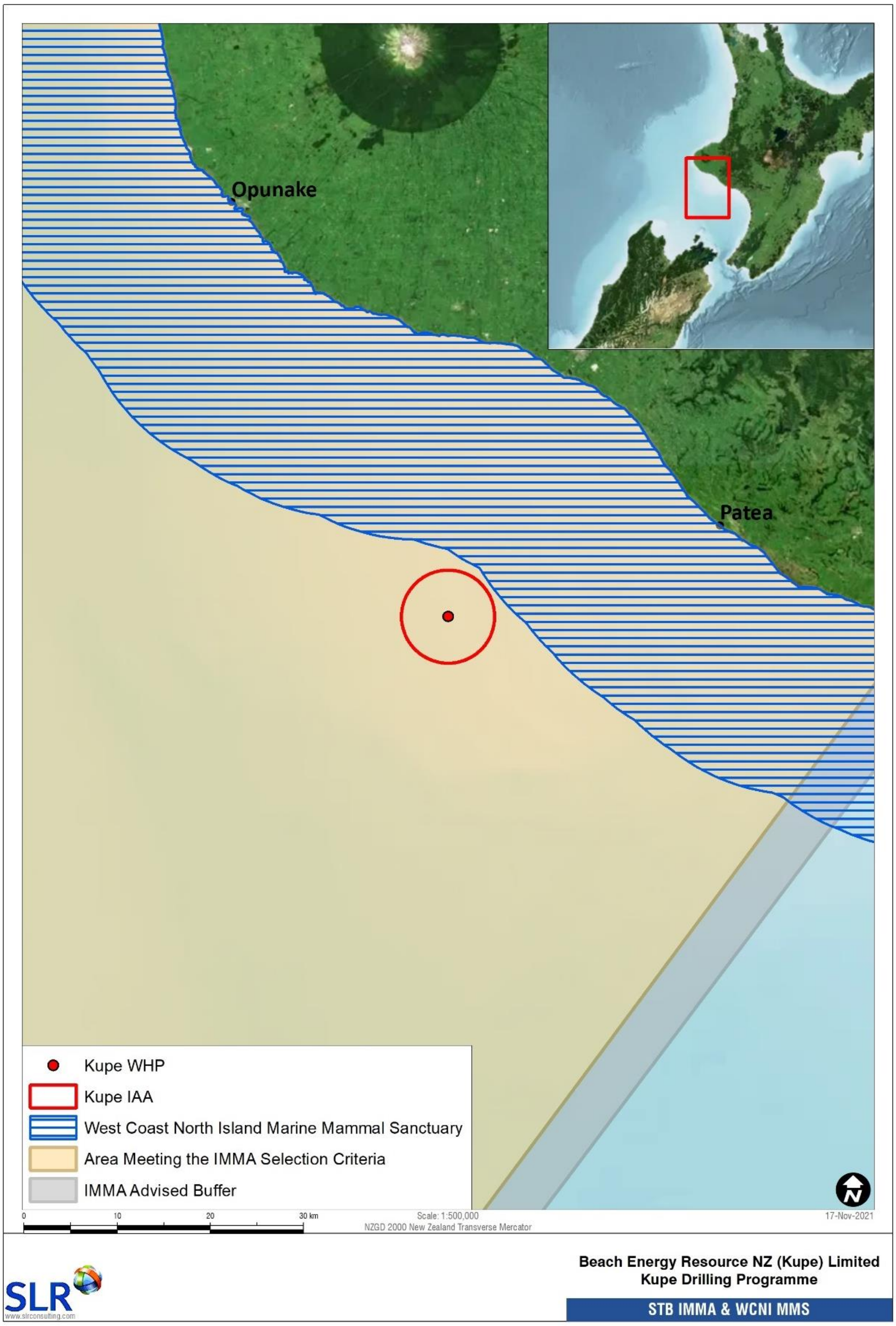
The Kupe IAA lies within the STB IMMA.

4.3.6.2 West Coast North Island Marine Mammal Sanctuary

The WCNI MMS (**Figure 28**) was established in 2008 as part of the Hector's and Māui's dolphin Threat Management Plan. The aim of the sanctuary is to protect the threatened Māui's dolphin, primarily from fishing impacts. The Kupe IAA does not lie within the WCNI MMS but is adjacent to it as shown in **Figure 28**.

Protection measures and boundaries of the sanctuary have been amended several times since its establishment. The WCNI MMS currently extends from Maunganui Bluff in Northland to Taputeranga Marine Reserve on the south coast of Wellington and out to 12 NM from the shoreline.

Figure 28 STB IMMA and WCNI MMS in relation to the Kupe IAA



Source: IMMA Area: https://www.marinemammalhabitat.org/portfolio-item/south-taranaki-bight/

WCNI MMS: https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-protected-areas/mms-westcoast-northisland-map.pdf

4.3.6.3 Cetacean Species that could be Present in the vicinity of the Kupe IAA

Knowledge of cetacean distribution is typically amassed over long temporal periods utilising a combination of data collection techniques (e.g. stranding data, opportunistic sightings, systematic survey data, etc.). It is therefore important to assess multiple data sources when considering cetacean distribution.

The following data sources have been used to predict which cetacean species may be present within and nearby the Kupe IAA:

- Sightings data (received from H. Hendricks, DOC[12] 27/09/2021):
  - From previous seismic surveys that have been undertaken in the Taranaki region (obtained from the DOC marine mammals sightings database);
  - From opportunistic sightings (obtained from the DOC marine mammals sightings database and the DOC Hector's and Maui's dolphin sighting database);
  - From operator work vessels (obtained from the DOC marine mammal sightings database);
- Stranding data (obtained from the DOC marine mammals incident database and the DOC Hector's and Maui's dolphin incident database as received from H. Hendricks, DOC 27/09/2021)[13];
- Habitat modelling and distribution descriptions (Stephenson *et al.*, 2020; Torres, 2015); and
- Knowledge of seasonal migration patterns, general ecology, and habitat preferences for each species (obtained from published literature).

Figure 29 shows all cetacean sightings recorded in the DOC marine mammal sightings database in the STB, highlighting those that occurred within 20 km of PML 38146 which, for the purpose of this IA, are considered to be 'in the vicinity of the Kupe IAA'. **Figure 30** provides a summary of the recorded cetacean stranding records along this coastline (from the DOC incident databases). While the above data sources represent the best possible information, it is important to note:

- Spatial 'gaps' in sightings data do not necessarily indicate an absence of cetaceans, but typically reflect a lack of observation effort as effort is highly variable through space and time;
- While stranding data gives a broad indication of species occurrence in an area, the deceased animals can wash ashore well away from where they initially perished and sick or diseased animals may have moved (intentionally or otherwise) outside of their normal range prior to death;
- Each point within **Figure 29** and **Figure 30** represents a sighting or stranding entry within the DOC databases as at 28/09/2021. Each entry can be either a single animal or a group of animals; and
- Entries in the sightings and stranding databases that do not identify cetaceans to species level were excluded from the analysis.

[12] The public service department of New Zealand charged with the conservation of New Zealand's natural and historical heritage
[13] Note that although supplied in September 2021, this database was last updated by DOC on 09/09/2020.

Figure 29 Cetacean sightings (as at 28/09/2021) in the vicinity of the Kupe IAA and within the wider STB

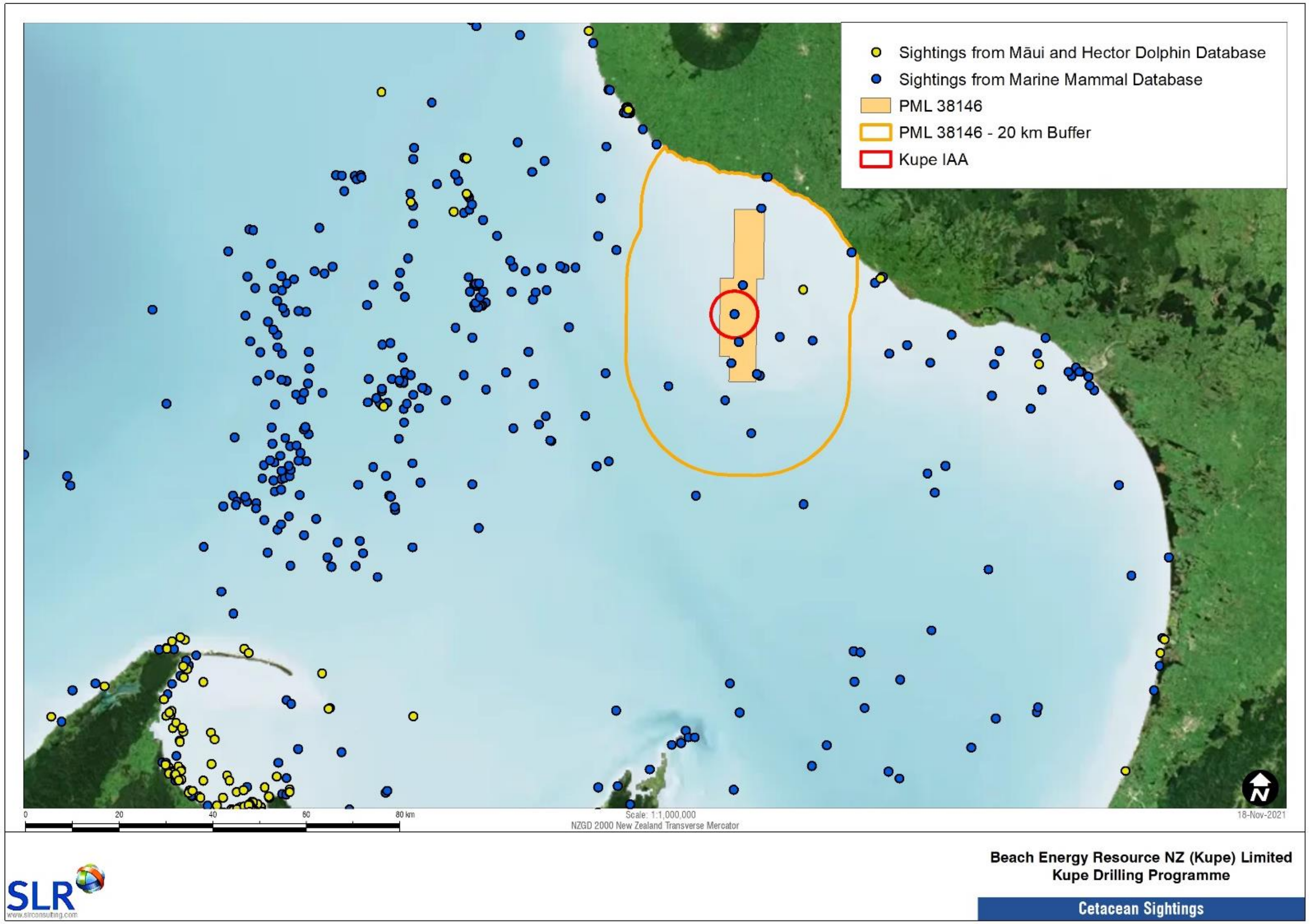
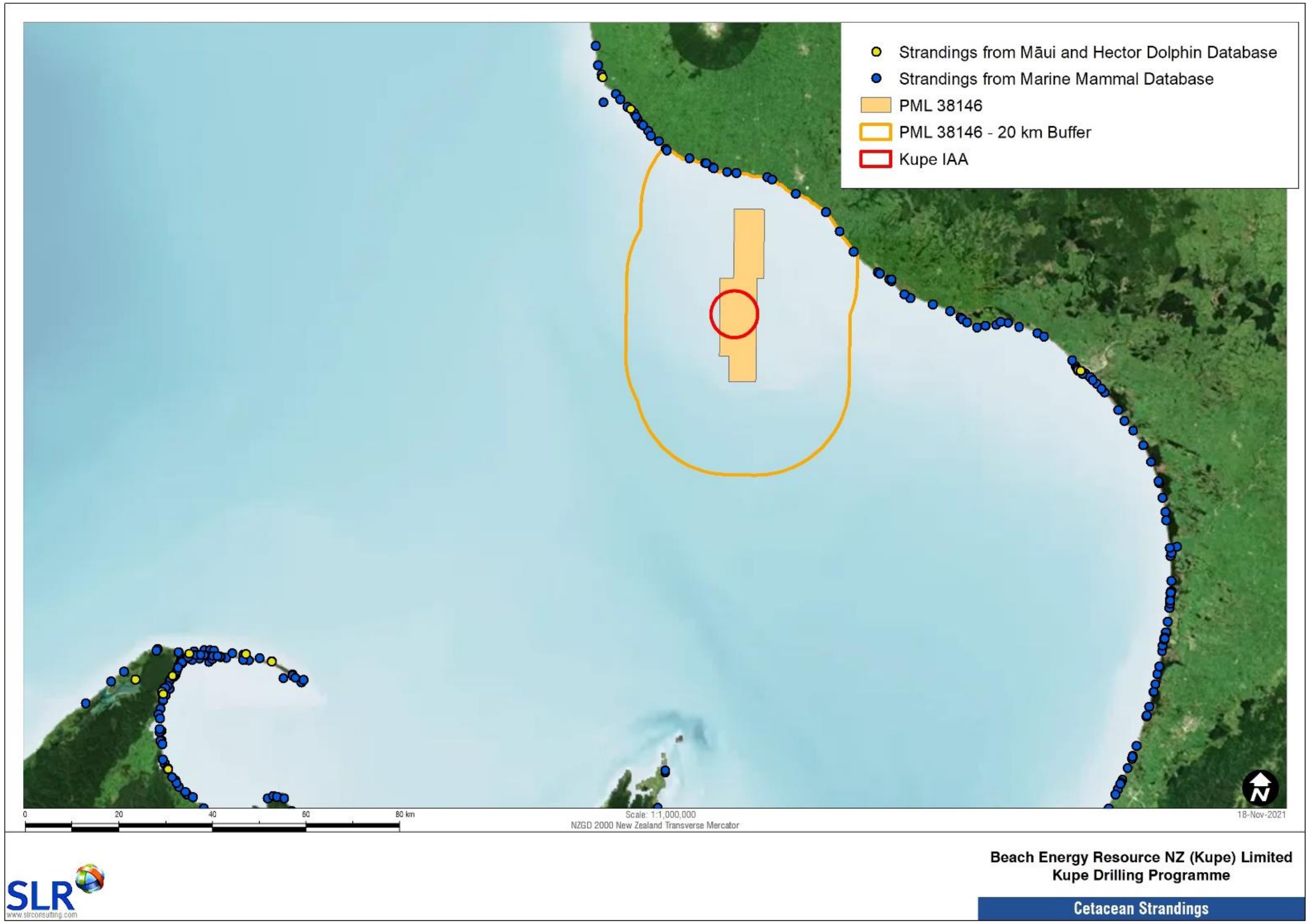


Figure 30 Cetacean stranding events (as at 28/09/2021) in the vicinity of the Kupe IAA and for the wider STB



After reviewing the available data, the likelihood of each marine mammal species being present in the STB, and in the vicinity of the Kupe IAA was determined as 'certain', 'likely', 'possible' or 'unlikely'. A full assessment of the findings is presented in **Appendix D**, and **Table 12** provides a summary of those species that are likely to be present and those that could possibly be present. In addition, the following subsections provide a brief discussion of those species that are most likely to occur in the vicinity of the Kupe IAA.

Table 12 Cetacean species that are 'likely' or could 'possibly' be present in the Kupe IAA and the wider STB

Species	Basic Ecological Description	Likelihood of presence in STB	Likelihood of presence in the vicinity of the Kupe IAA
Common dolphins (**Section 4.3.6.3.1**)	This species is commonly seen in Taranaki waters (Torres, 2012) and habitat modelling suggests high habitat suitability in and around PML 38146 (Stephenson *et al.*, 2020). While the modelling results suggest lower habitat suitability in central STB, the number of sightings reported in the DOC Sightings Database remains relatively high throughout the region. Hence, common dolphins are **likely** to be present both in the vicinity of the Kupe IAA and throughout the STB, particularly in spring and summer.	Likely	Likely
Killer whales (**Section 4.3.6.3.2**)	Small groups of killer whales are typically seen around New Zealand where they travel an average of 100 – 150 km per day (Visser, 2000). Some groups of are thought to feed predominantly on rays which can bring them into very shallow coastal waters (Visser, 2000). Sightings not uncommon in Taranaki waters (Torres, 2012). On this basis, it is **likely** that this species will pass through the area on a sporadic basis. There are no strong indicators of seasonal patterns of occurrence for this species in the STB.	Likely	Likely
Blue whales (**Section 4.3.6.3.3**)	Two subspecies of blue whale occur in New Zealand waters, both of which are known to occur in the STB. Feeding and breeding of resident pygmy blue whales has been confirmed and migrating Antarctic blue whales pass through (Barlow *et al.*, 2018). Feeding distribution is driven by concentrations of *Nyctiphanes australis* prey (Torres & Klinck, 2016). While high numbers of blue whales occur in the STB, few sightings have been recorded in the vicinity of PML 38146. Modelling suggests a low probability of occurrence in the Kupe field, but increasing dramatically towards central STB (Stephenson *et al.*, 2020); hence, it is **possible** that blue whales could occasionally be present in the vicinity of the Kupe IAA and **likely** that blue whales will be present in the wider STB particularly in autumn.	Likely	Possible
Humpback whale (**Section 4.3.6.3.4**)	Humpback whales migrate northwards along coastal New Zealand from May to August (Gibbs & Childerhouse, 2000), and southward from September to December (Dawbin, 1956). During migrations they typically use continental shelf waters (Jefferson *et al.*, 2008) and can approach closely to shore when passing headlands or moving through confined waters (e.g. Gibbs *et al.*, 2017). A well-established northward migration route passes through Cook Strait and on through the STB in winter. Hence it is **possible** that this species will be present in the vicinity of the Kupe IAA on a seasonal basis, and and **likely** that humpback whales will be present in the wider STB in winter.	Likely	Possible
Long-finned pilot whales (**Section 4.3.6.3.5**)	Pilot whale sightings occur in NZ waters year-round (Berkenbusch *et al.*, 2013). Long-finned pilot whales commonly strand on New Zealand coasts; with the stranding rate peaking in spring and summer (O'Callaghan *et al.*, 2001). Pilot whales forage at depth (i.e. several hundred metres; Berkenbusch *et al.*, 2013). But given their presence in the sighting record and the modelling results it is **likely** they will be present in the wider STB during warmer months and an occasional presence in the vicinity of the Kupe IAA is **possible**.	Likely	Possible

Species	Basic Ecological Description	Likelihood of presence in STB	Likelihood of presence in the vicinity of the Kupe IAA
Fin whale (**Section 4.3.6.3.6**)	Fin whales undertake long seasonal migrations and are usually found in deep offshore waters (Shirahai and Jarrett, 2006). They are occasionally seen in deep waters of the STB (Torres, 2012) and while habitat in the vicinity of the Kupe IAA is of low suitability, habitat is moderately suitable in the central STB (Stephenson *et al.*, 2020); hence, occasional sightings are **possible**. No information about seasonality is available, but during summer they feed at high latitude waters near the Antarctic; hence, would not be expected in STB in summer.	Possible	Possible
Minke whale (**Section 4.3.6.3.7**)	The Antarctic minke is very abundant in Antarctic waters in summer, but outside of the summer months their distribution is less well-known (Cooke *et al.*, 2018). Southern hemisphere Dwarf minke whales also feed in Antarctic waters in summer and have a broad latitudinal distribution in other seasons (Cooke, 2018). Most minke whale sightings around New Zealand occur in spring; aligning with the southern migration to Antarctic feeding grounds (Berkenbusch *et al.*, 2013). Based on this, occasional presence is **possible** in spring.	Possible	Possible
Southern right whale (**Section 4.3.6.3.8**)	Coastal waters around mainland New Zealand represent a historic calving ground for this species, with recent evidence suggesting a slow recolonization of this breeding range (Carroll *et al.*, 2014). Southern right whales utilise shallow coastal waters as their winter calving and nursery grounds (Patenaude, 2003). One sighting has been reported from the immediate vicinity. On this basis, it is **possible** that southern right whales could have a seasonal winter presence both in the vicinity of the Kupe IAA and in other coastal parts of STB.	Possible	Possible
Hector's/Māui's dolphins (**Section 4.3.6.3.9**)	Two subspecies: Māui's dolphins on the west coast of the North Island, and South Island Hector's dolphins around the South Island. Māui's and Hector's cannot be readily differentiated at sea; however, both subspecies have coastal distributions thought to be largely constrained within the 100 m isobath (Slooten *et al.*, 2006; Du Fresne, 2010). Māui's dolphins have a population stronghold between Manakau Harbour and Port Waikato (Slooten *et al.*, 2005), but their total distribution is wider; from Maunganui Bluff (Currey *et al.*, 2012) to Taranaki (DOC, 2020). Summer distributions are close to shore, while winter distributions are broader offshore and alongshore (Constantine, 2019). The inshore portion of PML 38146 occurs within the southern extreme of the Māui's sub-species distribution and overlaps with the WCNI MMS. One live sighting of a Māui dolphin was made in the vicinity of the Kupe IAA in 2012. Therefore, it is **possible** that Hector's/Māui's dolphins will occasionally be present both near the Kupe IAA and the wider STB.	Possible	Possible
Pygmy right whale (**Section 4.3.6.3.10**)	Pygmy right whales are the smallest, most cryptic and least known of the baleen whales (Fordyce & Marx, 2012). In New Zealand, sightings typically occur near Stewart Island and Cook Strait (Kemper, 2002). Therefore, it is **possible** that this species could be present given their apparent association with nearby Cook Strait, but ecological information is very scant for this species. No information about seasonality is available.	Possible	Possible
Bottlenose dolphin	The Marlborough Sounds supports a resident population of inshore bottlenose dolphins (Constantine, 2002). Offshore sightings are less common and typically occur in waters beyond the 100 m depth contour (Torres, 2012); therefore, occasional sightings are **possible** in the wider STB, but sightings are **unlikely** in the vicinity of the Kupe IAA. There are no strong indicators of seasonal patterns of occurrence for this species in the STB.	Possible	Unlikely

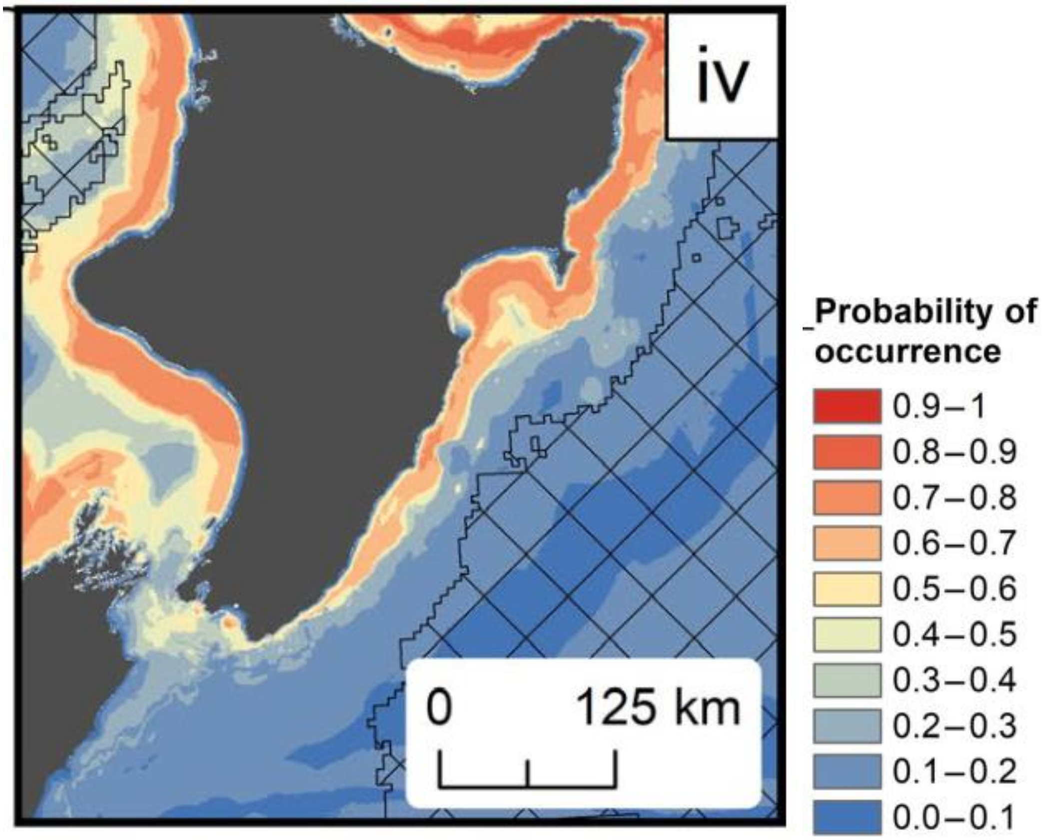
Species	Basic Ecological Description	Likelihood of presence in STB	Likelihood of presence in the vicinity of the Kupe IAA
Cuvier's beaked whale	This species is found in deep waters (> 200 m) and is thought to prefer steep bathymetry near the continental slope in water depths greater than 1,000 m (Baird *et al.*, 2020). Despite the predicted habitat suitability being low (Stephenson *et al.*, 2020), a reasonable number of strandings have occurred in the vicinity and acoustic recordings of this species have been made in Cook Strait (Goetz, 2017); therefore, it is **possible** that Cuvier's beaked whales will be occasionally present in deep waters of the wider STB, but **unlikely** to occur in the vicinity of the Kupe IAA. No information about seasonality is available.	Possible	Unlikely
Gray's beaked whale	This species has a circumpolar distribution south of 30° and occurs in deep waters beyond the shelf edge (Pitman & Taylor, 2020). Based on acoustic detections (Goetz, 2017) and reasonable number of strandings, it is **possible** that they could have an occasional presence in deep waters of the STB, but **unlikely** to occur in the vicinity of the Kupe IAA. No information about seasonality is available.	Possible	Unlikely
Strap-toothed whale	This species occurs between 35-60°S in cold temperate waters and prefers deep waters beyond the shelf edge (Pitman & Brownell, 2020a). Acoustic recordings of this species have been made in Cook Strait (Goetz, 2017) and explain the presence of this species in the stranding record. Despite the lack of sightings, it is **possible** that this species will occasionally be present in deep waters of the wider STB, but **unlikely** to occur in the vicinity of the Kupe IAA. No information about seasonality is available.	Possible	Unlikely
Pygmy sperm whale	Pygmy sperm whales are seldom seen at sea on account of their low profile in the water and lack of a visible blow; for this reason, little information is available on this species. They are known to be a deep-water species (Kiszka *et al.*, 2020) and this is reflected by habitat modelling (Stephenson *et al.*, 2020). Despite this, a reasonable number of strandings occur nearby and given that ecological information is relatively scant for this species it would be appropriate to conclude that it is **possible** that this species could be occasionally present in the wider STB but based on its preference for deeper water it is **unlikely** to occur in the vicinity of the Kupe IAA. No information about seasonality is available.	Possible	Unlikely
Sei whale	This species is generally found in offshore, deep waters beyond the continental slope (Horwood, 2009). They are occasionally seen in deep waters of the STB (Torres, 2012) and while habitat modelling suggests moderate habitat suitability in parts of the STB, habitat suitability is predicted to be low around PML 38146 (Stephenson *et al.*, 2020); therefore, occasional sightings are **possible** in the wider STB, but sightings are **unlikely** in the vicinity of the Kupe IAA. No information about seasonality is available, but during summer they feed at high latitude waters near the Antarctic; hence, would not be expected in STB in summer.	Possible	Unlikely
Sperm whale	Sperm whales have a wide global distribution but are predominantly found in deep waters (> 1,000 m) in the open ocean over the continental slope (Berkenbusch *et al.*, 2013). However, given the common occurrence of strandings nearby it is **possible** that sperm whales are occasionally be present in the wider STB, but their preference for deep water means they are **unlikely** to occur in the vicinity of the Kupe IAA. Torres (2012) noted that sightings in the STB largely occurred in summer.	Possible	Unlikely

4.3.6.3.1 Common dolphin

Common dolphins are abundant and widespread throughout tropical and temperate oceans (Berkenbusch *et al.*, 2013). They occur around most of the New Zealand coastline, where they are generally observed in coastal waters during spring and summer, moving further offshore in autumn (Stockin *et al.*, 2008). Common dolphins are a highly social species which sometimes form large groups consisting of thousands of individuals within which co-operative foraging is common (Stockin *et al.*, 2008).

Common dolphins are the most frequently encountered cetacean species in the STB (Torres, 2012). Most sightings occur over summer months, but this seasonality could simply reflect an observational bias (Torres, 2012). Nine sightings of common dolphins have been reported in the vicinity of the Kupe IAA, with three of these noting the presence of calves. A high number of sightings (45) and strandings (56) of this species have been reported in the wider STB. Based on these records, and their known presence in coastal waters, common dolphins are **likely** to be present both in and around the Kupe IAA and the wider STB. Habitat modelling for common dolphins has been undertaken by Stephenson *et al*. (2020) and gives a high likelihood of occurrence for this species in the area (see **Figure 31**). Common dolphins are considered 'not threatened' by the New Zealand Threat Classification System.

Figure 31 The predicted probability of common dolphin occurrence in the STB



Source: Reproduced from Stephenson *et al.* (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

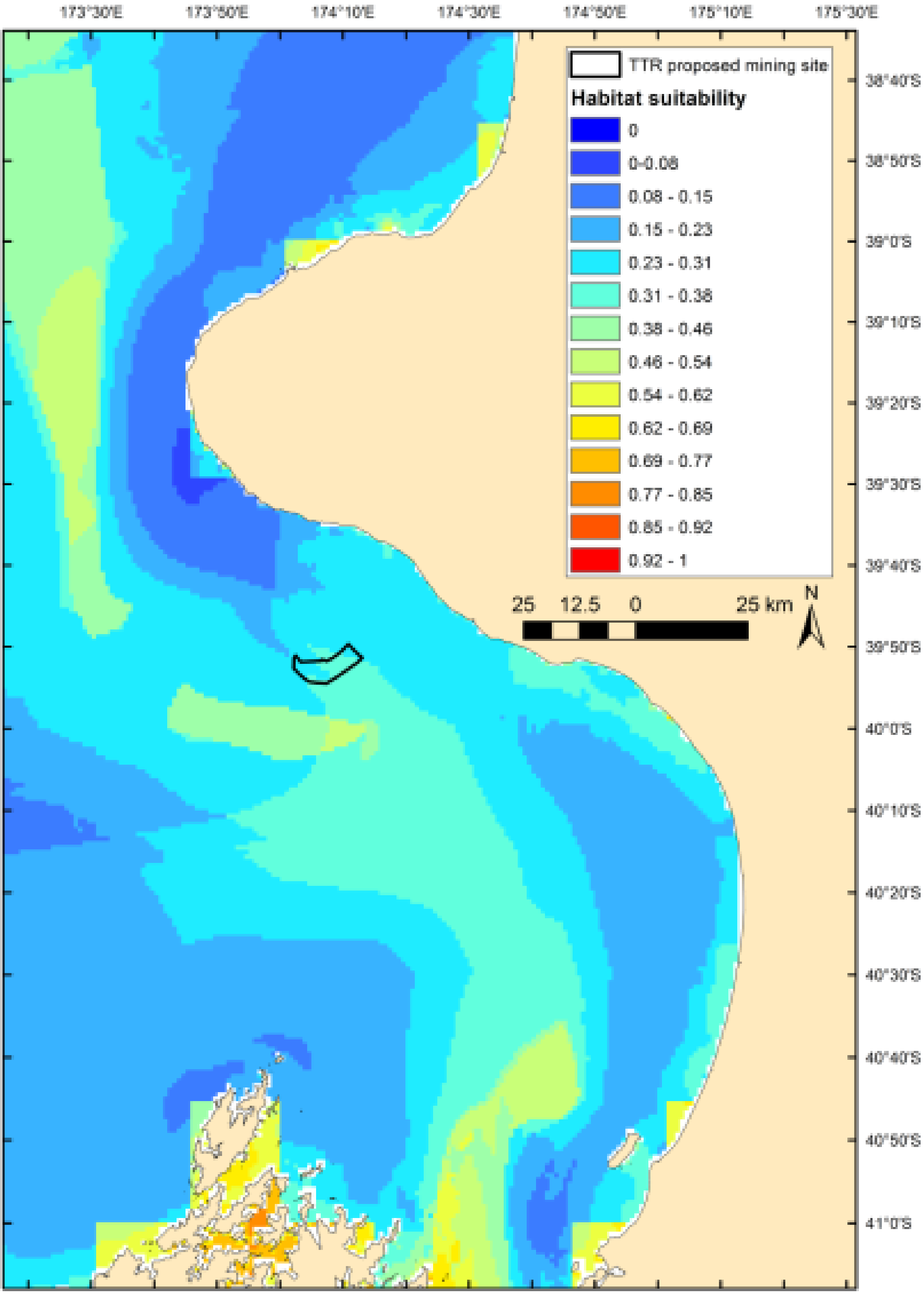
4.3.6.3.2 Killer whale

Killer whales are found in all marine regions, from the equator to polar waters (Reeves *et al*., 2017). There are four morphological 'ecotypes' of killer whales described in the southern hemisphere (Types A – D (Pitman *et al*., 2011)), with New Zealand being the only place where three out of the four ecotypes have been reported (Pitman *et al*., 2011; Foote *et al*., 2013). New Zealand's coastal ecotype killer whale population is small (65 – 167 individuals (Visser, 2006)) and is made up of at least three possible sub-populations based on geographic distribution; a North Island only subpopulation, South Island only subpopulation, and a North and South Island sub-population (Visser, 2000). The abundance of other ecotypes utilising New Zealand waters is unknown.

Killer whales are wide-ranging, with some New Zealand whales estimated to travel an average of 100 – 150 km per day (Visser, 2007). High re-sighting rates of some identifiable individuals suggest killer whales live permanently or at least semi-permanently around New Zealand's coast (Visser, 2007); however, the mobility of this species and their opportunistic foraging behaviour (Visser, 2000) indicates that this species can readily move between areas to maximise foraging opportunities and avoid disturbances.

Three killer whale sightings have been recorded in the vicinity of the Kupe IAA, with one noting the presence of calves. Strandings for this species are rare, with only three stranding reported for the region of interest around the STB. Torres (2015) undertook habitat modelling which, because of its proximity to the Kupe field, is of direct relevance. Results from this study found that sea surface temperature is a strong driver of killer whale distribution and that "*the predicted habitat suitability for killer whales in the STB ranges from low to moderate (0.08 > P < 0.62)*" (see **Figure 32**). Probability of occurrence modelling for this species has also been undertaken by Stephenson *et al*. (2020) and is presented in **Figure 33**. Based on the sightings data, the habitat modelling results and the wide-ranging nature of this species, it is considered that killer whales are **likely** to visit waters of both the Kupe IAA and the wider STB. Killer whales are considered 'nationally critical' by the New Zealand Threat Classification System.

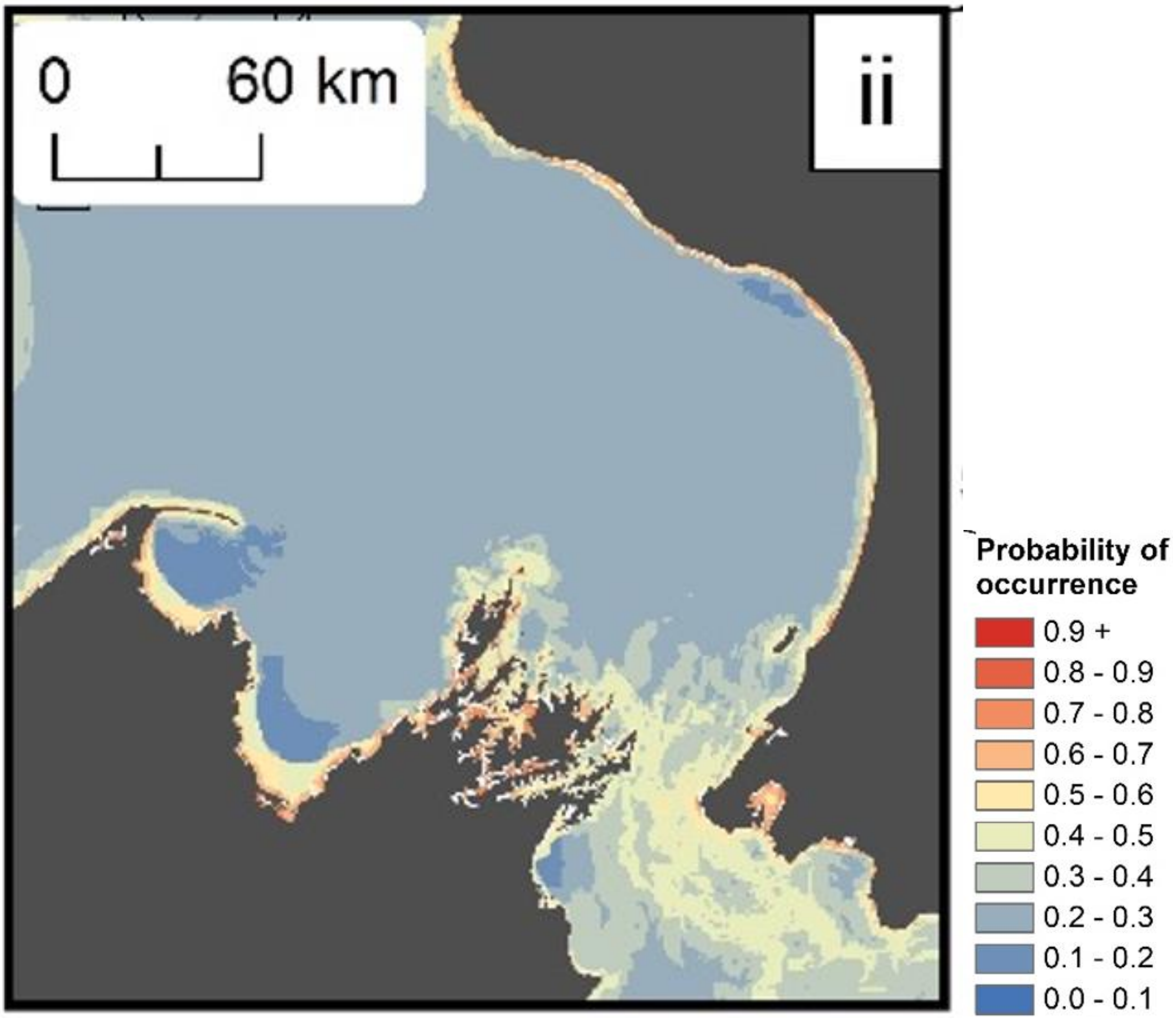
Figure 32 Habitat suitability predictions for killer whales in the wider Taranaki region derived from the habitat use model with bias correction



Source: Reproduced from Torres (2015)

Note: The habitat suitability index is a logistic output from the Maxent model (warm colours showing the highest habitat suitability).

Figure 33 The predicted probability occurrence of killer whales in the STB



Source: Reproduced from Stephenson *et al* (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

4.3.6.3.3 Blue whales

Two subspecies of blue whale occur in New Zealand waters: Antarctic and pygmy blue whales. Antarctic blue whales are migratory through New Zealand (particularly the STB; Warren *et al*., 2021), while New Zealand waters support a population of pygmy blue whales that are thought to be largely resident to the region (Barlow *et al*., 2018). While sightings of blue whales occur across many regions of New Zealand, sightings are concentrated in the STB (Barlow *et al*. 2018), leading researchers to conclude that this is as "*an important area for blue whales within the New Zealand EEZ, particularly for foraging*" (Barlow *et al*., 2018), albeit at a naturally low level (Barlow & Torres, 2021). Visual sightings records and acoustic detections reveal that blue whales are present here in every month of the year (Torres *et al.*, 2017; Barlow *et al*. 2018) with a concentration of acoustic detections occurring particularly between March and May (Warren *et al*., 2021). This consistency of presence, coupled with genetic data that suggests a high degree of genetic isolation and a lack of international photo-identification matches, indicates that the New Zealand population has a high degree of residency. Using mark-recapture data Barlow *et al*. (2018) produced a conservative abundance estimate for the New Zealand population of pygmy blue whales of 718 (SD = 433) individuals.

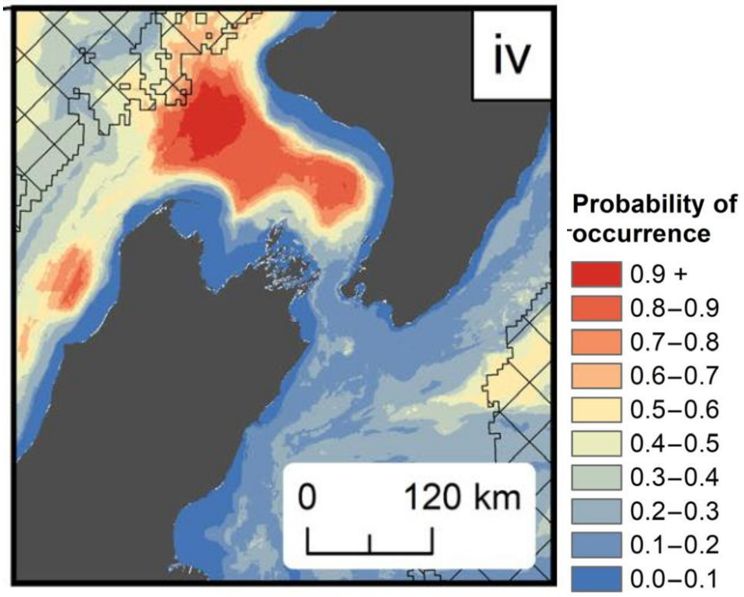
Data collected since 2012 has identified the STB as a blue whale foraging ground, with data suggesting whales target the aggregations of the krill species *Nyctiphanes australis*. The absolute distribution of blue whales in the region varies with oceanographic patterns and the subsequent distribution of prey. In El Niño conditions whales tend to be located west of the STB, but inside the STB during more typical weather patterns (Torres & Klinck, 2016). Most sightings records of blue whales around Taranaki occur beyond the 12 NM CMA boundary (see Figure 16 in Torres *et al.,* 2017). Recently, forecast models have been developed to predict suitable blue whale habitat up to three weeks in advance, using sea surface temperature and net primary productivity data (Barlow & Torres, 2021). It is anticipated that this forecasting methodology, in time, will become beneficial to proactively inform conservation management decisions around planned anthropogenic activities within STB; however, the model is currently limited to predictions in spring and summer (Barlow and Torres, 2021).

In February 2016, a field survey gathered the first evidence of breeding behaviour in the waters within and to the west of the STB. High densities of mother/calf pairs were observed, and documentation included the first aerial footage of blue whale nursing behaviour (Torres & Klinck 2016).

The IUCN Red List of Threatened Species currently lists the pygmy blue whale as 'data deficient'. In the latest DOC threat assessment for marine mammals, the threat classification for pygmy blue whales was changed from 'migrant' to 'data deficient' (Baker *et al*., 2019) given the recent evidence of population residency around New Zealand. Due to the lack of availability of population trend data, a 'data deficient' classification was considered the most appropriate for this subspecies (Baker *et al*., 2019).

While in general there have been a high number of blue whale sightings reports from STB waters (60), the majority of these occur in waters beyond the CMA. In keeping with this, only one blue whale sighting has been reported in the vicinity of the Kupe IAA. Seven stranding events have been documented along the coastline nearby. Habitat modelling for blue whales has been undertaken by Stephenson *et al*. (2020) (**Figure 34**) and Barlow and Torres (2021) (**Figure 35**) where high probabilities of occurrence occur offshore. Based on this information, it is **possible** that blue whales could occasionally approach the Kupe IAA, but typically they would be expected further offshore (i.e. a **likely** presence in the wider STB).

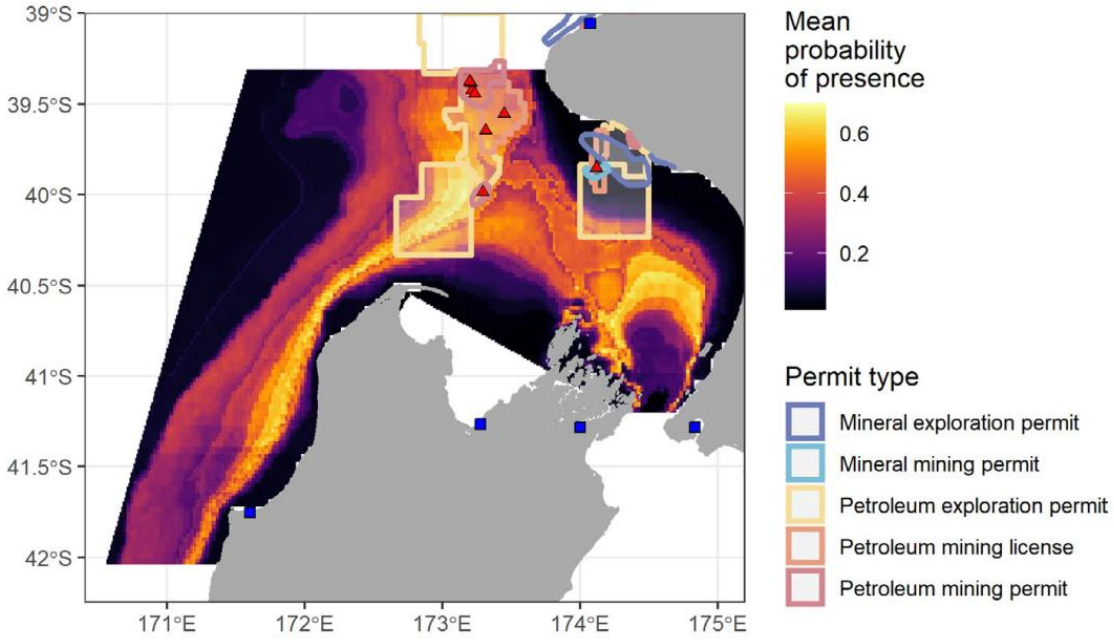
Figure 34 Predicted probability occurrence of blue whales



Source: Reproduced from Stephenson *et al*. (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

Figure 35 Predicted mean probability of blue whale presence



Source: Reproduced from Barlow and Torres (2021)

Note: predicted by the Boosted Regression Tree (BRT_{whale}) model, calculated across 100 bootstrap runs, including petroleum and mineral permit areas (as of May 2021), ports (blue squares) and active oil platforms (red triangles).

4.3.6.3.4 Humpback whales

Humpback whales are distributed throughout the North Atlantic, North Pacific, and southern hemisphere (Gibbs & Childerhouse, 2000) and undertake the longest migration of any mammal (Jackson *et al.*, 2016), feeding in the circumpolar waters of the Antarctic in summer and migrating to breeding grounds in sub-tropical or tropical waters in winter (Dawbin, 1956). Migrating whales typically use continental shelf waters (Jefferson *et al.*, 2008) and can approach closely to shore when passing headlands or moving through confined waters (e.g. Gibbs *et al.*, 2017).

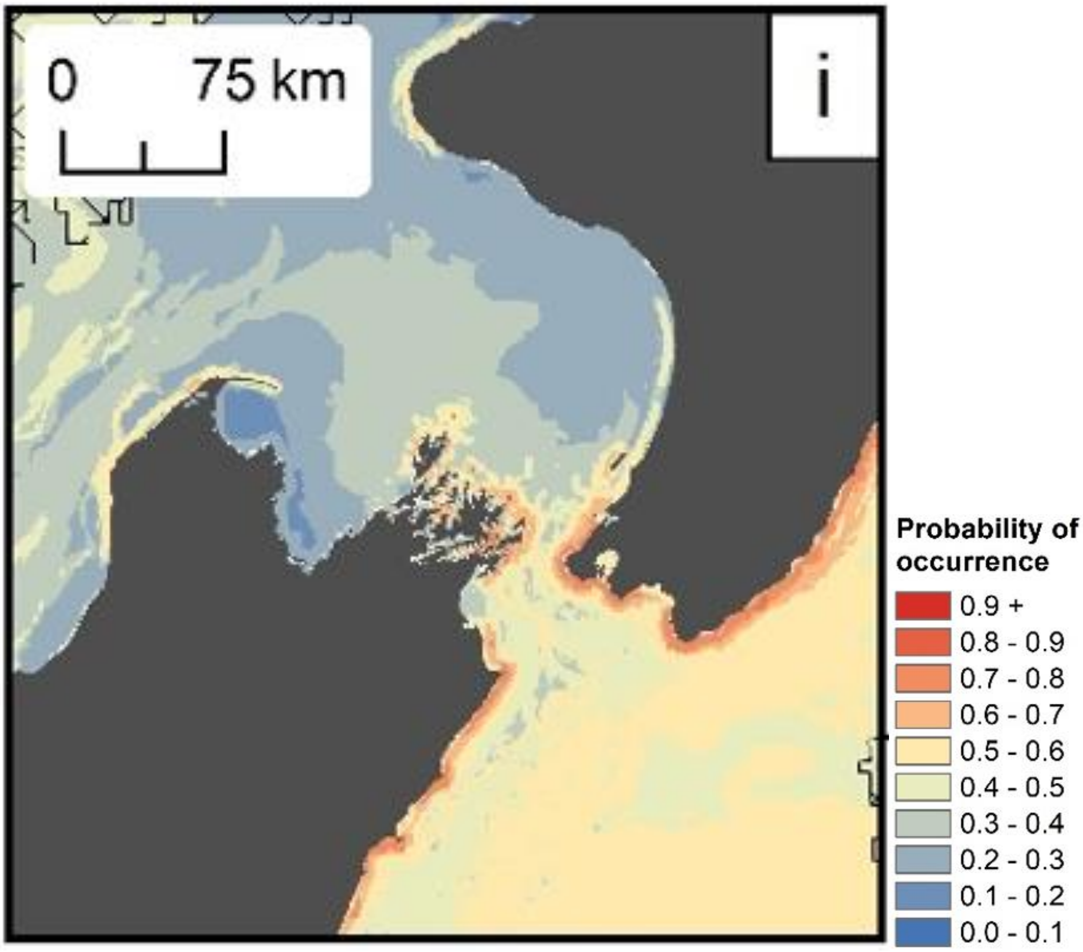
Humpback whale migration routes along the coast of New Zealand were first described by Dawbin (1956) with later descriptions by Gibbs and Childerhouse (2000) confirming a similar pattern. When migrating north, the majority of whales move up the South Island's east coast towards Cook Strait. Here, the migration route splits with most whales passing through Cook Strait and up the North Island's west coast, with some individuals continuing north along the North Island's east coast (Gibbs & Childerhouse, 2000). The northward migration occurs from late May to early August (Dawbin, 1956). Although the breeding grounds of humpbacks that migrate past New Zealand have not been clearly identified, a number of studies have linked New Zealand humpbacks to breeding grounds in New Caledonia, Fiji and Tonga (Gibbs *et al.*, 2017).

Southern migrating humpbacks pass along the west coast of the North and South Islands where they aggregate near the southwest corner of the South Island before moving further south. A small number of southern migrating whales pass the east coast of the North Island to East Cape where they depart offshore (Gibbs & Childerhouse, 2000). Recent satellite tagging of southern-migrating whales has revealed those that travel to the east of New Zealand typically congregate at the Kermadec Islands before proceeding south to two recently discovered Southern Ocean feeding areas (Riekkola *et al.*, 2019). Southern migrations occur from mid-September to early December (Dawbin, 1956).

On their migrations, humpback whales can spend considerable time in coastal regions over the continental shelf (Jefferson *et al.*, 2008). Annual winter surveys of humpback whales occurred in Cook Strait over the 12 years from 2004 – 2015. During this period, 659 whales were observed (Gibbs *et al.*, 2017), with the number of individuals recorded yearly ranging from 15 (in 2006) to 137 (in 2015) (Gibbs *et al.*, 2017). From this data the calculated rate of population increase was 13% (5-22%, 95% confidence interval), suggesting the beginning of population recovery.

Humpback whales are occasionally seen in coastal Taranaki waters, particularly between the months of May and August on their northern migration. While no sightings have been reported in the vicinity of the Kupe IAA, 16 sightings have been made in the wider STB and two stranding events have occurred along the surrounding coastline. Habitat model results for this species are reproduced from Stephenson *et al.* (2020) in **Figure 36**. Based on the available information, humpback whales will certainly have a presence in the wider STB from May to August and it is **possible** that some individuals could transit waters within and nearby the Kupe IAA during this time. This species is less **likely** to be present in the STB at other times of the year.

Figure 36 The predicted probability occurrence of humpback whales in the STB



Source: Reproduced from Stephenson *et al*. (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

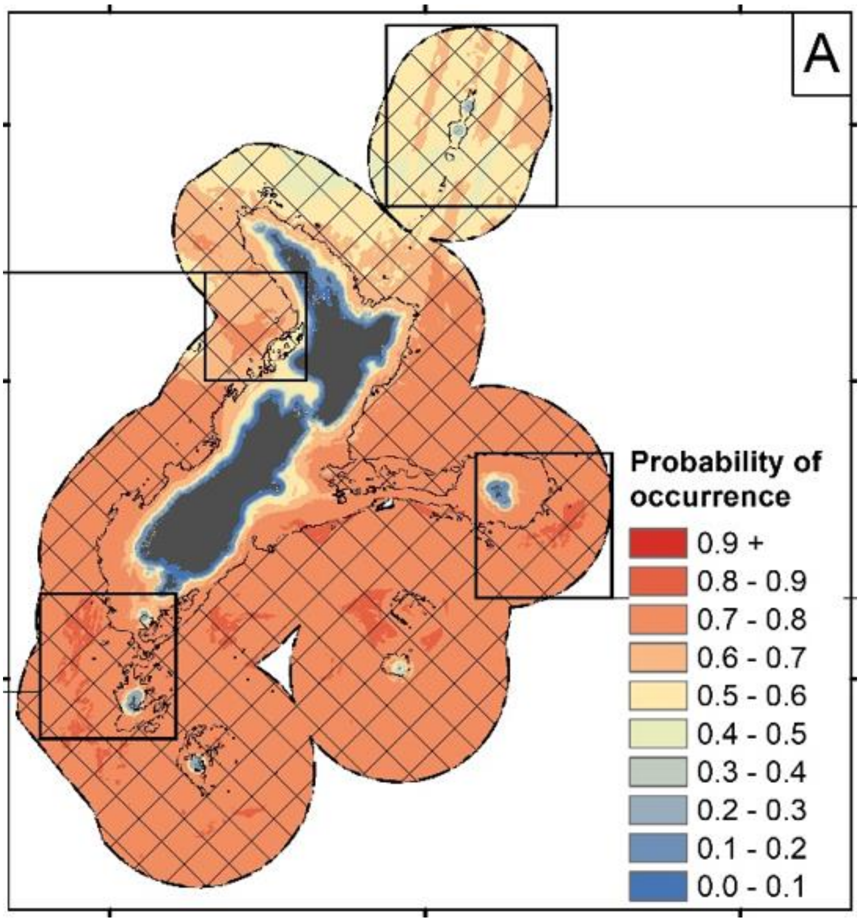
4.3.6.3.5 Long-finned pilot whale

Pilot whale sightings occur in New Zealand waters during all seasons (Berkenbusch *et al.*, 2013), with sightings of pilot whales in Taranaki waters reasonably common, particularly in summer (Torres, 2012).

Pilot whales are highly social, often travelling in large groups of over 100 individuals (DOC, 2021b). These whales commonly strand on New Zealand coasts, with the stranding rate peaking in spring and summer (O'Callaghan *et al.*, 2001). Farewell Spit is a recognised hotspot for pilot whale mass-stranding incidents; and November, December and January are the most common months in which mass stranding events occur (DOC marine mammal stranding data).

While sightings of pilot whales are fairly common in offshore Taranaki waters (18), there are no sighting records for this species in the vicinity of the Kupe IAA. In total 84 stranding events are reported from the regions surrounding the STB, most occurring in Golden Bay. Habitat modelling for pilot whales has been undertaken by Stephenson *et al*. (2020) where moderate probabilities of occurrence occur throughout the STB (**Figure 37**). Hence, it is **possible** that long-finned pilot whales have an occasional presence in and around the Kupe IAA, but occurrence is generally associated with waters further offshore (i.e. this species is expected to have a **likely** presence in wider STB).

Figure 37 The predicted probability occurrence of pilot whales in the New Zealand EEZ



Source: Reproduced from Stephenson *et al*. (2020)

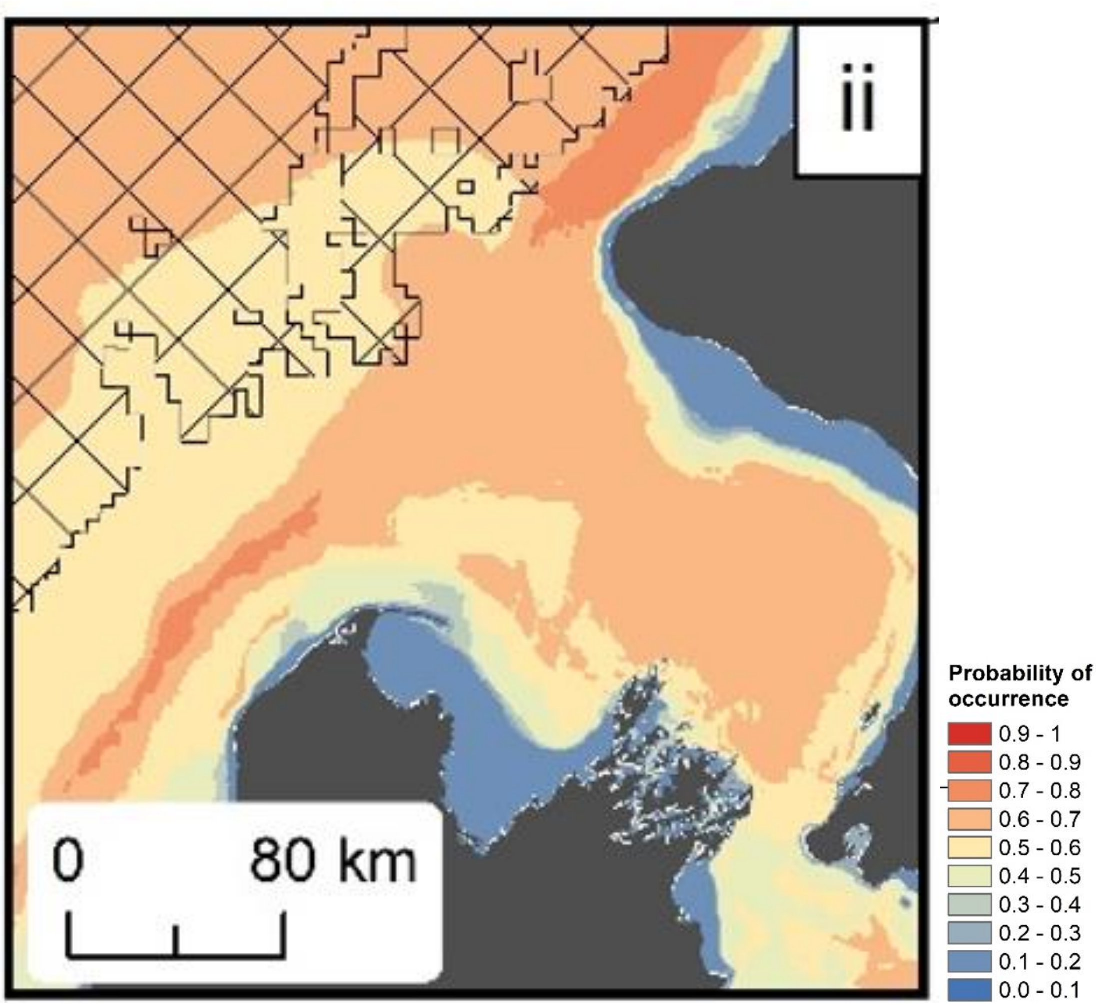
Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

4.3.6.3.6 Fin whale

Like most baleen whales, fin whales carry out migrations, moving to lower latitudes in winter for breeding; however, little is known about the specific movements of fin whales around New Zealand, although fin whales are typically associated with deep offshore waters (Shirihai, 2002). The diet of fin whales varies with location. In the southern hemisphere their diet is dominated by krill, whereas elsewhere they consume a range of prey including fish, squid, krill, and other crustaceans (Miyashita *et al.*, 1995; Shirihai & Jarrett, 2006). Krill aggregations in the STB may be significant for feeding fin whales (Torres, 2012).

Habitat model results for this species are reproduced from Stephenson *et al.* (2020) in **Figure 38**. No sightings of fin whales have been reported in the vicinity of the Kupe IAA, but two sightings have been made in the wider STB, and four stranding events have been reported along the coastline. Hence, it is **possible** that fin whales could be present in both the Kupe IAA and the wider STB on occasion.

Figure 38 The predicted probability occurrence of fin whales in the STB



Source: Reproduced from Stephenson *et al*. (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

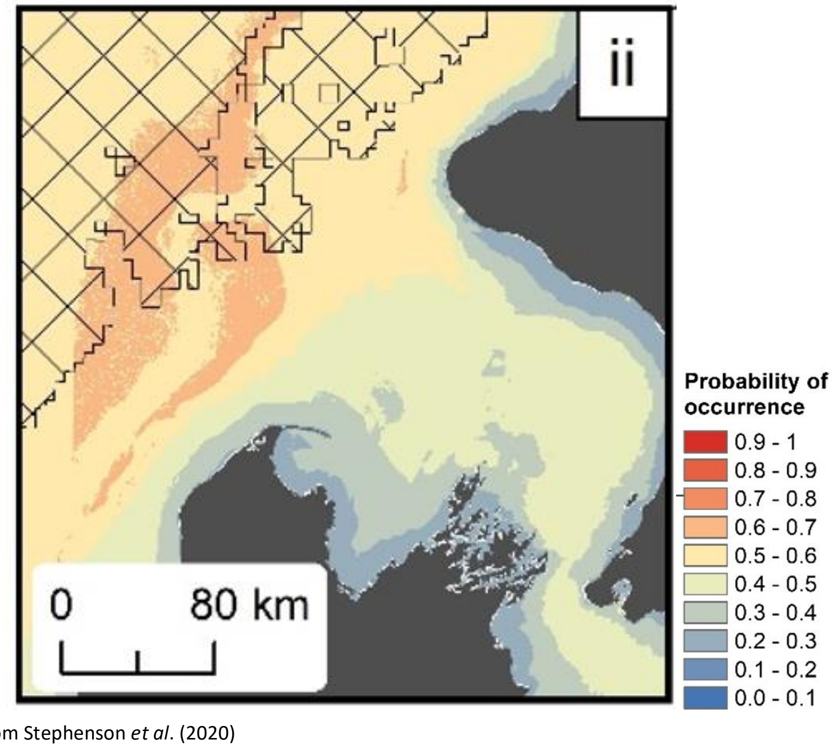
4.3.6.3.7 Minke whale

Antarctic minke whales (*B. bonaerensis*) and dwarf minke whales (*B. acutorostrata*) both occur in New Zealand waters. The distribution of the Antarctic minke is restricted to the southern hemisphere where it is very abundant in Antarctic waters in summer. This species is seen at lower latitudes in other seasons, although outside of the summer months their distribution is less well-known (Reilly *et al.*, 2008). Dwarf minke whales occur over most latitudes in both hemispheres. In the southern hemisphere, they too feed in Antarctic waters in summer, with a broader latitudinal distribution in other seasons (Reilly *et al.*, 2008).

The DOC marine mammal sighting and stranding databases indicate the distribution of minke whales extends around mainland New Zealand and throughout New Zealand's sub-Antarctic waters. New Zealand-wide there were 60 reported sightings of minke whales (both species) in New Zealand's EEZ between 1970 and 2013, the majority of which were in spring (38%). This timing aligns well with the southern migration towards Antarctic feeding grounds (Berkenbusch *et al.*, 2013). Minke whales feed on planktonic crustaceans and small schooling fish (e.g. anchovy and herring); with fish comprising a higher proportion of their diet compared to other baleen whales.

Habitat model results for this species are reproduced from Stephenson *et al.* (2020) in **Figure 39**. In total, 16 minke whales have stranded on the coastline bordering the STB. One minke whale sighting has been reported in the vicinity of the Kupe IAA and two sightings have occurred in the wider STB. Based on the stranding data and the low level of sightings nearby, it is **possible** that minke whales could be occasional visitors to the Kupe IAA and surrounding waters.

Figure 39 The predicted probability occurrence of minke whales in the STB



Source: Reproduced from Stephenson *et al*. (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

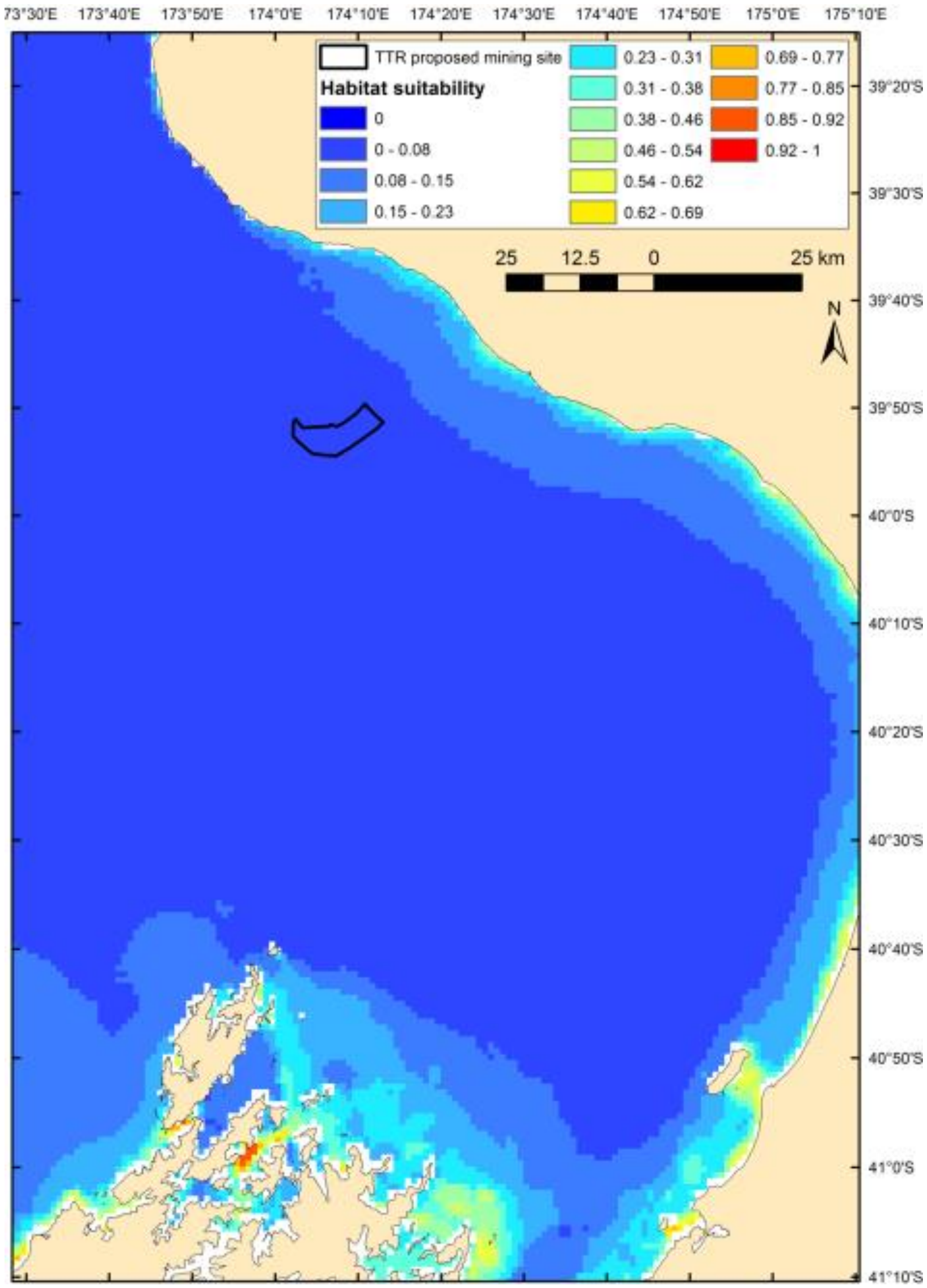
4.3.6.3.8 Southern right whale

Southern right whales exhibit a seasonal distribution, spending summer months feeding in latitudes between 40 and 50°S (Oshumi & Kasamatsu, 1986) and winter months breeding in more temperate coastal habitat. Their migratory routes span thousands of kilometres, and encompass a range of habitats, from sheltered coastal wintering grounds to offshore summer feeding grounds (Carroll *et al*., 2011). While summer distribution at feeding grounds is likely linked to the distribution of prey (Tormosov *et al*., 1998), maternally directed learning of migratory destinations is evident in this species.

Southern right whales originally occupied bays and inlets around mainland New Zealand during their winter breeding season (Bannister, 1986; Dawbin, 1986); however, commercial whaling reduced numbers around New Zealand to near extinction and no whales were seen around the mainland between 1928 and 1963 following the cessation of commercial operations (Gaskin, 1963). Capture-recapture data (photo-identification and genetics) now suggests that the New Zealand population is recovering (Carroll *et al*., 2015) and although Port Ross in the subantarctic Auckland Islands supports the densest New Zealand breeding aggregation (Rayment *et al*., 2012), recent evidence suggests a gradual recolonisation of breeding range around mainland New Zealand (Patenaude, 2003; Carroll *et al*., 2014; Carroll *et al*., 2015).

Southern right whales have been reported from waters in the vicinity of the Kupe IAA only once, but 17 records of this species exist for the wider STB. Only one southern right whale stranding has been reported for the nearby coastal regions; however, it is noteworthy that this species rarely strands as it is well accustomed to very shallow coastal habitat. Southern right whales use nearshore coastal waters during the winter breeding season. Torres (2015) undertook habitat modelling and found that the winter distribution of southern right whales around New Zealand was most strongly influenced by bathymetry which explained 84% of distribution. Torres (2015) states that "*habitat suitability was highest in areas with shallow water (< 20 m), low wave heights during extreme events (between 0 and 2 m), high concentrations of dissolved organic matter (> 0.2 m-1), and with tidal current velocity greater than 1 m/s*". Regarding the STB, Torres (2015) states that "*The persistent low to moderate level (P<0.54) of predicted habitat suitability along the coast of the STB may reflect a migration pathway that southern right whales use while transiting to more suitable wintering grounds to the north or south*." (see **Figure 40**). Based on the information presented here, it is **possible** that southern right whales could have an occasional seasonal presence both in the vicinity of the Kupe IAA and in other coastal waters of the wider STB.

Figure 40 Habitat suitability predictions for southern right whales in the STB



Source: Torres (2015)

Note: The habitat suitability index is a logistic output from the Maxent model (warm colours showing the highest habitat suitability).

4.3.6.3.9 Hector's/Māui's dolphins

There are two subspecies of Hector's dolphin: South Island Hector's dolphin (*Cephalorhynchus hectori hectori*) and the Māui's dolphin (*C. hectori maui*). In general, Māui's dolphins are present on the west coast of the North Island, and South Island Hector's dolphins are present around the South Island. Over the last 40 years, numbers of both subspecies have significantly declined, largely on account of high levels of by-catch in coastal fisheries (Roberts *et al*., 2019); with other threats such as disease (i.e. toxoplasmosis) being a recent focus of scientific studies. Māui's dolphins are of high relevance to this consent application given the proximity of the Kupe IAA to the WCNI MMS, which was established to protect Māui's dolphins from threats throughout their distribution. Māui's dolphins are classified as 'nationally critical' by the New Zealand Threat Classification System.

The most recent Māui's dolphin population estimate for individuals aged one year and over is 63 individuals (95% CI = 57–75) (Baker *et al.*, 2016), but recent media attention suggests that the population has declined even further since this estimate (RNZ, 2021). A revised population estimate from genetic mark-recapture surveys undertaken in 2020/2021 is expected to be published in the coming months.

Māui's and Hector's cannot be readily differentiated at sea which complicates sightings records; however, both subspecies have coastal distributions thought to be largely constrained within the 100 m isobath (Slooten *et al.*, 2006; Du Fresne, 2010); although, Māui's dolphins have been observed out to 12 NM offshore during research surveys (DOC, 2017). Summer densities are generally highest close to shore, while in winter their distributions are broader both offshore and alongshore (Constantine, 2019). Despite these movements, both subspecies are characterised by having small home ranges averaging ~50 km alongshore (Oremus *et al*., 2012).

Both Māui's and Hector's dolphins have a strong preference for turbid waters (Derville *et al*., 2016) that are often associated with river or estuary outflows. These areas of high productivity would typically support abundant prey species on which the dolphins feed (Constantine, 2019).

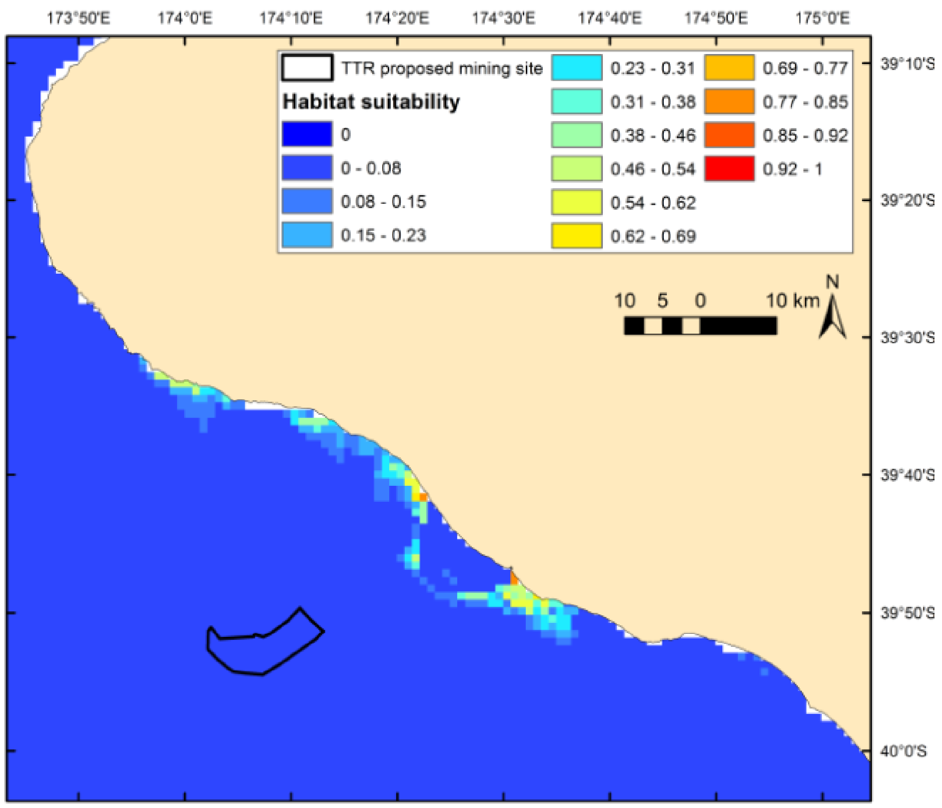
Māui's dolphins are only found along the west coast of the North Island, with a population stronghold between Manakau Harbour and Port Waikato (Slooten *et al*., 2005). While their total distribution is wider, extending from Maunganui Bluff (Currey *et al*., 2012) to South Taranaki (DOC, 2020), information about habitat use at the extremes of their distributional range is scarce. Māui's dolphins occur in very low densities in Taranaki waters (Currey *et al.*, 2012), and acoustic monitoring has recently been used to quantify their presence here (Nelson & Radford, 2018). This study used C-POD click detectors moored approximately 2 km offshore during several deployments between November 2016 and April 2019. No deployments occurred at locations in the vicinity of the Kupe IAA, but the permit area lies between the Tapuae and Whanganui River deployment locations. Of relevance to the Kupe IAA, Nelson & Radford, 2018 made one acoustic detection of a Māui's dolphin at Tapuae in December 2018, but no detections were made at the Whanganui River deployment location during the 166-day deployment (from 18 November 2016 to 4 May 2017). This study confirms that Māui's dolphins are regularly present in the coastal waters of northern Taranaki (especially near Tongaporutu) and visit as far south as Tapuae (DOC, 2020). This information reinforces the notion introduced by Currey *et al*. (2012) that Māui's dolphin densities decrease towards the southern extremities of their alongshore range (i.e. through Taranaki and Whanganui) and indicate that both the density and rate of occurrence for Māui's dolphins within and nearby the Kupe IAA is likely be very low.

There has only been one potential sighting of a Māui's or Hector's dolphin within the vicinity of the Kupe IAA. This sighting, of a group of four dolphins fitting the description of the species, was made in 2012 approximately 13 km off Patea; however, insufficient information was available from the observer to confidently validate this sighting. The closest validated sighting of this species to the Kupe IAA is a sighting of a single animal made 600 m off the Patea River Mouth in May 2018. There have also been a small number of other validated sightings nearby (one near Opunake and one near Whanganui River Mouth). Three strandings of Māui's dolphins have been reported along the coastline (one in South Taranaki and two in Whanganui) and 18 Hector's dolphin strandings have been reported: one in South Taranaki, two at Kapiti Coast and the remainder along the top of the South Island.

Habitat modelling by Torres (2015) found that the distribution of Hector's dolphins was most strongly influenced by suspended particulate matter concentrations and that "*The predicted suitability of habitat for Hector's dolphin in the STB was generally low (P < 0.08; Figure 3-18). However, pockets of increased habitat suitability (P> 0.46) were predicted in the coastal region to about 8 km offshore adjacent to the TTR proposed project area*" (which is relevant to the Kupe IAA) (see **Figure 41**). Probability of occurrence for the STB has also been modelled by Stephenson *et al.* (2020) and is presented in **Figure 42**.

Based on the information above, and despite their very low densities off the Taranaki coast, it is **possible** that Hector's or Māui's dolphins could be present both in the vicinity of the Kupe IAA and in coastal areas of the wider STB. Given the 'nationally critical' threat status of Māui's dolphins and their small home ranges this possibility must be seriously considered.

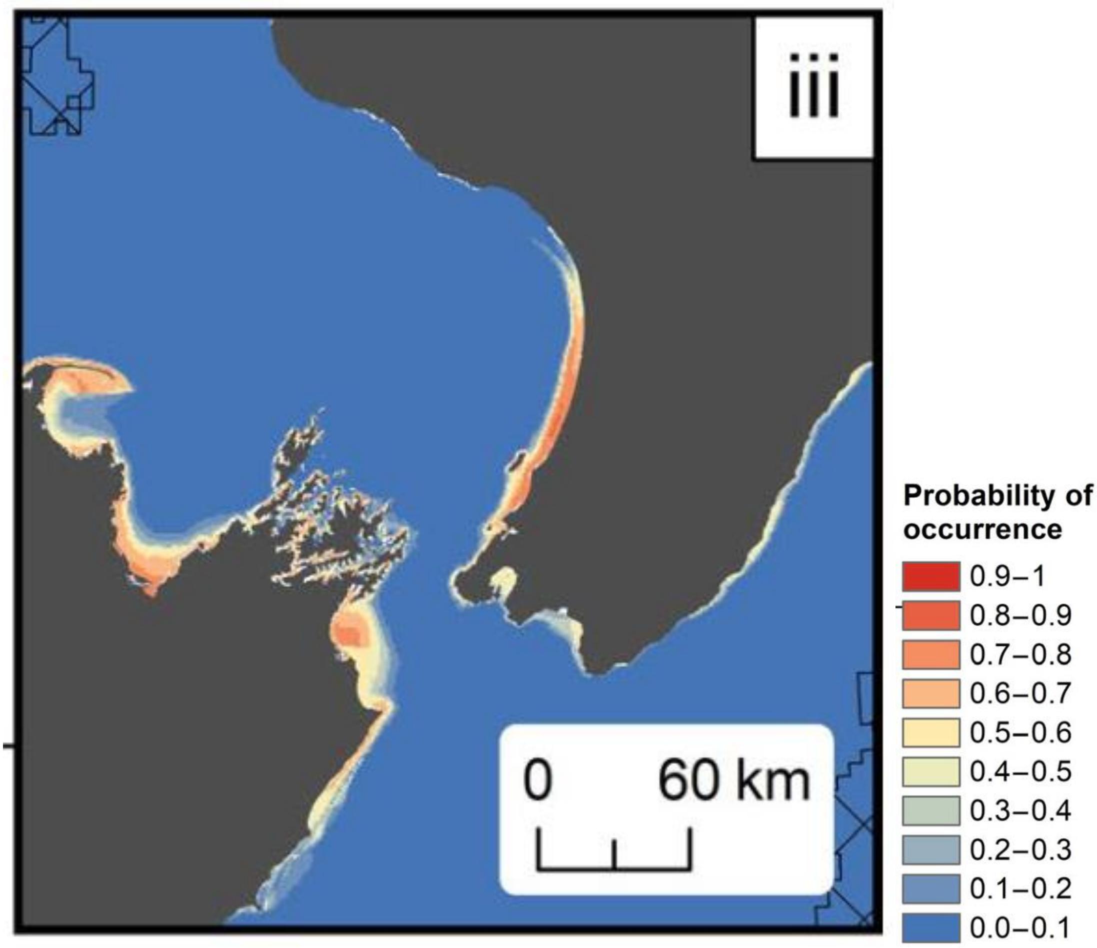
Figure 41 Prediction of habitat suitability for Hector's dolphin in the STB



Source: Torres (2015)

Note: Predictions derived from the habitat use model with bias correction. The habitat suitability index is a logistic output from the Maxent model (warm colours showing the highest habitat suitability).

Figure 42 The predicted probability occurrence of Hector's dolphin in central New Zealand



Source: Reproduced from Stephenson *et al.* (2020)

Note: Modelled using bootstrapped BRTs and areas of low predicted environmental coverage depicting the lower confidence that can be placed in the predicted probability occurrence (criss-cross black line).

4.3.6.3.10 Pygmy right whale

Pygmy right whales are the smallest, most cryptic, and least known of the living baleen whales (Fordyce & Marx, 2012). They are known to have a worldwide distribution and a diet consisting largely of calanoid copepods and euphausiids (Kemper, 2002). Globally, sightings are known from both oceanic and coastal habitats and a presence close to shore cannot be discounted (Kemper, 2009). New Zealand sightings typically occur near Stewart Island and Cook Strait (Kemper, 2002). Kemper *et al.* (2013) suggests an association between pygmy right whales and areas of high marine productivity.

There have been no sightings of pygmy right whales in the STB (including in the vicinity of the Kupe IAA), but 17 strandings have been reported inshore. Despite having little information available on which to assess the likelihood of this species being present in and around the Kupe IAA (in particular, no habitat modelling results are available for this species), the relatively high number of strandings reported for this species suggest that it is **possible** that they could occasionally be present in both the Kupe IAA and surrounding STB waters.

4.3.6.4 Pinniped Species that could be Present in and around the Kupe IAA

New Zealand fur seals are the only pinniped species that is expected to have a routine presence in and around the Kupe IAA. However, rare visits by leopard seals could potentially occur (see Hupman *et al.*, 2019).

4.3.6.4.1 New Zealand Fur Seal

New Zealand fur seals are widespread around rocky coastlines on the mainland and offshore islands (Wilson, 1981). The closest fur seal colony of relevance to PML 39146 is at Ngā Motu/the Sugar Loaf Islands, approx. 105 km around the coastline of Cape Egmont to the north. Smaller haul-out sites are present throughout the Taranaki coast, although these do not meet the definition of a colony/rookery (Miller & Williams, 2003). Population numbers within the Ngā Motu area appear to be stable, with a lack of suitable habitat for hauling out and breeding likely limiting population growth (Miller & Williams, 2003).

New Zealand fur seals are opportunistic feeders that forage on a range of species, with the relative importance of each prey item varying seasonally and geographically (Baird, 1994). Foraging habitats vary with season and sex although inshore and deeper offshore foraging habitat is used throughout the year (Harcourt *et al.*, 2002). Females tend to forage over continental shelf waters, with males using deeper continental shelf breaks and pelagic waters (Page *et al.*, 2005). Foraging trips often last for several days (Page *et al.*, 2005) and GPS tagged animals have shown females to forage up to 78 km from breeding colonies (Harcourt *et al.*, 1995), foraging further offshore in winter (Harcourt *et al.*, 2002).

The breeding season for New Zealand fur seals occurs from mid-November to mid-January, with peak pupping in mid-December (Crawley & Wilson, 1976; Miller & Williams, 2003). Pups are suckled for approximately 300 days, during which adult females alternate between foraging at sea and returning to shore to feed their young (Boren, 2005).

At sea sightings of New Zealand fur seals in the STB are common (see Cawthorn (2015) and DOC marine mammal sighting database) and New Zealand fur seals are known to occur at the Kupe WHP; hence, this species will certainly be present in the vicinity of the Kupe IAA. This species is listed in Schedule 4 of the PRCP for Taranaki as being regionally significant for their coastal indigenous biodiversity values. In addition, marine mammal rookeries and haul outs are listed as rare and uncommon ecosystem types found on the Taranaki coast.

4.3.7 Seabirds

The term 'seabirds' is used here to represent the bird species that spend some or part of their life cycle feeding over open marine waters (following Taylor, 2000).

4.3.7.1 Species Potentially Present

The wider STB area in which the Kupe IAA is situated is visited by several seabird species that either pass through the region during migrations or foraging voyages, or are permanent residents. Approximately 60% of New Zealand's seabirds regularly forage more than 50 km from shore, while the remaining species feed over inshore waters and are only occasionally sighted away from land (Taylor, 2000).

Systematic and quantitative studies of seabird distributions and abundances specifically in the STB have not been carried out (Thompson, 2015); with at-sea abundance and distribution surveys for seabirds generally being lacking throughout New Zealand waters. Species likely to be present in and around the Kupe IAA range from relatively coastal seabirds such as blue penguins, shags, gulls and terns, to wide-ranging pelagic species such as albatross, petrels, and shearwaters.

Knowledge of the at-sea distribution of New Zealand's seabirds is generally restricted to targeted studies and opportunistic observations from commercial fishing vessels (e.g. Richard *et al*., 2020[14]). Therefore, sightings typically favour those species that are attracted to fishing vessels and small/cryptic species may be missed and underestimated. A summary of the seabird species identified as potentially present within the STB (in waters over 20 m depth) is provided in **Appendix E**, including relevant threat classifications (IUCN and New Zealand Threat Classification System) (Scofield & Stephenson, 2013; Thompson, 2015; Richard *et al*., 2020; eBird, 2021; NZBirdsOnline, 2021). Due to the lack of distribution and abundance surveys carried out on seabirds, a lack of sightings records for the STB should not be interpreted to mean that a species is not present or does not utilise this region.

Within the PRCP for Taranaki, the TRC has listed several birds as being regionally significant on account of their coastal indigenous biodiversity values (TRC, 2018), and these species have been marked accordingly in **Appendix E**. Black-fronted tern, Caspian tern, and grey-faced petrel have also been listed within the PRCP for Taranaki as 'regionally distinctive' (TRC, 2018).

4.3.7.2 Breeding Areas

Approximately 84 species of seabird are known to breed throughout New Zealand (Taylor 2000); however, the STB lacks suitable predator-free breeding habitat for many species. The closest large seabird breeding colonies to the Kupe IAA are found off the coast of New Plymouth at the Ngā Motu/Sugar Loaf Islands, although smaller colonies occur at various locations along the STB coast. Where available, an indication of breeding season and breeding location within the STB has been provided for each species in **Appendix E**.

[14] Since 2004, independent fisheries observers working off commercial fishing vessels have been making regular counts of the number of seabirds surrounding fishing vessels. This data is coordinated by the Department of Conservation and collated by Dragonfly Science. The correct reference for this is Richard *et al*. (2020).

4.3.7.3 Little Penguin/Kororā

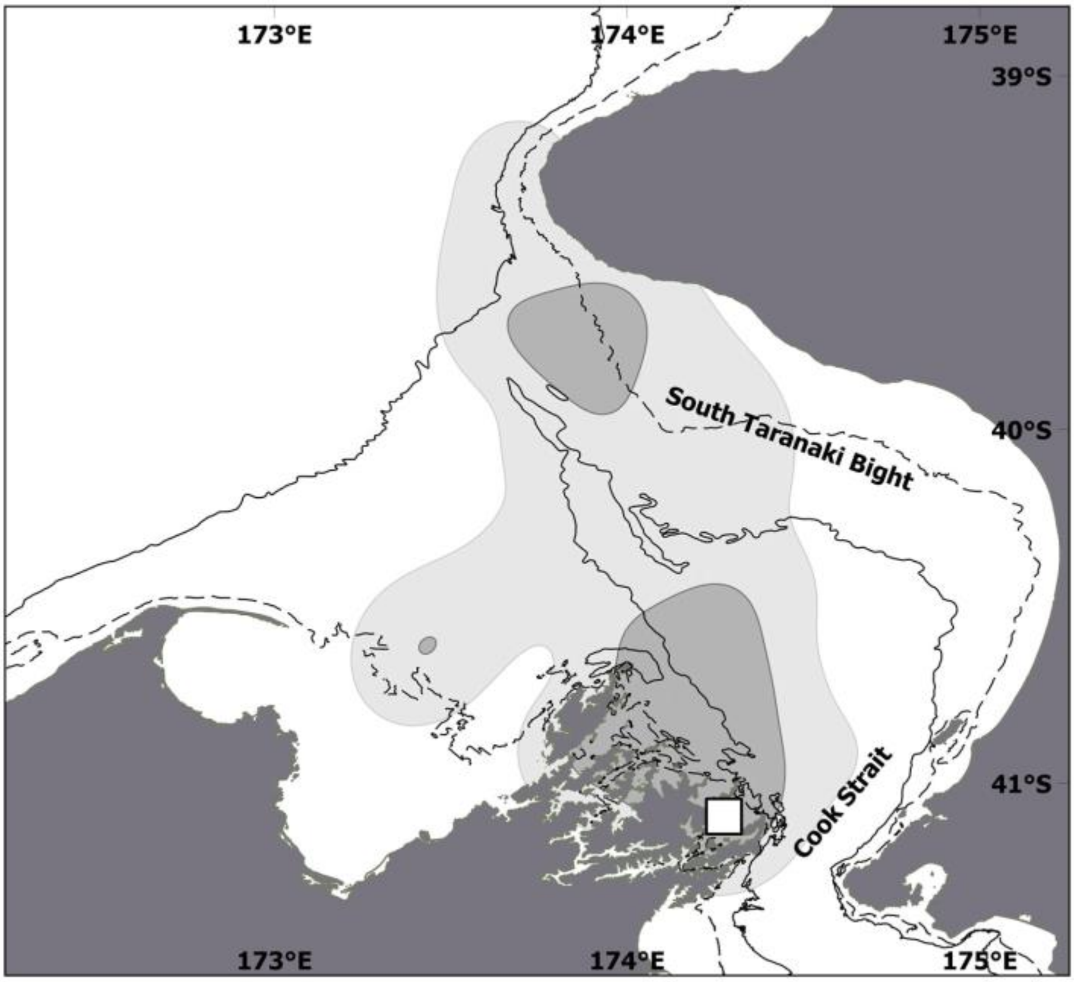
Little penguins/Kororā (also commonly known as little blue penguins) are the world's smallest species of penguin, with a wide distribution throughout coastal New Zealand (Scofield & Stephenson, 2013), and are considered a taonga species by iwi and concerns are regularly raised with regard to any potential effects of activities on foraging and nesting of these birds.

Except for within the Taranaki region, there are few colonies along the North Island's west coast (Wilson & Mattern, 2018). Little penguins forage at sea during the day, returning at night to their burrows (NZBirdsOnline, 2021). They generally return to their natal colony for breeding and retain their pair bond and often the same burrow year after year (Wilson & Mattern, 2018).

Historically little penguins were thought to forage within 30 km of their nest site during the chick-rearing stage (Hoskins *et al*., 2008; Agnew, 2014; Pelletier *et al*., 2014), with unusually long foraging trips of up to 118 km only recorded in the closely related Australian little blue penguin (*E. novaehollandiae*) foraging in the Great Australian Bight (Wiebkin *et al*., 2005). However, based on GPS tracking data, Poupart *et al*. (2017) revealed that little penguins in New Zealand waters are capable of, and routinely carry out, extended foraging trips of up to 214 km from breeding colonies, with penguins from Marlborough Sounds colonies frequently utilising STB waters as foraging grounds (**Figure 43**). Long-distance foraging trips were found to be particularly important during the egg-incubation stage (Poupart *et al*., 2017); eggs are typically laid in July to November, with incubation lasting up to 36 days (NZBirdsOnline, 2021). Following the incubation period, chicks are fed by both parents who carry out foraging trips closer to the nest site (Poupart *et al*., 2017).

Taranaki's Project Hotspot (a citizen-science project driven by the Ngā Motu Marine Reserve Society) collects public sightings of little penguins from within the Taranaki region. As part of this project several reports have been logged of little penguins along the STB coastline (**Figure 44**) and it is possible that these animals could utilise waters surrounding or even within the Kupe IAA for foraging and may nest inshore.

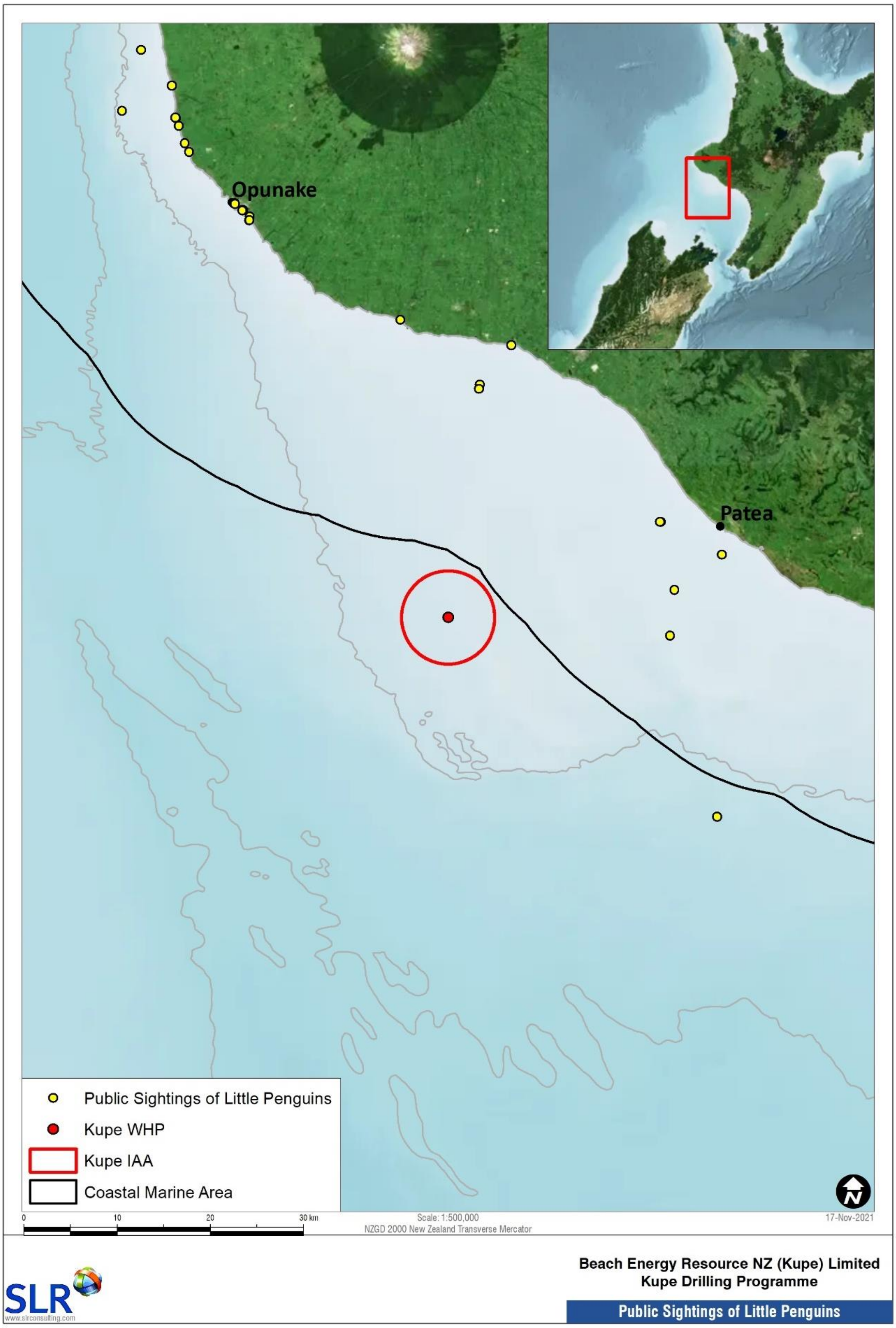
Figure 43 Little penguins of Motuara Island, Marlborough Sounds, foraging areas during incubation stage



Source: Poupart *et al*., 2017

Light grey area represents the home range (95% UD) and the dark grey the focal area (50% UD). The study colony is shown by the white square. The 50 m bathymetry contour is represented by a dashed line and the 100 m contour by the solid line.

Figure 44 Public sightings of little penguins in the STB



Source: Project Hotspot, 2021.

4.3.7.4 Important Bird Areas

Forest and Bird, Birdlife International, and Birds New Zealand have identified several areas throughout New Zealand as 'Important Bird Areas' which provide input into the international Important Bird Area Programme. These areas are identified as internationally important for bird conservation and are known to support key species and other biodiversity.

Important Bird Areas have not been officially protected under legislation; their function is to help focus and facilitate conservation action for a network of sites that are significant for the long-term viability of naturally occurring bird populations (Forest & Bird, 2014a). However, during the review of the PRCP for Taranaki, Forest and Bird submitted on a number of issues, including the inclusion of the Important Bird Areas within the PRCP for Taranaki. These have subsequently been included, with a respective policy requiring avoiding, remedying or mitigating adverse effects of activities in this area.

Important Bird Areas are broken down by 'coastal sites and islands', 'rivers, estuaries, coastal lagoons and harbours', and 'seaward extensions, pelagic areas' (Forest & Bird, 2014a). There are no land-based Important Bird Areas located in close proximity to the Kupe IAA or within the wider STB.

Seaward extensions are areas that extend out from the land-confines of breeding colonies and which are used by the colony for feeding, maintenance behaviours and social interactions. The boundaries of seaward extensions are typically limited to the foraging range, depth, and/or habitat preferences of the species concerned, but may also cover the passage of birds in and out of their colonies (Forest & Bird, 2014b).

The Cook Strait Important Bird Area covers the STB and Greater Cook Strait Area, including the Kupe IAA (**Figure 45**). Cook Strait is a major passage or flyway for pelagic seabirds breeding outside the region, including birds from northern islands (e.g. Buller's shearwater, grey-faced petrel), the South Island's West Coast (e.g. Westland petrel), and Subantarctic islands (e.g. Salvin's mollymawk, Antipodean albatross) (Forest & Bird, 2014b). This area meets the following criteria:

- A1: Regular presence of threatened species – i.e. more than threshold numbers of one of more globally threatened species; and
- A4: More than one percent of the world population of one or more congregatory species:
- A4ii: 1% global population.
- A4iii: 10,000 pairs seabirds or 20,000 individual seabirds.

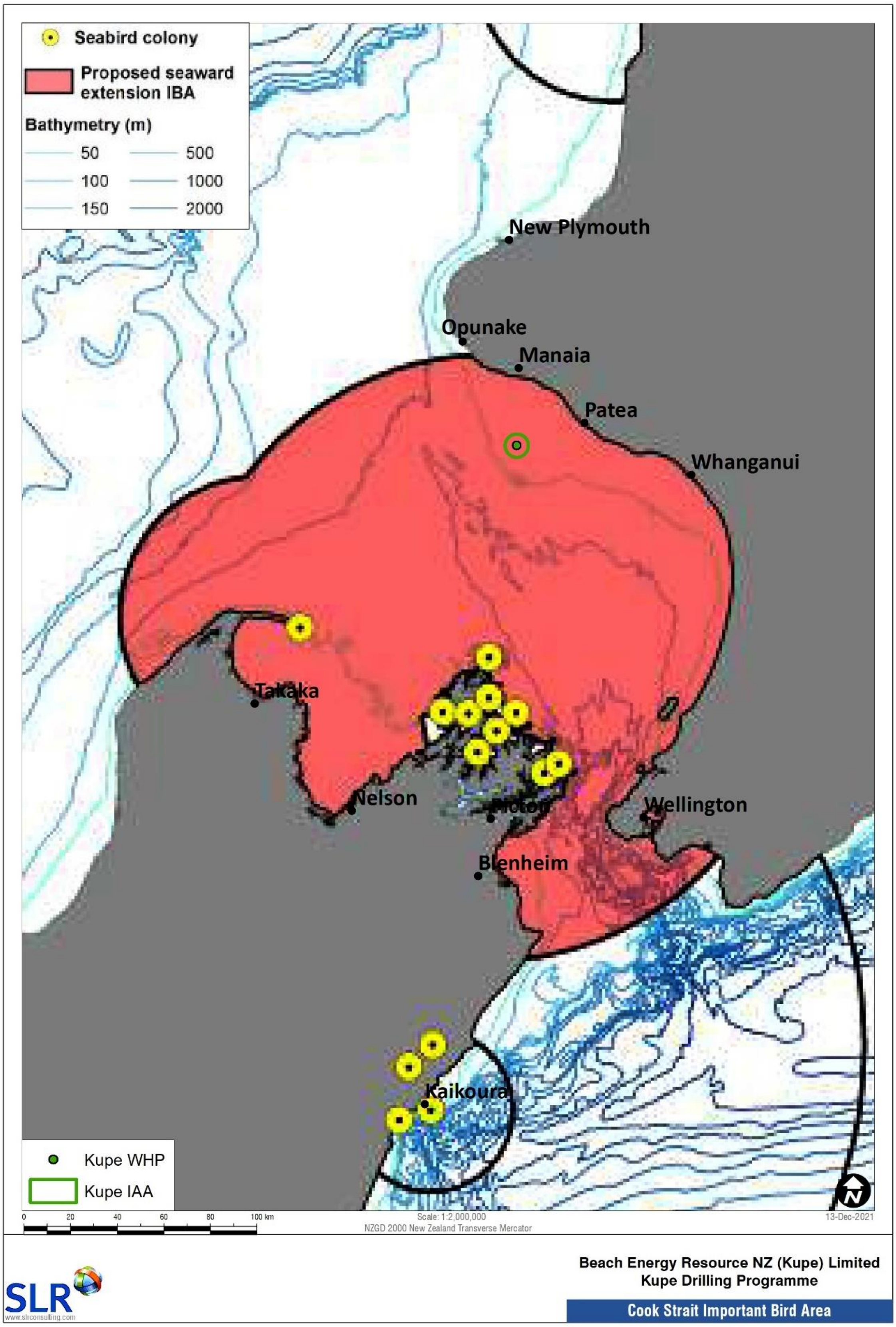
Trigger species and their qualifying Important Bird Area criteria (based on the above criteria) for the Cook Strait Important Bird Area are listed in **Table 13**.

Table 13 Cook Strait Important Bird Area trigger species

Trigger species	Activity	IBA Criteria
Fairy prion	Foraging	A4ii
Fluttering shearwater	Foraging	A4ii
Sooty shearwater	Foraging, passage	A1, (A4iii)
Australasian gannet	Foraging	A4ii
Black-billed gull	Post-breeding foraging	A1
Black-fronted tern	Post-breeding foraging	A1
Antipodean albatross	Passage	A1
Northern royal albatross	Passage	A1
White-capped albatross	Passage	A1
Salvin's mollymawk	Passage	A1
Westland petrel	Passage	A1, A4ii
White-chinned petrel	Passage	A1
Buller's shearwater	Passage	A1
Hutton's shearwater	Passage	A1, A4ii
Species group (multiple species including a number not listed above)		A4iii

Source: Forest & Bird, 2014b. '*New Zealand seabirds: Sites at sea, seaward extensions, pelagic areas*'. The Royal Forest & Bird Protection Society of New Zealand, Wellington, New Zealand, 91p.

Figure 45 Cook Strait Important Bird Area



4.4 Cultural Environment

The marine environment is highly valued by all Māori communities and plays an important role in historic and present-day culture. Marine waters provide a valuable source of kaimoana, raranga (weaving) materials, and rongoā (traditional medicines) – particularly the marine waters close to New Zealand's coastline.

There are eight recognised iwi within the Taranaki Region, all of which have traditions that demonstrate an ancestral, cultural, historical and spiritual connection to the coastal environment (TRC, 2018).

Beach commissioned a Cultural Impact Assessment (**CIA**) from Te Runanga o Ngāti Ruanui Trust (**Ngāti Ruanui**) and Te Korowai o Ngāruahine Trust (**Ngāruahine**), who together determined they would prepare a single collaborative CIA (**the collaborative CIA**). In addition, Ngāti Manuhiakai hapū (**Ngāti Manuhiakai**), being the hapū with whom Beach has consulted over many years, including prior to and following the construction of the onshore production station and the Kupe WHP, have voluntarily prepared and provided a separate CIA. These CIAs are included in **Appendix F**.

The collaborative CIA provides information on the hapū and history of Ngāti Ruanui. The collaborative CIA notes the coastline interests of Ngāti Ruanui extends from the mouth of the Whenuakura River north to the Waingongoro River and beyond to the Tasman Sea. Section 3 of the collaborative CIA describes the special cultural, spiritual, historical, and traditional associations of Ngāti Ruanui with Te Moananui A Kupe O Ngāti Ruanui (coastal area) and Nga Taonga a Tane raua ko Tangaroa (all indigenous species and certain species of fish and other aquatic life).

The collaborative CIA provides information on the hapū and history of Ngāruahine. The CIA notes the rohe of Ngāruahine extends from the coastal mouths of the Taungatara Stream and Waingongoro River[15] "*…to Hawaikinui, Tawhitinui, Hawaikiroa, Tawhitiroa, Hawaiki pamaomao, Tawhiti pamaomao*". The Ngāruahine CIA describes the special associations contained within the Ngāruahine Claims Settlement Act 2016.

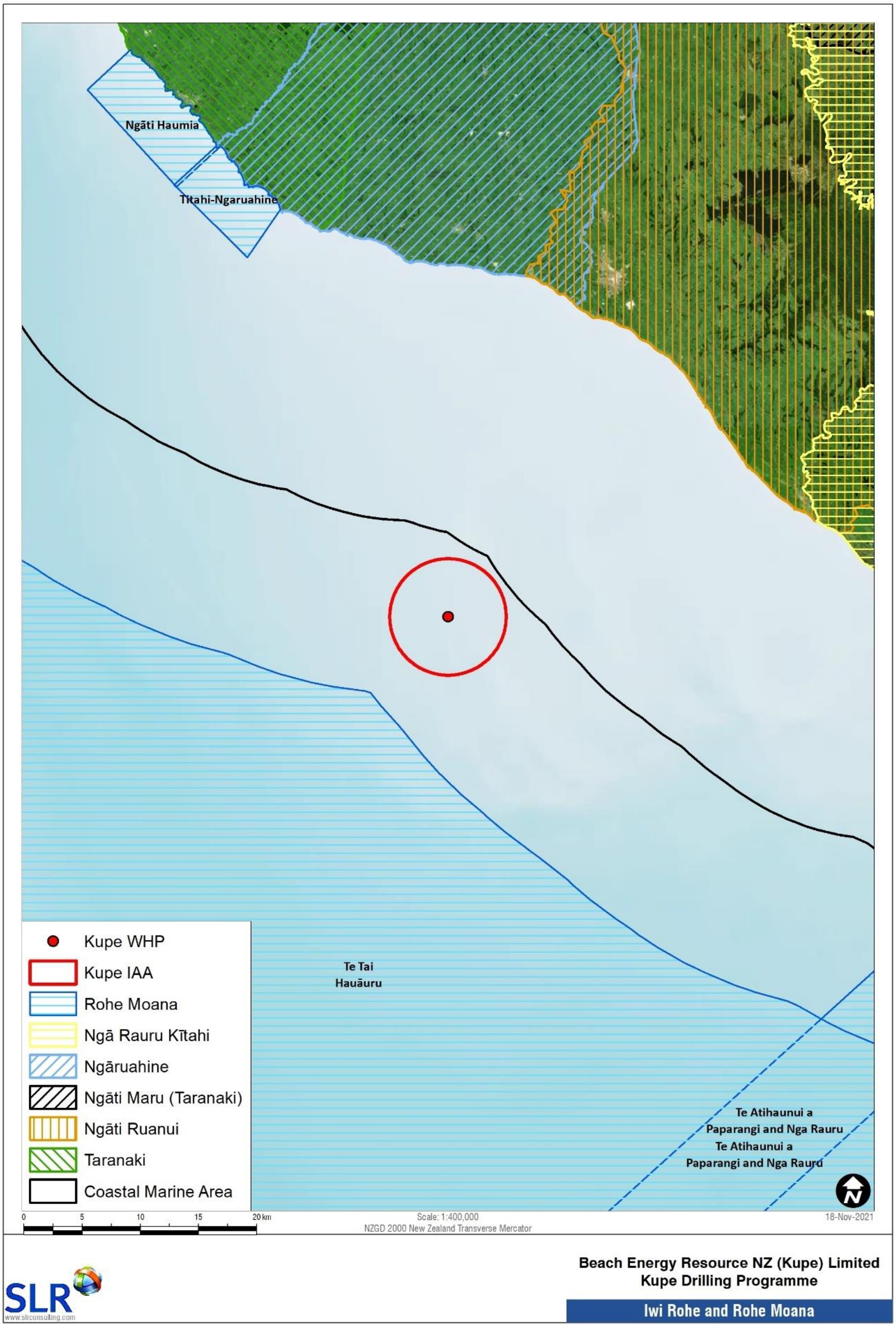
The Ngāti Manuhiakai CIA provides information on the history of Ngāti Manuhiakai hapū. The CIA notes that Ngāti Manuhiakai exercise mana whenua and mana moana over the ancestral lands, waters, taonga species, wāhi tapu, and wāhi taonga within the takiwa which extends from the tip of Maunga Taranaki into Te Moana O Tangaroa (including out into the outermost extent of the EEZ) taking in Te Rere o Kapuni and Inaha Rivers. From east to west, the rohe boundary extends from the western banks of the Waingongoro River to the eastern banks of the Raoa Stream. These interests are recognised in the Ngāruahine Claims Settlement Act 2016.

The reader is referred to the CIAs in **Appendix F** as they provide full details of the cultural, spiritual, historical, and traditional associations Ngāti Ruanui, Ngāruahine, and Ngāti Manuhiakai have with the coastal waters in and around the IAA.

In addition to the CIAs contained in **Appendix F**, the following sections provide a brief description of the cultural environment in relation to the Kupe IAA. The onshore rohe (geographic boundaries) of iwi that occur in the vicinity of the IAA are illustrated in **Figure 46**.

[15] The Ngāruahine Coastal Marine Area shown on Plan OTS-023-56 extends to the Waihi Stream, which is located further south than the Waingonoro River.

Figure 46 Cultural environment overview in relation to the IAA



4.4.1 Customary Fishing and Iwi Fisheries Interests

The fishing rights of tangata whenua are referred to as 'customary fisheries'. Te Tiriti o Waitangi – The Treaty of Waitangi guarantees customary fishing rights to tangata whenua, and these rights have been adopted into numerous pieces of legislation. Customary fisheries take place in rohe moana which are defined customary fishing areas recognised for the purposes of the Fisheries (Kaimoana Customary Fishing) Regulations 1998. The rohe moana of relevance to the IAA are illustrated in **Figure 46** with Te Tai Hauāuru being the most relevant (the others are over 30 km from the IAA).

Iwi hold customary fishing rights under the Fisheries (Kaimoana Customary Fishing) Regulations 1998. These regulations stem from the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 and provide for the customary harvesting of kaimoana for special occasions. Under these regulations iwi may issue permits to harvest kaimoana in a way that exceeds those levels typically permitted in order to provide for hui (a gathering or meeting), tangi (funeral) or as koha (a gift, donation or contribution). The sale of any kaimoana harvested under a customary permit is prohibited. Only iwi may authorise a permit within their rohe moana, although the applicant/holder of a customary permit does not have to be affiliated to any iwi.

The allocation of customary fishing rights is undertaken by Tangata Kaitiaki/Tiaki in accordance with tikanga Māori (meaning culturally proper, i.e. aligned with the customary system of values and practices that have been developed over time and are deeply embedded in the social context). Tangata Kaitiaki/Tiaki are individuals or groups that have been appointed by local Tangata Whenua and confirmed by the Minister of Fisheries and whose role is to authorise customary fishing within their rohe moana. Under the regulations, customary fishing rights can be exercised by commercial fishing vessels on behalf of the holder of the customary fishing right.

Customary fisheries can be managed by the establishment of one of the following customary management areas:

- Mātaitai reserves – recognise and provide for traditional fishing through local management. These areas are closed to commercial fishing, and may have bylaws affecting recreational and customary fishing;
- Taiāpure – estuarine or coastal areas that are significant for food, spiritual, or cultural reasons. These local fisheries of special significance allow all types of fishing but may have additional fishing rules and are managed by local communities;
- Temporary closures – areas that are temporarily closed to fishing or certain fishing methods. These are issued under sections 186A or 186B of the Fisheries Act 1996; and
- Customary bylaw areas – changes to fisheries management rules made by tangata whenua or Tangata Kaitiaki/Tiaki (guardians) for their Crown settlement area or mātaitai reserve.

Customary fishing rights are in addition to recreational fishing rights and do not remove the right of tangata whenua to catch their recreational limits under the amateur fishing regulations. The Fisheries (Amateur Fishing) Regulations 2013 impose restrictions on the taking of fish, aquatic life, or seaweed, unless they are taken for the purposes of a hui or tangi and are in accordance with an authorisation issued under regulation 51 of the Fisheries (Amateur Fishing) Regulations 2013.

The collaborative CIA (**Appendix F**) records that large cockles, Tucetona laticostata, a taonga shellfish, which played an important role in customary fishing (also biogenic reef forming specie) for Ngāti Ruanui, are locally known to live buried in the sediments within the proposed exploration area. Further, the collaborative CIA records that many demersal fish species support Ngāti Ruanui customary fishing rights and species such as leatherjackets, golden mackerel, eagle rays and blue cod are known to Ngāti Ruanui to occur within the IAA. The collaborative CIA also notes baracoutta, carpet sharks, gurnard, school shark, spiny dogfish, anchovy, snapper, rig, trevally, and tarakihi are commonly caught through the whole South Taranaki Bight. Further, the collaborative CIA notes that, according to Ngāti Ruanui traditional knowledge, large rock lobsters move offshore in winter and summer to depths >25 m to feed on shellfish beds and customary fishing targets rock lobsters on these beds.

In addition to customary fishing rights, recognised iwi were allocated fisheries assets via commercial quota under the Māori Fisheries Act 2004. Each iwi was also assigned income shares in Aotearoa Fisheries Limited, which is managed and overseen by Te Ohu Kaimoana (the Māori Fisheries Commission). Te Ohu Kaimoana harvest, procure, farm, process, and market kaimoana in New Zealand and internationally. For quota associated with fisheries that are classified as ‘deepwater’, all iwi were assigned quota based on population size and relative length of coastline within their rohe. Quota for fisheries considered to be ‘inshore’ was allocated only to iwi whose rohe overlapped with the management area of the stock.

4.4.2 Statutory Acknowledgement Areas

Statutory Acknowledgements are acknowledgements made by the Crown of an iwi or hapū’s particular cultural, spiritual, historical or traditional association with specified areas. These acknowledgements are made in each Deed of Settlement that is negotiated between an iwi and the Crown during the process of a Treaty of Waitangi claim and, once settlement is complete, are legally recognised by each settlement act. They include areas of land, geographic features, lakes, rivers, wetlands, and the CMA that are part of Crown-owned land (MfE, 1999).

A Statutory Acknowledgement generally requires councils to:

- Forward summaries of all relevant resource consent applications to the relevant claimant group governance entity, and to provide the governance entity with the opportunity to waive its right to receive summaries;
- Have regard to a statutory acknowledgement in forming an opinion as to whether the relevant claimant group may be adversely affected in relation to resource consent applications concerning the relevant statutory area; and
- Within the claim areas, attach for public information a record to all regional policy statements, district plans, and regional plans of all areas affected by statutory acknowledgements.

For the most part, the statutory acknowledgement areas in the Taranaki region are located onshore; however, there are relevant areas in the coastal and marine areas. Those areas are Te Moananui A Kupe O Ngati Ruanui (Ngati Ruanui Claims Settlement Act 2003), referenced in the collaborative CIA (**Appendix F**), and Ngāruahine Coastal Marine Area - Ngāruahine (Ngāruahine Claims Settlement Act 2016), also referenced in the collaborative CIA and the Ngāti Manuhiakai CIA (**Appendix F**).

4.4.3 Interests under the Marine and Coastal Area (Takutai Moana) Act 2011

The Marine and Coastal Area (Takutai Moana) Act 2011 (**MACA**) acknowledges the importance of the marine and coastal area to all New Zealanders while providing for the recognition of the customary rights of iwi, hapū and whānau in the CMA. Iwi, hapū, or whānau groups may be granted recognition of two types of customary interest under the MACA: Customary Marine Title and/or Protected Customary Rights. The recognition that these two types of customary interest were summarised by Te Arawhiti – the Office for Māori Crown Relations (Te Arawhiti, 2021), as outlined below.

Customary Marine Title recognises the relationship of an iwi, hapū, or whānau with a part of the common marine and coastal area[16]. Public access, fishing, and other recreational activities are allowed to continue in Customary Marine Title areas; however, the group that holds Customary Marine Title maintains the following rights:

- An RMA permission right which lets the group give or decline permission to activities that need resource consents or permits in the area;
- A conservation permission right which lets the group give or decline permission to certain conservation activities in the area;
- The right to be notified and consulted when other groups apply for marine mammal watching permits in the area;
- The right to be consulted about changes to Coastal Policy Statements;
- A wāhi tapu protection right which lets the group seek recognition of a wāhi tapu and restrict access to the area if this is needed to protect the wāhi tapu;
- The ownership of minerals other than petroleum, gold, silver and uranium which are found in the area;
- The interim ownership of taonga tūturu found in the area; and
- The ability to prepare a planning document which sets out the group’s objectives and policies for the management of resources in the area.

Protected Customary Rights may be granted within the common marine and coastal area to allow for customary activities such as the collection of hāngi stones or launching of waka. If a group has a Protected Customary Right recognised, they do not need a resource consent to carry out that activity and local authorities cannot grant resource consents for other activities that would have more than minor adverse effects on the Protected Customary Right.

Table 14 lists the Customary Marine Title and Protected Customary Rights applications that have been received, in the Taranaki region. **Table 14** highlights those applications which relate to the area of the coast inshore of the IAA, in addition to those other applications around the Taranaki coastline. The Ngāti Ruanui CIA (**Appendix F**) notes its application for Customary Marine Title and Protected Customary Rights and the Ngāruahine CIA (**Appendix F**) states that applications for Customary Marine Title and Protected Customary Rights have been lodged by all six of its hapū.

[16] The marine and coastal area is the area between the mean high-water springs and the outer limits of the territorial sea (12 NM from shore). The common marine and coastal area are the parts of the marine and coastal area that aren’t in private ownership or part of a conservation area.

Table 14 Applications under MACA in the vicinity of the IAA

Applicant	High Court Reference	Recognition Sought	Application Area
Applications relating to the area of the coastline inshore of the IAA			
Ngāti Ruanui	CIV-2017-485-000282	Customary Marine Title and Protected Customary Rights	Northern boundary is Waingongoro River, southern boundary is Whenuakura River and out to 12 NM offshore between these points.
Araukuuku Hapū	CIV-2017-485-000210	Customary Marine Title and Protected Customary Rights	From Taungatara Stream in the north, south to Waihi Stream and out to 12 NM.
Te Korowai o Ngāruahine	CIV-2017-485-000243	Customary Marine Title and Protected Customary Rights	12 NM out from the mouth of Taungātara Stream to the northwest and from the mouth of Waihi Stream to the southeast.
Okahu Inuawai Hapū	CIV-2011-485-000803	Protected Customary Rights	12 NM out from the mouth of Inaha Stream to the northwest, and from the mouth of Waihi Stream to the southeast.
Robinson & Anor (Ngati Manuhiakai)	CIV-2011-485-000797	Protected Customary Rights	Foreshore and seabed within the tribal takiwa of Ngati Manuhiakai: from Waingongoro River in the south to the Wahamoko Stream in the north west.
Ngati Tū Hapū	CIV-2017-485-000213	Customary Marine Title and Protected Customary Rights	From Taungatara Stream in the north, south to Waihi Stream and out to 12 NM.
Ngāti Hāua Hapū of Ngāruahinerangi iwi	CIV-2017-485-000293	Customary Marine Title and Protected Customary Rights	Between the mouth of the Raoa (Rawa) Stream to the mouth of the Ōtakeho Stream and out to 12 NM offshore between these points.
Ngāti Tamaahuroa and Tītahi Hapū	CIV-2017-485-000300	Customary Marine Title and Protected Customary Rights	12 NM out from the mouth of Taungātara Stream to the northwest and the mouth of Rāroa/Rawa Stream to the southeast.
Kanihi-Umutahi Hapū	CIV-2011-485-000814	Protected Customary Rights	12 nautical miles out from the mouth of Inaha Stream to the northwest, and from the mouth of Waihi Stream to the southeast.
Further applications relating to other areas of the coastline around Taranaki			
Taranaki iwi	CIV-2017-485-000212	Customary Marine Title and Protected Customary Rights	Paritūtū to Rawa-o-Turi Stream and out to 12 NM offshore between these points.
Te Kaahui o Rauru Trust	CIV-2017-485-000183	Customary Marine Title and Protected Customary Rights	12 NM out from Patea River in the north through to the Whanganui River in the south.

Applicant	High Court Reference	Recognition Sought	Application Area
Te Atiawa (Taranaki)	CIV-2017-485-000310	Customary Marine Title and Protected Customary Rights	From Paritutu in the south to Waiau Stream in the north out to 12 NM.

4.4.4 Coastal Taonga Species

Both the Ngāti Ruanui and Ngāruahine CIAs describe taonga species relevant to each iwi.

Schedule 5 of the PRCP for Taranaki identifies a number of taonga species with special cultural, spiritual, historical, and traditional associations located within the Taranaki CMA, and as identified in the deeds of settlement for iwi of Taranaki. A list of these species and an assessment as to whether they may be found within the IAA is included within **Table 15**.

Table 15 Coastal taonga species identified within the PRCP for Taranaki and their likelihood within the IAA

Māori Name	Common Name	Scientific Name	Likelihood of being present within IAA?
Marine fish			
Tuna	Long-finned eel	*Anguilla dieffenbachia*	Possible – during juvenile migration and then older adults departing for spawning grounds – both could potentially pass through the area.
Tuna	Short-finned eel	*Anguilla australis*	Possible– during juvenile migration and then older adults departing for spawning grounds – both could potentially pass through the area.
	Australian long-finned eel	*Anguilla rheinhartii*	Possible but unlikely
Piharau	Lamprey	*Geotria australis*	Possible but unlikely – parasitic species so could in theory be attached to larger fish species that pass through or inhabit the area
Hāpuka	Groper	*Polyprion oxygeneios*	Possible but unlikely – tend to be present in deeper waters near structures
Kahawai	Sea trout	*Arripis trutta*	Yes – large schools observed frequently during baseline survey
Kanae	Grey mullet	*Mugil cephalus*	Unlikely – tend to prefer estuarine or shallow coastal areas
Mararī	Butterfish	*Odax pullus*	No – rocky reef inhabitant where there is large algae species present.
Moki	Blue moki	*Latridopsis ciliaris*	Possible – but tend to prefer to be near reef structures.
Paraki/Ngaore/Pōrohe	Common smelt	*Retropinna retropinna*	Unlikely as it is a shallow estuary species

Māori Name	Common Name	Scientific Name	Likelihood of being present within IAA?
Pāra	Frostfish	*Lepidopus caudatus*	Possible but unlikely as tend to be in deeper waters
Pātiki mahoao	Black flounder	*Rhombosolea retiaria*	Possible – but tend to be more predominant in shallow coastal areas, particularly estuaries and in fact right into freshwater. Adults do spawn at sea in winter though.
Pātiki rore	New Zealand sole	*Peltorhamphus novaezeelandiae*	Present
Pātiki tore	Lemon sole	*Pelotretis flavilatus*	Yes
Pātiki totara	Yellow-belly flounder	*Rhombosolea leporina*	Possible
Pātiki	Sand flounder	*Rhombosolea plebeia*	Possible
Pātukituki/Rāwaru	Blue cod/Rock cod	*Parapercis colias*	Yes – observed during baseline survey
Pioke, Tope, Mangō	School shark/rig	*Galeorhinus galeus*	Likely
Reperepe	Elephant fish	*Callorhynchus millii*	Possible
Koiro, ngoiro, totoke, hao, ngoio, ngoingoi, putu	Conger eel	*Conger verreauxi*	Likely – Observed in amongst subsea infrastructure at nearby offshore O&G facilities.
Marine Invertebrates			
Pūpū	Cat's eye snail	*Lunella smaragdus/Diloma sp*	Unlikely as it is a rock reef inhabitant
Kōtoretore, Kotore, humenga	Sea anemone	*Order Actiniaria*	Yes – observed in baseline survey
Rori, rore	Sea cucumber	*Australostichopus mollis*	Yes – observed in baseline survey
Rori (which includes ngutungutukaka)	Shield shell/Seasnail	*Scutus breviculus*	Possible but prefers reef habitats.
Hihiwa	Yellowfoot paua	*Haliotis australis*	No – needs hard rocky reef substrates in shallow subtidal
Paua	Blackfoot paua	*Haliotis iris*	No – needs hard rocky reef substrates in shallow subtidal
Kutai/Kuku	Blue mussel	*Mytilus edulis*	Likely – as part of fouling communities on intertidal/shallow subtidal parts of Kupe WHP legs
Kutai/Kuku	Green lipped mussel	*Perna canaliculus*	Likely – as part of fouling communities on intertidal/shallow subtidal parts of Kupe WHP legs
Pipi/Kakahi	Pipi	*Paphies australis*	No – intertidal and shallow subtidal species
Tītiko/Karehu	Mud snail	*Amphibola crenata, Lunella smaragdus, Diloma* sp.	No – intertidal and shallow subtidal species

Māori Name	Common Name	Scientific Name	Likelihood of being present within IAA?
Kina	Sea urchin	*Evechinus chloroticus*	Possible
Kōura	Rock lobster/crayfish	*Jasus edwardsii*	Possible but require some sort of reef or artificial habitat to shelter in/amongst.
Kaeo	Sea tulip	*Pyura pachydermatina*	Likely – as part of fouling communities on intertidal/shallow subtidal parts of Kupe WHP legs
Koeke	Common shrimp	*Palaemon affinis*	Possible
Wheke	Octopus	*Macroctopus maorum*	Likely
Kaunga	Hermit crab	*Pagurus novizealandiae*	Likely
Pāpaka parupatu	Mud crab	*Austrohelice crassa*	Possible but unlikely as tend to be present more on shallow mud sediments.
Pāpaka parupatu	Paddlecrab	*Ovalipes catharus*	Possible
Patangatanga, patangaroa, pekapeka	Starfish	*Class Asteroidea*	Yes – observed during baseline survey
Purimu	Surfclam	*Dosinia anus, Paphies donacina, Spisula discors, Spisula murchisoni, Crassula aequilatera, Bassina yatei, or Dosinia subrosea*	Possible but unlikely in the IAA itself, but will be present inshore of the IAA in shallow subtidal areas
Tuangi	Cockle	*Austrovenus stutchburyi*	Unlikely – intertidal and shallow subtidal species
Tuatua	Tuatua	*Paphies subtriangulata, P. donacina*	Unlikely – intertidal and shallow subtidal species
Waharoa	Horse mussel	*Atrina zelandica*	Possible – but mobile sandy sediments common in IAA not preferred habitat
Karauria, ngakihi, tio, repe	New Zealand rock oyster	*Saccostrea glomerata*	Possible but unlikely. Could be present attached to legs of Kupe WHP as fouling organism.
Kuakua, pure, tipa, tipai, kopa	Scallop	*Pecten novaezelandiae*	Yes – empty shells and very small number of adults were observed during baseline survey.
Marine plants			
Karengo	Nori	*Porphyra/Pyropia* sp.	Possible but unlikely - needs hard substrate (for attachment) near surface for adequate light for photosynthesis. Could be attached to Kupe WHP legs
Marine mammals – all species but specifically:			
Tohorā	Beaked whales	Family *Ziphiidae*	

Māori Name	Common Name	Scientific Name	Likelihood of being present within IAA?
Tohorā	Melon-headed whale	*Peponocephala electra*	Refer to the **Section 4.3.6** for the likelihood of marine mammals within and around the IAA
Tohorā	Pygmy killer whale	*Feresa attenuata*	
Tohorā	False killer whale	*Pseudorca crassidens*	
Tohorā	Killer whale	*Orcinus orca*	
Tohorā	Long-finned pilot whale	*Globicephala melas*	
Tohorā	Short finned pilot whale	*Globicephala macrorhynchus*	
Parāoa	Sperm whale	*Physeter macrocephalus*	
	Pygmy sperm whale	*Kogia breviceps*	
	Dwarf sperm whale	*Kogia sima*	
	Common bottlenose dolphin	*Tursiops truncatus*	
Aihe	Short-beaked common dolphin	*Delphinus delphis*	
	Hector's dolphin (South Island Hectors dolphin and Māui dolphin)	*Cephalorhynchus hectori (C. hectori hectori* and *C. hectori maui)*	
	Dusky dolphin	*Lagenorhynchus obscurus*	
	Risso's dolphin	*Grampus griseus*	
	Spotted dolphin	*Stenella attenuata*	
	Striped dolphin	*Stenella coeruleoalba*	
	Rough-toothed dolphin	*Steno bredanensis*	
	Southern right whale dolphin	*Lissodelphis peronii*	
	Spectacled porpoise	*Phocoena dioptrica*	

4.4.5 Sites of Significance to Māori

Schedule 6B of the PRCP for Taranaki identifies various known Sites of Significance to Māori due to a variety of values, including kaitiakitanga and mouri, with the nearest site being approximately 20 km inshore of the Kupe IAA.

4.5 Socio-Economic Environment

This section outlines the socio-economic environment within and in proximity to the Kupe IAA, including fisheries, shipping, seabed mining and oil and gas activities.

4.5.1 Fisheries

There are ten Fisheries Management Area (**FMAs**) implemented within New Zealand waters that have been established to manage the Quota Management System. This system is currently regulated by Fisheries New Zealand (**FNZ**) and is the primary management tool to allow commercial utilisation of New Zealand's fisheries resources while ensuring their sustainability for the future; the Quota Management System and Annual Catch Entitlements provide for the commercial utilisation and sustainable catch of 96 species.

The Kupe IAA lies within FMA 8 (Central). FMA 8 covers the Taranaki and Whanganui coastline, where the exposed coastline is subject to westerly winds and southwest swells, which can often result in rough seas which can limit the number of fishable days. Despite the exposed nature of the coastline, the area is considered to have a valuable inshore commercial and offshore trawl fishery.

4.5.1.1 Commercial Fishing

FMAs are further subdivided into Statistical Areas which form the basis of the spatial reporting requirements to FNZ; the Kupe IAA overlaps with Statistical Area 40.

For the purpose of this consent application, catch data was requested from FNZ under the Official Information Act 1982. Data provided by FNZ in response to this request was minimal and covered the last five fishing years (1 October 2015 – 30 April 2021) in an area defined around the Kupe IAA, and those that were on the boundary of the defined area. Some information has been withheld by Fisheries New Zealand under section 9(2)(b)(ii) of the Official Information Act as releasing the information may prejudice the commercial position of the person who is the subject of the information. However, the following descriptors have been based on the information available.

The number of fishing events over the last five years totalled approximately 89 (this number may be slightly higher based on the withheld information). The fishing methods utilised in and around the Kupe IAA were:

- Bottom long line (utilised approximately six times);
- Bottom trawl (utilised approximately 37 times);
- Hand line (number withheld); and
- Set net, including gill net (utilised approximately 46 times).

The primary target species during these fishing events were school shark and trevally, being targeted in 39 and 28 events, respectively. A full list of the target species are as follows:

- Blue cod (number withheld);
- Gurnard (targeted approximately six times);
- School shark (targeted approximately 39 times);
- Snapper (number withheld);
- Rig (targeted approximately 13 times); and

- Trevally (targeted approximately 28 times).

The total greenweight of the target species in the defined area, and those on the boundary, totalled 80,215 and 18,115 kg, respectively. In addition, the greenweight of non-target species was reported as 60,482 and 13,534 kg.

Due to the limited fishing events, and without information on the exact location of those events, a dedicated fishing intensity map cannot be created for the Kupe IAA. However, **Figure 47** and **Figure 48** provide an illustration of the fishing intensity in the wider STB, where catch per km^2 is mapped for all fishing methods (**Figure 47**) and for trawl fishing only (**Figure 48**). These maps were generated by FNZ using fishing events reported in statutory catch and effort returns for the period 1 October 2007 to 30 September 2019. These data have been aggregated into grid squares to give 12-year annual average of data from at least three permit holders. Areas containing fewer than three permit holders using similar fishing methods have been omitted from these maps. **Figure 47** and **Figure 48** illustrate that, while there is considerable commercial fishing effort outside of the Kupe IAA (i.e. around the 100 m isobath), the intensity of fishing is relatively low around the Kupe IAA itself.

Figure 47 Fishing intensity in the STB – all fishing methods

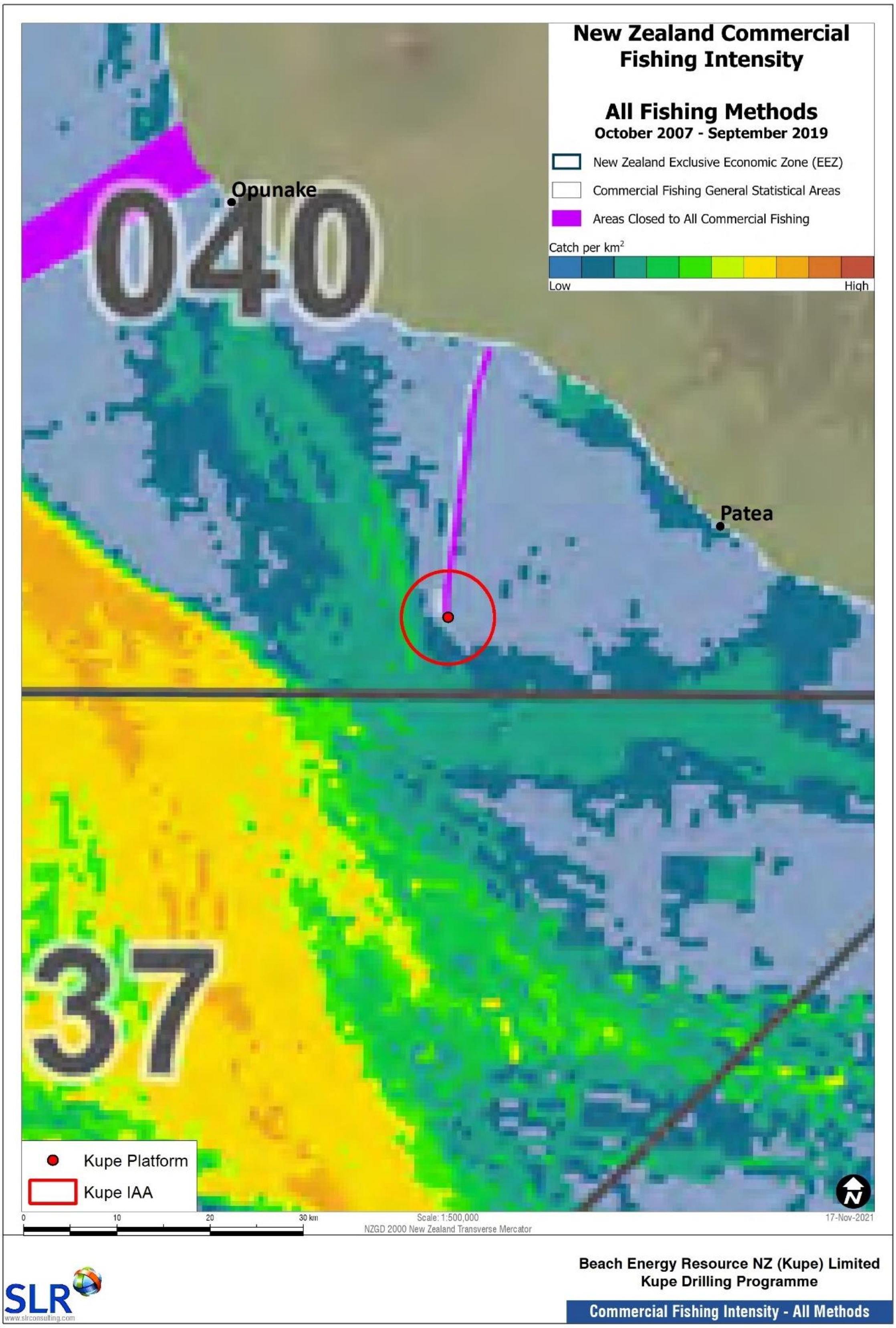
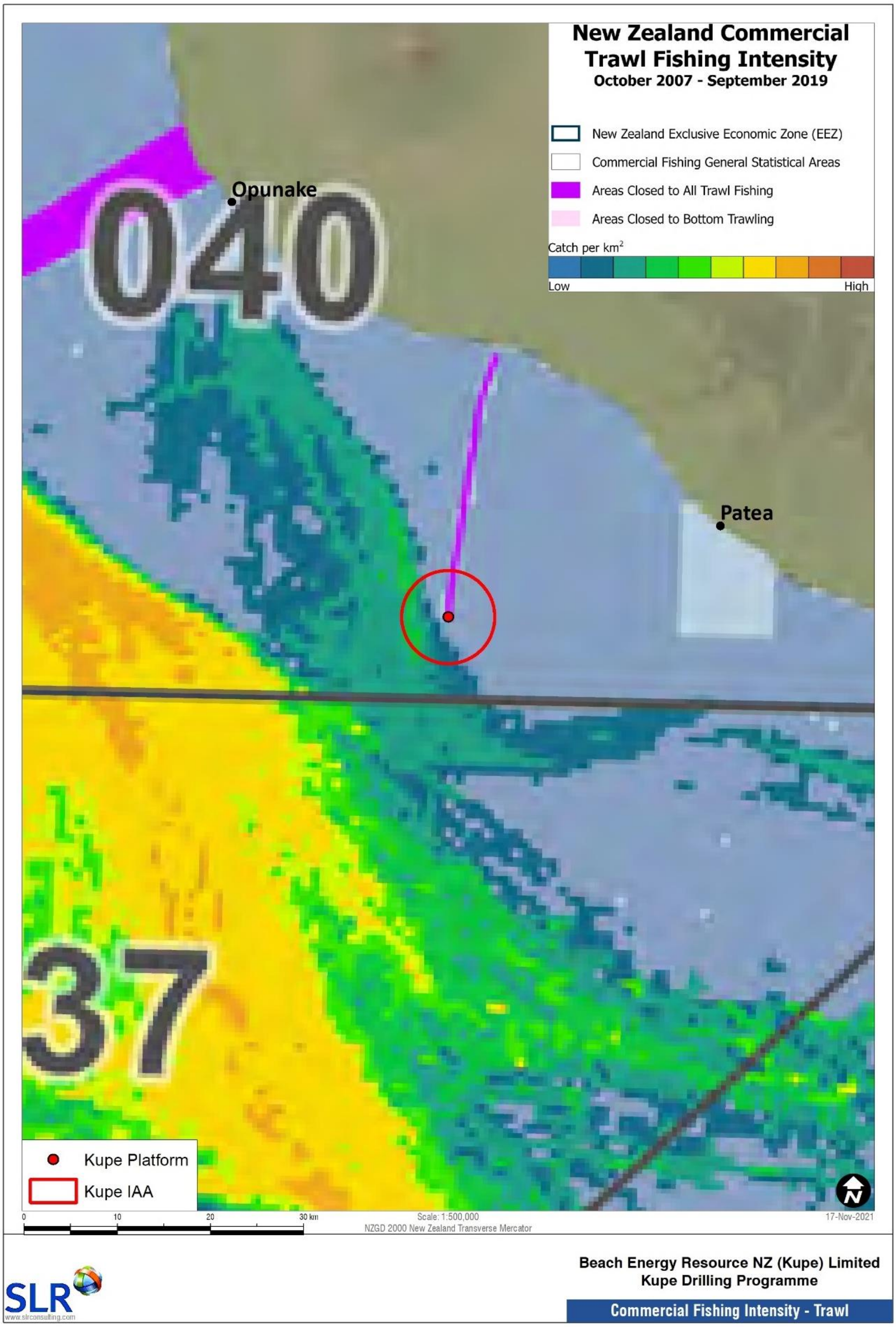


Figure 48 Fishing intensity in the STB – trawl fishing methods



Gibbs (2014), in her Statement of Evidence dated 16 February 2014, stated that '*the South Taranaki Bight supports a productive and diverse range of valuable inshore fisheries*'. In addition, the following can be inferred in relation to commercial fishing operations in the STB, including near the Kupe IAA:

- A mixed bottom trawl fishery for trevally, leatherjacket, gurnard, and snapper over 'the rolling grounds' (see **Section 4.5.1.3** for further information on the Rolling Grounds). Gibbs (2014) stated that the rolling grounds are "*fished by one trawler based in New Plymouth and around a dozen from the top of the South Island which visit on an occasional basis as part of their annual fishing plans. Although trawling effort occurs year-round, the species taken show a distinct seasonality, with catches of many species peaking during the summer months*". The majority of trawl effort occurs beyond the 50 m depth contour (Gibbs, 2014), which is outside the Kupe IAA (see **Figure 48**);
- A set net fishery targeting school shark (in waters around 50 m deep, which is outside of the Kupe IAA), rig (was targeted in shallow waters within 4 NM of the coast, but recent fishing restrictions to protect Māui's dolphins within the WCNI MMS now prohibits set netting within 7 NM of the coast north of Hawera and within 4 NM of the coast south of Hawera, effectively eliminating this fishery from October 2020 and blue warehou (in shallow waters around Cape Egmont). Gibbs (2014) stated that "*four set net vessels fish out of New Plymouth, often operating in all three target fisheries at different times of year, and several other vessels travel up from the South Island*";
- A mid-water trawl fishery for jack mackerel in deeper offshore waters of FMA 8;
- A small bottom longline fishery which also occurs in deeper offshore waters of FMA 8; and
- A coastal rock lobster fishery operated by a single commercial vessel.

Gibbs (2014) also stated that "*Quota ownership in both the trawl and set net fisheries is dominated by the large seafood companies Talleys and Sanford. Te Ohu Kaimoana Trustee is also a major quota owner on behalf of Maori, and several other iwi-owned companies feature in the top 10 quota owners for stocks in this area*".

4.5.1.1.1 Cloudy Bay Clams Limited

Cloudy Bay Clams Limited holds quota for surf clams (*Paphies donacina*, *Crassula aequilatera*, *Mactra murchisoni*, and *Dosinia anus*) within coastal areas of FMA 8. This quota is currently undeveloped; however, Cloudy Bay Clams Limited is continuing to look into developing a commercial surf clam fishery within the STB, particularly from the surf zone out to 10 m water depth. Cloudy Bay Clams Limited also hold 80% of prawn killer (velvet slipper lobster) quota within FMA 8, another undeveloped fishery (Piper, 2016).

4.5.1.2 Recreational Fishing

Recreational fishing is the fifth most popular recreational activity for adult New Zealanders and pre-pandemic data suggest that over 100,000 international visitors spent time fishing in the sea every year (Holdsworth *et al*., 2016). This figure has undoubtedly changed since the emergence of Covid-19, but the potential for future tourist participation remains. The primary motivation for many New Zealand recreational fishers is not purely to catch for sustenance but to enjoy the fishing experience; it constitutes an integral part of 'Kiwi culture' (Bess, 2016).

Wynne-Jones *et al*. (2019) reported the results of the National Panel Survey of Recreational Fishers, the most comprehensive survey undertaken on recreational fishing catch and effort, based on FMAs which involved year-long contact with approximately 7,000 recreational fishers. The most common finfish species caught within the wider FMA 8 (within which the Kupe IAA is located) are snapper, kahawai, red gurnard, blue cod, and tarakihi, while pipi, paua, kina, tutaua, and rock lobster are the most commonly fished invertebrates. November to January represents the months with the highest number of fishing days. More than half of recreational fishing events in FMA 8 occur from land, followed by trailer/motorboat, with rod/line and long-line/kontiki the most popular fishing methods (Wynne-Jones *et al*., 2019).

Boat fishing activities are mainly centred around the main boat launching locations, particularly between Patea and Whanganui, and around New Plymouth, with the area from Patea north to Cape Egmont relatively lightly fished by recreational anglers (Rob Greenaway & Associates, 2015). Launching at many of these locations is limited by sea conditions, for example, boat access at Ohawe is only suitable for approximately one in five days, while the Patea Bar is usable for approximately 80 days a year (Rob Greenaway & Associates, 2015).

Rob Greenaway and Associates (2015) listed the following areas within the STB in the vicinity of the Kupe IAA as important areas for recreational fishers:

- Surfcasting: Ohawe and Waihi Beach, the mouths of the Tangahoe and Manawapou Rivers, Waipipi, Waverly, Waiinui, Kai Iwi, and Castlecliff;
- Fishing and boating: marine area predominantly around Patea and further south towards Whanganui. Boat launching is available at Ohawe, Patea, Waipipi, Waiinu, Kai Iwi, and Whanganui;
- Crayfish diving: Ohawe, Graham Bank, North and South Traps, rocky streams off Waitotara and Waverley, and at many dispersed sites along the coast where there are rocky features on the seabed; and
- Shellfish gathering: reef areas from Ohawe to the Manawapou River mouth, south of Patea, Whenuakura, Waitotara, Waiinu, Kai Iwi, and Castlecliff.

Hartill *et al*. (2011) undertook aerial surveys of fishing effort and boat-ramp interviews of fishers to investigate the snapper fishery along the Taranaki coast. Fishers interviewed during the study estimated the majority of fishing occurred within a few kilometres of the shore, from trailer motorboats (rather than launches, charter boats, yachts, or kayaks). Recreational fishing effort was generally highest over the summer months and on weekends and public holidays, with daily effort peaking mid-morning or early-afternoon. Common target species were blue cod, red gurnard, kahawai, snapper, red cod, terakihi, and trevally (Hartill *et al*., 2011). Summer months also see pelagic fish species such as striped marlin, tuna (albacore and skipjack), dorado, and mako shark present in the offshore Taranaki waters, which tend to be targeted by larger vessels capable of travelling further offshore.

Exact fishing locations are typically kept secret (Rob Greenaway & Associates, 2015) and are generally not reported during recreational fishing surveys. Most productive fishing areas are inshore of the 12 NM limit, although hapuku, rig, and shark are targeted outside of 12 NM when sea conditions allow (these offshore trips often involve two or more boats for safety reasons).

Targeted rocky outcrops on the seabed can come and go with sand movement; fishers tend to travel with fish finders on and identify spots as they go. Recreational fishers in the STB have reported poor fishing at the North and South Traps which are typically avoided by charter operators due to the presence of foul ground, although pelagic fish such as kingfish are often caught here. The 40 m drop-off and Graham Bank have been identified as preferred fishing areas (Rob Greenaway & Associates, 2015) in the vicinity of the Kupe field.

Diving occurs throughout the STB. But due to the highly turbid nature of the coastal waters causing restricted visibility for most of the year, diving events are usually for crayfish harvesting rather than sightseeing, underwater photography, or spearfishing which require considerably higher visibility. Crayfish diving occurs predominantly at Ohawe, Graham Bank, the North and South Traps, and on rocky seabed areas off Waitotara and Waverley. There are also many other more isolated sites along the coast that are targeted where rocky features occur on the seabed. Diving depths along the coast are typically between 8 – 27 m water depth, although there are more than an estimated 50 suitable reefs for crayfish harvesting accessible from Patea that are out as far as 9 NM and to depths of 31 m. Four Mile Reef, located approximately 6.5 km off and slightly south of Ohawe, has been identified as a productive and popular crayfish dive site (Rob Greenaway & Associates, 2015); however, this is approximately 23 km inshore of the Kupe WHP.

Recreational shellfish gathering occurs in intertidal and shallow-subtidal areas within the STB, and, although the level that occurs is currently unknown, it is thought to be locally important (Rob Greenaway & Associates, 2015). Target species for shellfish gathering include mussels (plentiful south from Manaia), paua (particularly around Oeo and Opunake), and kina. The coastline north of Ohawe is considered a prime regional shellfish gathering area. Due to the movement of coastal sands (inundation and retreat) intertidal reef areas for shellfish gathering may change in size or total occurrence.

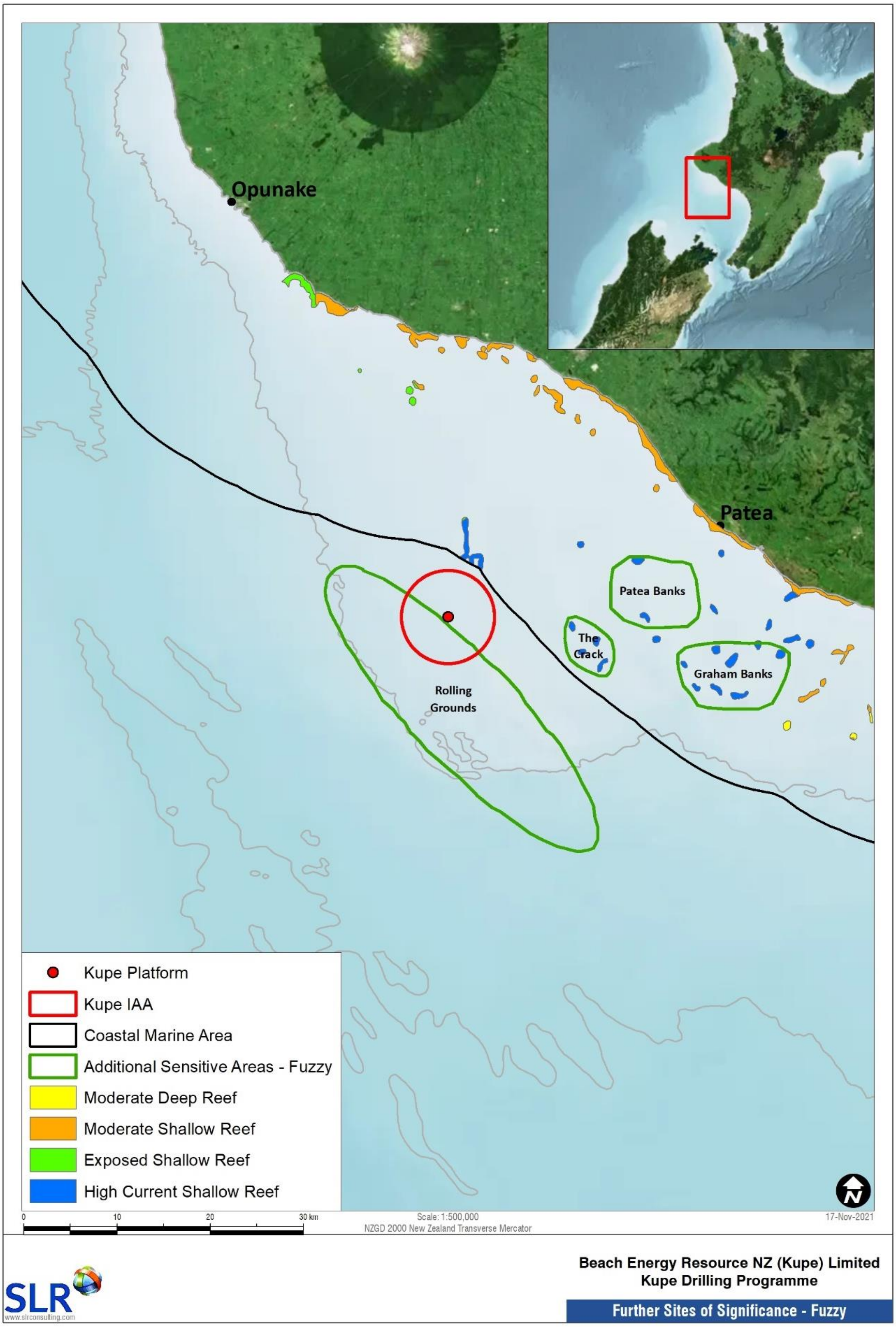
Several recreational fishing and boating clubs exist throughout the Taranaki and Manawatū-Whanganui regions, and many host and administer fishing competitions throughout the year, with anglers fishing over wide areas of the coastline and further out to sea. For example, the New Plymouth Sport Fishing and Underwater Club runs several major competitions over its season and the summer game fishing tournaments attract large numbers of vessels that head offshore to target striped marlin and tuna.

4.5.1.3 Sites of Significance for Fishers

Although not identified within the PRCP for Taranaki, the 'Rolling Grounds' has been identified as important to commercial fishers in recent applications (e.g. TTRL). Local ecological knowledge derived from fishers of the STB has provided some insight into mapping of broad scale habitats and seascapes within the CMA, including an area of 'Rolling Grounds' or subtidal dunes located near Patea Shoals (Jones *et al*, 2016). This area has been described by local fishers as including shell hash, dog cockles, patches of hard ground, and may include coral-like species such as bryozoans, corals, and sponges (Jones *et al*, 2016). The areas identified within Jones *et al.* (2016) based on local ecological knowledge are presented in **Figure 49**. It is important to note that this local ecological knowledge was based on general descriptions provided by local fishermen, proper scientific identification has not been made and these areas had not been ground-truthed. For example, several identifications in Jones *et al*. (2016) were made by local fishermen after being shown example photographs. However, these observations by fishers were corroborated by the findings of the Beaumont *et al.* (2015) study of the broader Patea Shoals area which found significant areas of biogenic rubble through the 'Rolling Grounds' area composed of bivalve rubble containing the large dog cockle species *Tucetona laticostata*, and further out bryozoan rubble composed of living and broken bryozoans and large numbers of other motile taxa.

These areas identified within the local ecological knowledge has been reproduced in **Figure 49**, overlain with reefs identified in the STB; however, these areas are identified as 'fuzzy' as the precise location cannot be determined.

Figure 49 Further sites of significance



4.5.2 Shipping

4.5.2.1 Ports and Harbours

Thirteen major commercial ports and harbours exist around New Zealand's coastline and can be split into three types: major ports, river ports, and breakwater ports. The two main ports of relevance to the Kupe IAA are Port Taranaki and Whanganui Port.

Although Port Taranaki is located well north of the Kupe IAA at New Plymouth, most vessel traffic through the port relates to the farming, engineering, fishing, and oil and gas industries which are in relatively close proximity to Kupe. Port Taranaki has nine fully serviced berths catering to a wide variety of vessels and cargoes with a maximum draft of 12.5 m, and provides a full range of providoring, stevedoring, ship agency, customs, and border protection services. Port Taranaki has been the main base for oil and gas industries since the beginning of offshore and onshore exploration and production activities in New Zealand.

Port Whanganui is a small commercial river port that operates close to the mouth of the Whanganui River at Whanganui providing docking facilities for smaller coastal freight vessels and commercial boats (up to 51 m in length and 4.2 m draft), with facilities including cargo handling, 580 lineal meters of wharf space, warehouse buildings for storage use and a trailer boat-launching ramp facility. The only commercial cargo vessel regularly using the facilities at Whanganui Port is the 'Anatoki', a general bulk cargo vessel that uses the port for shipping dolomite, logs, urea, and barley (Dilley, 2016). Access to Port Whanganui requires crossing the river bar, which can be dangerous in rough conditions such as those frequently occurring on the exposed west coast of the North Island.

4.5.2.2 Commercial Shipping

MNZ recommends that commercial vessels should stay a minimum of 5 NM off the mainland, any charted points of danger, or any offshore islands. There are no dedicated shipping lanes between the major and/or minor ports of New Zealand, and as a result, vessels travelling to/from or between ports will generally take the most direct or shortest route possible, providing it is safe to do so. The general shipping lane of relevance to the Kupe IAA is shown in **Figure 50**.

A precautionary area was established in the offshore Taranaki area by the International Maritime Organisation in 2007 (shown in **Figure 52**) – this area being called the Taranaki Offshore Precautionary Area. All ships passing through this area must navigate with particular caution in order to reduce the risk of a maritime incident and the possible resulting marine pollution, given the high level of offshore petroleum activity within this area. The Taranaki Offshore Precautionary Area is a standing notice in the Notice to Mariners issued by Land Information New Zealand each year in the New Zealand Nautical Almanac. The Almanac lists the navigation hazards within the Taranaki Offshore Precautionary Area as the Pohokura, Māui, Maari, Tui, and Kupe fields. The entire Kupe field is within this Taranaki Offshore Precautionary Area. Maritime Chart NZ48 – 'Western Approaches to Cook Strait' states '*All ships should navigate with particular caution in order to reduce the risk of marine pollution in the precautionary area*'.

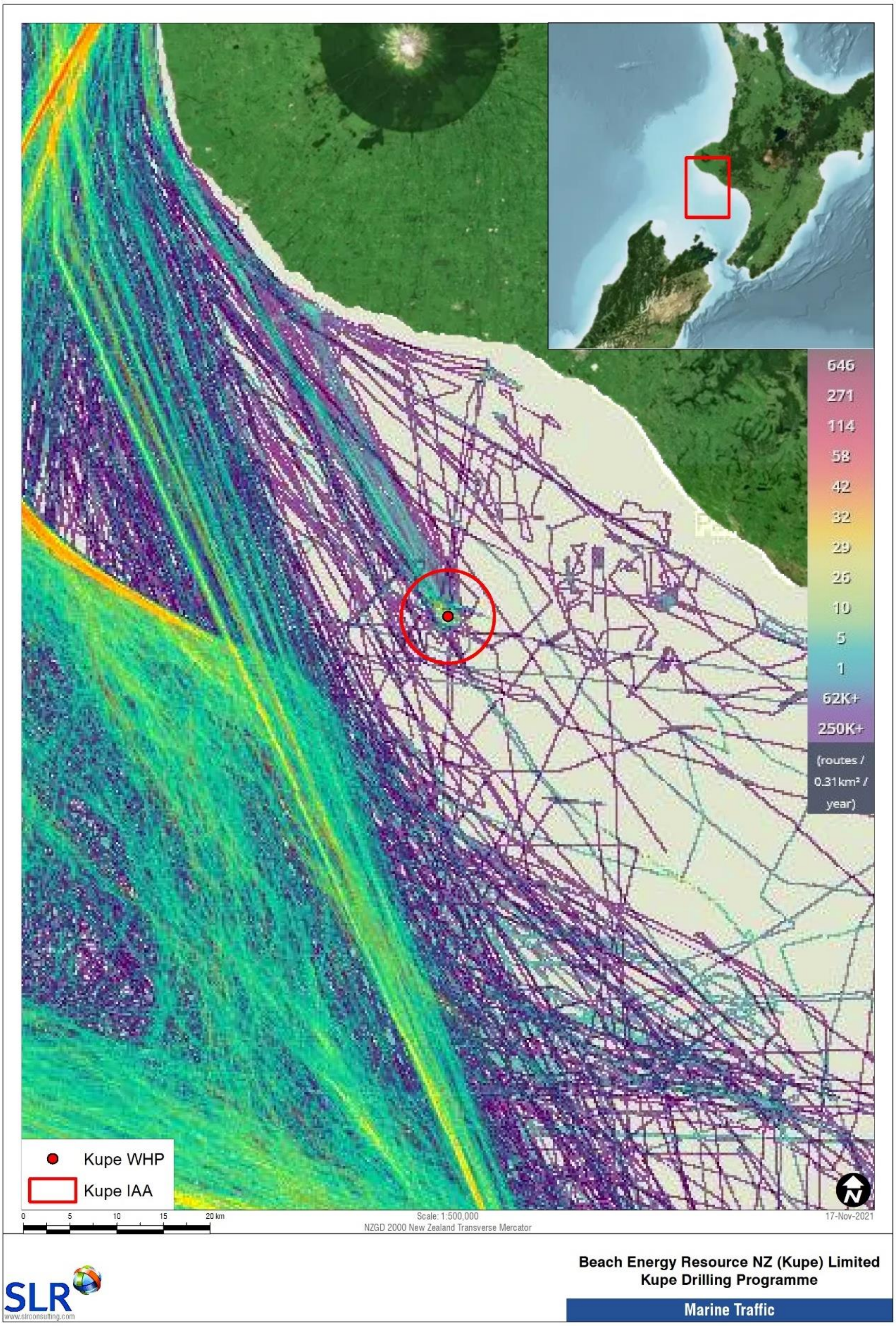
Under the Submarine Cables and Pipelines Protection (Kupe Gas Project) Order 2008 an 800 m wide protection corridor (400 m either side of the pipeline) is in place from the Kupe WHP back towards the coastline, finishing approximately one km from the coast, just beyond the point where the pipeline enters the horizontal section below the seabed/shoreline. Vessels may transit through this corridor but must not make any contact with the seabed and there is a prohibition of anchoring and fishing. Around the Kupe WHP itself there is a Safety Zone prescribed by the Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006. This zone extends from each point of the outer edge of the Kupe WHP to a distance of 500 m and prohibits any ship from entering the Safety Zone unless it is engaged in constructing or servicing the Kupe WHP, associated submarine pipelines, or associated offshore facilities.

An assessment has been undertaken utilising the shipping density maps[17] to identify how highly utilised the area within and around the Kupe IAA is for commercial shipping during 2019 and 2020, the results of which are shown in **Figure 50**. The vessel movements through the Kupe IAA and the surrounding area are indicated with a gradient from blue/purple for lower density through to red for high density. It is worth noting that the vessel density identified within **Figure 50** only relates to those vessels that are utilising Automatic Identification System (**AIS**) at the time they were passing through the area, meaning that other vessels not using these systems could have passed through the area.

Figure 50 confirms the majority of the Kupe IAA is not of high utilisation for commercial shipping, which can be expected based on the various restrictions and nautical advisories that exist in the area. However, within and beyond the southern and south-western edge of the IAA, the shipping traffic density is relatively high, likely linked with commercial fishing activities within the Rolling Grounds and commercial shipping traffic moving up/down the west coast of the North Island and approaching Cook Strait area from the northwest.

[17] Obtained from www.marinetraffic.com

Figure 50 General shipping routes in the vicinity of the Kupe field



Note: Commercial shipping density map obtained from www.marinetraffic.com.

4.5.3 Seabed Mining

New Zealand's west coast is rich in onshore and offshore iron sand deposits, including areas overlapping the Kupe IAA. TTRL has two active minerals permits which overlap the southern portion of the Kupe IAA (**Figure 51**):

- Minerals Exploration Permit 54068 covers 63,504 ha within the CMA which was granted to TTRL on 19 December 2012 and is due to expire on 18 December 2021. This permit covers a variety of metals and minerals, including aluminium, antimony, bismuth, copper, garnet, gold, ilmenite, iron, iron sand, lead, magnesium, molybdenum, nickel, platinum group metals, rare earth elements, rutile, silver, tantalum, tin, titanium, tungsten, zinc, and zircon; and
- Minerals Mining Permit 55581 (**MMP 55581**) covers 6,576 ha within the EEZ which was granted to TTRL on 2 May 2014 and is due to expire on 1 May 2034. This permit simply covers iron sand.

Although these two permits are in place in the STB, the ability to undertake mining operations is reliant on TTRL obtaining the relevant consents (i.e. marine consents and/or marine discharge consents in the EEZ and/or resource consents in the CMA). TTRL was originally granted consents by the EPA to mine iron sand within MMP 55581 in 2017; however, various appeals were lodged on the granting of those consents, which have subsequently been heard in the High Court, Court of Appeal, and culminating in the recent judgment by the Supreme Court in September 2021. The Supreme Court decision provides clear direction on a number of issues and interpretations under the EEZ Act and the Court has referred the matter back to the EPA for reconsideration by a decision-making committee. The EPA has yet to reconsider the application.

Figure 51 Active minerals permits

4.5.4 Oil and Gas Activities

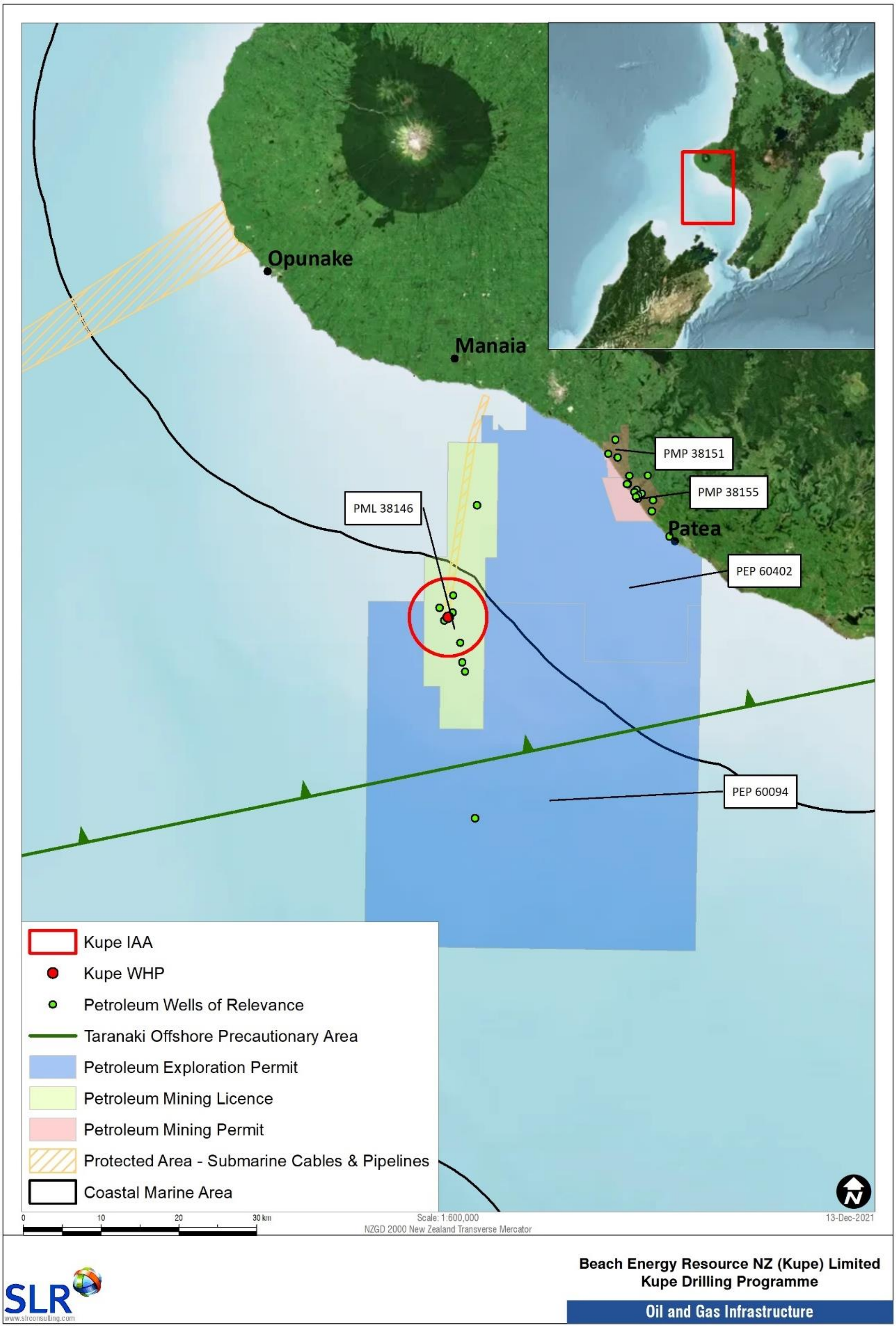
Exploration and production activities for oil, gas, and associated products have occurred along and off the coast of Taranaki since the 1960s, with an increase in activity since the early 2000s, particularly in relation to exploration and further expansion of existing fields. The Taranaki region is the centre of New Zealand's oil, gas, and petrochemical industries, and, with the significant economic input the industry and associated support industries contribute, oil and gas is of major importance to the New Zealand economy. Oil and gas facilities in the Taranaki region produce crude oil, condensate, naphtha, natural gas, liquefied petroleum gas, and compressed natural gas, as well as the petrochemical products methanol and urea.

Current producing fields in the offshore Taranaki area include the Maari, Māui, Kupe, and Pohokura fields. Under the Submarine Cables and Pipelines Protection Act 1996 various protected areas have been established around New Zealand by Order in Council. These areas typically prohibit all anchoring and most types of fishing in and around infrastructure to prevent cable and pipeline damage. The Kupe Gas Project protected area under the Submarine Cables and Pipelines Protection (Kupe Gas Project) Order 2008is of relevance to the IAA (discussed further in **Section 3.4.6**). In addition a Safety Zone around the Kupe WHP exists under the Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006.

Figure 52 provides an overview of the existing oil and gas activities and infrastructure within and nearby the Kupe IAA. The identified aspects include:

- Permits/licences under the Crown Minerals Act 1991, specifically:
  - PML 38146 (Kupe), operated by Beach;
  - Petroleum Mining Permit 38151 (Rimu), operated by Westside New Zealand Limited;
  - Petroleum Mining Permit 38155 (Kauri), operated by Westside New Zealand Limited;
  - Petroleum Exploration Permit 60094 (South Basin Boundary), operated by Todd Exploration Management Services Limited;
  - Petroleum Exploration Permit 60402 (Kaheru), operated by Westside New Zealand Limited;
- A Protected Area under the Submarine Cables and Pipelines Protection (Kupe Gas Project) Order 2008, pursuant to the Submarine Cables and Pipelines Protection Act 1996;
- A Safety Zone under the Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006;
- The Taranaki Offshore Precautionary Area established through the International Maritime Organization where ships have to navigate with particular caution in order to reduce the risk of a maritime casualty and resulting marine pollution; and
- A number of petroleum wells previously drilled and abandoned.

Figure 52 Oil and gas infrastructure of relevance to the Kupe IAA



5 Existing Interests and Engagement

5.1 Introduction

Section 39(1)(c) of the EEZ Act requires an IA to identify persons whose existing interests are likely to be adversely affected by the activities.

Section 4 of the EEZ Act defines existing interests, in relation to New Zealand, the EEZ, or the continental shelf as the interest a person has in:

(a) any lawfully established existing activity, whether or not authorised by or under any Act or regulations, including rights of access, navigation, and fishing:

(b) any activity that may be undertaken under the authority of an existing marine consent granted under section 62:

(c) any activity that may be undertaken under the authority of an existing resource consent granted under the Resource Management Act 1991:

(d) the settlement of a historical claim under the Treaty of Waitangi Act 1975:

(e) the settlement of a contemporary claim under the Treaty of Waitangi as provided for in an Act, including the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992:

(f) a protected customary right or customary marine title recognised under the Marine and Coastal Area (Takutai Moana) Act 2011.

The extent of the IAA (discussed in **Section 4.1**) was used to identify persons with existing interests which may be adversely affected by the proposed Kupe Phase 2 Development Drilling Programme. Any interest within, or in close proximity to the IAA which could potentially be adversely affected by the activities which are the subject of this marine consent application and satisfy one or more of the above criteria is discussed in the following sections.

5.2 Identification of Persons with Existing Interests

5.2.1 Lawfully Established Existing Activities

Under part (a) of the definition of existing interest, the interest a person has in any lawfully established existing activity, whether or not authorised by or under any Act or regulations, is considered an existing interest. The lawfully established existing activities within the IAA are: 1) existing MMP 55581 held by TTRL; 2) kaitiakitanga; 3) commercial and recreational fishing (including Māori customary and commercial fishing); and 4) maritime traffic. These are discussed separately in the following subsections.

5.2.1.1 Minerals Mining Permit 55581

In August 2017 the EPA granted marine consents and marine discharge consents to TTRL (EEZ000011) for the extraction and processing of iron sand within MMP 55581. The area covered by these consents for TTRL's mining overlaps the southern portion of the Kupe IAA discussed in **Section 4.5.3** and shown in **Figure 51**.

The EPA's decision on EEZ000011 was appealed to the High Court and then the Court of Appeal. TTRL then sought leave from the Supreme Court and the Court agreed to hear the appeal. The Supreme Court has recently released its decision (30 September 2021[18]) in which it agreed that the Court of Appeal was correct to uphold the High Court's decision to quash the Decision-making Committee's decision. A majority of the Supreme Court considered the matter should be referred back to the Decision-making Committee for reconsideration. Therefore, at this stage, TTRL is not considered a person with existing interests under part (a) of the definition of existing interest as it does not have any operative marine consents to undertake mining of the seabed.

5.2.1.2 Rights and Interests Recognised under the Treaty of Waitangi

The Supreme Court decision discussed in the previous section made findings on existing interests that are relevant to this consent application. The Court's decision traverses a large number of matters relating to the Decision-making Committee's decision to grant various marine consents and marine discharge consents for TTRL's iron-sand mining proposal. While many of the matters and findings presented in the Supreme Court decision relate specifically to the TTRL proposal, the decision is the most up to date case law on a number of matters relating to the interpretation and application of certain sections of the EEZ Act.

The Supreme Court stated:

> *[8] In considering the effect of the Treaty of Waitangi clause in s 12 of the EEZ Act, all members of the Court agreed that a broad and generous construction of such Treaty clauses, which provide a greater degree of definition as to the way Treaty principles are to be given effect, was required. An intention to constrain the ability of statutory decision-makers to respect Treaty principles should not be ascribed to Parliament unless that intention is made quite clear. Here, s 12(c) provided a strong direction that the DMC was to take into account the effects of the proposed activity on existing interests in a manner that recognises and respects the Crown's obligation to give effect to the principles of the Treaty. It followed that tikanga-based customary rights and interests constitute "existing interests" for the purposes of the s 59(2)(a) criterion, including kaitiakitanga and rights claimed, but not yet granted, under the Marine and Coastal Area (Takutai Moana) Act 2011.*

[18] SC 28/2020 [2021] NZSC 127

[9] Further, drawing on the approach to tikanga in earlier cases such as Takamore v Clarke, all members of the Court agreed that tikanga as law must be taken into account by the DMC as "other applicable law" under s 59(2)(l) of the EEZ Act where its recognition and application is appropriate to the particular circumstances of the consent application at hand.

Ngā Kaihautū Tikanga Taiao, the statutory Māori Advisory Committee of the EPA, has published a protocol entitled '*Incorporating Māori Perspectives into Decision Making*'[19]. This protocol includes a description of key Māori concepts and practices to guide decision makers in considering Māori perspectives as they relate to EPA matters. The protocol provides the following useful description of the principle of kaitiakitanga (noting the protocol states that various iwi and hapū groups may have different interpretations):

Kaitiakitanga is a guiding principle for decision makers and a valuable navigational tool for the EPA in making sound judgements and decisions when taking into account mātauranga Māori. Kaitiakitanga is defined in the Resource Management Act 1991 as guardianship or stewardship, though it was used by Māori to define conservation customs and traditions. It is intimately linked to rangatiratanga, the power and authority of tangata whenua to control and manage the resources within their territory, as guaranteed in the preamble and Article II of Te Tiriti o Waitangi (The Treaty of Waitangi).

All resources and forms of life were birthed from Papatūānuku, the earth mother who is the personification of the Whenua (Earth). Through her union with Ranginui (sky father), all things were created – meaning that all animate and inanimate things are related through whakapapa.

According to Māori tradition, the resources or children of Papatūānuku do not belong to tangata (people), but rather tangata are one of the many children who belong to Papatūānuku. People, animals, birds and fish all harvest the bounties of Papatūānuku but do not own them.

Kaitiakitanga is therefore the undertaking of duties and obligations inherited from the atua (spiritual guardians and first children of Papatūānuku) over the realms of those atua. They include but are not limited to:

- *Tāne Mahuta – kaitiaki of the resources of the forests*
- *Tangaroa – kaitiaki of the resources of the oceans*
- *Rongo-mā-tāne – kaitiaki of the resources of cultivated foods*
- *Haumietiketike – kaitiaki of uncultivated foods*
- *Tūmatauenga – kaitiaki of people and tribal conflicts*
- *Tāwhirimātea – kaitiaki of the elements*
- *Rūaumoko – kaitiaki of volcanoes and earthquakes*

[19] https://www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/293bdc5edc/EPA-Maori-Perspectives.pdf

It is the responsibility of people as kaitiaki to ensure the protection of the cultural and spiritual health and well-being both of themselves and of the resources which it is their duty to protect. This is achieved by performing kawa or ceremonial rituals according to the tikanga or laws/rules of those rituals. There are three key spiritual elements (taha wairua) of kaitiakitanga which define health and well-being for Māori. They are mauri, mana and tapu.

As outlined within **Section 4.4**, there are eight iwi in the Taranaki region. Each iwi has a 'rohe' which describes the territory or boundary, however there are often overlaps between adjacent iwi's rohe. The extent of each iwi's rohe within the coastal environment is more complex and there are significant overlaps in rohe, noting too that all iwi have a significant connection to coastal waters (both in terms of specific areas as well as more generally).

Ngāti Ruanui and Ngāruahine have interests in the coastal waters in and around the Kupe IAA.

The interests of Ngāti Ruanui are recognised in the Ngāti Ruanui Deed of Settlement between Ngāti Ruanui and the Crown and given effect to in the Ngati Ruanui Claims Settlement Act 2003 which includes a list of Statutory Acknowledgement areas, one of which is Te Moananui A Kupe O Ngati Ruanui (Coastal Area). The following statement of association by Ngāti Ruanui included within the Ngāti Ruanui Deed of Settlement supporting documents[20] applies to Te Moananui A Kupe O Ngati Ruanui:

The resources found within Te Moananui A Kupe have, since time immemorial, provided the people of Ngaati Ruanui with a constant supply of food resources. The hidden reefs provided koura, paua, kina, pupu, papaka, pipi, tuatua and many other species of reef inhabitants. Hapuka, moki, kanae, mako and patiki swim freely between the many reefs that can be found stretching out into the spiritual waters of Te Moananui A Kupe and along the Ngaati Ruanui coastline.

Names such as Rangatapu, Ohawe Tokotoko, Waihi, Waukena, Tangaahoe, Manawapou, Taumaha, Manutahi, Pipiri, Kaikura, Whitikau, Kenepuru, Te Pou a Turi, Rangitawhi, and Whenuakura depict the whereabouts of either a fishing ground or fishing reef.

All along the shoreline from Rangatapu to Whenuakura food can be gathered depending on the tides, weather and time of year. Tragedies of the sea are also linked to these reefs. Ngaati Ruanui oral history records the sinking off Tangaahoe of a Chinese trade ship that had just been loaded with a cargo of flax. When the bodies were recovered and brought to shore, none of them had any eyes.

The people of Ngaati Hine believe that they did something wrong and in turn were punished by the Ngaati Ruanui taniwha named Toi, kaitiaki (guardian) of the fishing reefs and grounds, who is renown to this day to eat the eyes of his victims.

The above text is included in the Ngāti Ruanui CIA (**Appendix F**). In addition, the CIA notes whaikorero (oral history) of their tupuna of old, and now honoured by each generation, thereafter, places the utmost importance on the role of Ngāti Ruanui as kaitiaki (guardians) for all the life forms of the environment. The CIA records that Ngāti Ruanui continue to maintain a kaitiaki (guardian) role to look after all species within the environment.

20 https://www.govt.nz/assets/Documents/OTS/Ngati-Ruanui/Ngati-Ruanui-Deed-of-Settlement-Schedule-2-Cultural-redress-12-May-2001.pdf

The interests of Ngāruahine are recognised in the Ngāruahine Deed of Settlement between Ngāruahine and the Crown and given effect to in the Ngāruahine Claims Settlement Act 2016 which includes a list of Statutory Acknowledgement areas, one of which is the Ngāruahine Coastal Marine Area. The Ngāruahine Deed of Settlement includes statements of association for each hapū and these make specific reference to the moana and coastal environs. The Ngāruahine CIA includes a section on kaitiakitanga and notes:

> *Tangaroa-i-te-Ruapetu is the spiritual guradian of the moana and other water bodies and all that live within them. This guardian was central to the lives of Hapū tūpuna and remains culturally significant to the Hapū whānau living today. Tangaroa has provided for them materially, acted as a highway for travel, a source of rongoā, aided their wellbeing and provided for their spiritual sustenance.*

5.2.1.3 Commercial and Recreational Fishing

Fishing activity, both commercial and recreational, is limited within the IAA due to the Safety Zone around the Kupe WHP, established under Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006, (discussed in **Section 3.4.2**) which covers 10% of the IAA (no fishing may occur within the Safety Zone).

The proposed drilling activities associated with the Kupe Phase 2 Development Drilling Programme will be undertaken within this Safety Zone around the Kupe WHP. Therefore, it is considered that commercial and recreational fishers are not persons whose existing interests will be adversely affected by the proposed activities.

5.2.1.4 Marine Traffic

As discussed in **Section 4.5.2**, there are no dedicated shipping lanes around New Zealand. As a result, vessels travelling in the waters around New Zealand (including the IAA) generally take the most direct or shortest route possible, provided it is safe to do so.

When drilling the development wells, the MODU will be located within the 500 m Safety Zone that was established pursuant to the Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006. As outlined within **Section 3.4.2**, the effect of this Safety Zone is that a ship may not enter the Safety Zone unless it is engaged in constructing or servicing the Kupe WHP, associated submarine pipelines, or associated offshore facilities. As maritime traffic is restricted from entering this Safety Zone, it is considered that the presence of the MODU will not cause any adverse effects on maritime traffic during drilling operations.

In addition to the above, the Kupe IAA is located within the Taranaki Offshore Precautionary Area which was established in the offshore Taranaki area (previously discussed in **Section 4.5.2.2**) which requires all ships passing through the area to navigate with particular caution to reduce the risk of a maritime casualty or possible marine pollution. The New Zealand Nautical Almanac also states that where there is sufficient sea room, vessels should keep at least 5 NM clear of oil and gas installations, and that due allowance should always be given to prevailing weather conditions and the possibility of engine steering or other mechanical failure.

As a result of the various restrictions and advisories discussed above, and given the transient and temporary nature of marine traffic and the ability for ships to move to avoid conflicting activities, marine traffic operators are not considered to be persons whose existing interests will be adversely affected by the proposed activities.

5.2.2 Existing Marine Consents

Under part (b) of the definition of existing interest, the interest a person has in any activity that may be undertaken under the authority of an existing marine consent granted under section 62 of the EEZ Act is considered an existing interest.

Based on a review of the publicly available marine consent decision reports on the EPA website[21], there are no current marine consents within the Kupe IAA, with the exception of the applications being considered by the EPA for TTRL's iron sand mining proposal. As discussed in **Section 5.2.1.1**, the Supreme Court recently issued its decision on the appeal, finding the Court of Appeal was correct to uphold the High Court's decision to quash the Decision-making Committee's decision – meaning TTRL's consents it was issued do not currently have any legal status. The Supreme Court considered the matter should be referred back the Decision-making Committee for reconsideration and this reconsideration has yet to be undertaken. Accordingly, TTRL is not considered a person with existing interests under part (b) of the definition of existing interests.

5.2.3 Existing Resource Consents

Under part (c) of the definition of existing interest, the interest a person has in any activity that may be undertaken under the authority of an existing resource consent granted under the RMA is considered an existing interest. The RMA has jurisdiction out to 12 NM (22.2 km) from the coastline of New Zealand, being the CMA.

Although the Kupe IAA extends from the Kupe WHP out 5 km, which results in the outer edge of the IAA being approximately 700 m offshore from the CMA/EEZ boundary. However, the potential impacts from the Kupe Phase 2 Development Drilling Programme are more limited in spatial extent (**Section 7.2**) than this. Nevertheless, a review of the consented coastal permits on the TRC website[22] was conducted. With the exception of the coastal permits granted to Beach for the Kupe field (related to the pipeline etc.), the majority of the coastal permits granted by TRC in the south Taranaki area relate to sites in close proximity to the shoreline. The nearest consented activity (outside of Beach's own consents) relates to a dairy factory marine outfall (R2/1450-3/1) which is approximately 27 km to the north-northeast of the activities associated with the Kupe Phase 2 Development Drilling Programme. Therefore, it is considered that there are no parties who hold an existing resource consent, who would be considered an existing interest affected by the proposed activities.

5.2.4 Historical Claim under the Treaty of Waitangi Act 1975

Under part (d) of the definition of existing interest, the interest a person has in any settlement of a historical claim under the Treaty of Waitangi Act 1975 is considered an existing interest.

For the most part, the statutory acknowledgement areas in the Taranaki region are located onshore; however, there are two relevant areas in the coastal and marine areas. Those areas are Te Moananui A Kupe O Ngati Ruanui (Ngati Ruanui Claims Settlement Act 2003) and Ngāruahine Coastal Marine Area - Ngāruahine (Ngāruahine Claims Settlement Act 2016). These statutory acknowledgement areas are recognised under the RMA, including the Proposed Taranaki Regional Coastal Plan, and the Heritage New Zealand Pouhere Taonga Act 2014.

The broad range of interests of Ngāti Ruanui and Ngāruahine in the IAA (and the coastal marine area more generally) are relevant to decision-making, and as such they are considered to be persons with existing interests under part (d) of the definition. These interests are discussed in detail in the CIAs included in **Appendix F**.

[21] https://www.epa.govt.nz/
[22] https://data-trcnz.opendata.arcgis.com/datasets/resource-consent-coastal-permits/explore

5.2.5 Contemporary Claim under the Treaty of Waitangi Act 1975

Under part (e) of the definition of existing interest, the interest a person has in any settlement of a contemporary claim under the Treaty of Waitangi as provided for in an Act, including the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992, is an existing interest. Potential existing interests fall into two categories: customary fishing rights and fishing quota holders which are discussed in the subsections below.

5.2.5.1 Customary Fishing Rights

Iwi hold customary fishing rights under the Fisheries (Kaimoana Customary Fishing) Regulations 1998. These regulations stem from the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 and provide for the customary harvesting of kaimoana for special occasions. This enables iwi to issue permits to harvest kaimoana in a way that exceeds levels permitted in standard practice to provide for a hui, tangi or as koha.

There are three types of customary fishing areas recognised under the legislation: rohe moana, mātaitai, and Taiāpure as discussed within **Section 4.4.1**.

The closest customary fishing area to the IAA is the Te Tai Hauāuru (**Figure 46**) which is located approximately 4.5 km to the south of the IAA.

Māori customary fishing interests are sometimes exercised using commercial fishing vessels. However, as the proposed activities will occur within the Safety Zone established around the Kupe WHP, it is considered that Māori customary interests will not be affected, in addition to any cultural values associated with customary fishing.

5.2.5.2 Fishing Quota Holders

In addition to the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992, the Maori Fisheries Act 2004 establishes the regime for allocating fisheries settlement assets, including income shares in Aotearoa Fisheries Limited (now trading as Moana New Zealand) and quota to iwi recognised under that Act. The Act also establishes Te Ohu Kaimoana whose role is to advance the interest of iwi individually and collectively, primarily in the development of fisheries, fishing, and fisheries-related activities, in order to:

- Ultimately benefit the members of iwi and Māori generally;
- Further the agreements made in the Deed of Settlement;
- Assist the Crown to discharge its obligations under the Deed of Settlement and the Treaty of Waitangi; and
- Contribute to the achievement of an enduring settlement of the claims and grievances referred to in the Deed of Settlement (s 32).

Te Ohu Kaimoana's duties and functions include: allocating and transferring settlement assets to mandated iwi organisations, appointing the directors of Aotearoa Fisheries Limited and protecting and enhancing the interests of iwi and Māori in relation to fisheries, fishing and fisheries-related activities. Aotearoa Fisheries Limited/Moana New Zealand harvests, procures, farms, processes and markets kaimoana in New Zealand and internationally. The company owns 50% of Sealord, which harvests primarily in deep-water fisheries, including areas within the offshore Taranaki region.

Although Te Ohu Kaimoana and Aotearoa Fisheries Limited/Moana New Zealand oversees quota holders within and surrounding the IAA, as the activities associated with this consent application will be limited to within the Safety Zone that has been established around the Kupe WHP, it is considered that they are not existing interests which could potentially be adversely affected by proposed activities.

5.2.6 Protected Customary Right or Customary Marine Title

Under paragraph (f) of the definition of existing interest, the interest a person has in any protected customary right or customary marine title recognised under MACA is an existing interest. There are no such areas within the Kupe IAA; however, there are a number of applications for customary right or customary marine title that are yet to be determined inshore of the IAA, within the CMA. As such, there are no protected customary rights or customary marine titles (strictly speaking, in terms of paragraph (f) of the definition) which are considered existing interests that would be adversely affected by the proposed activities.

However, the customary interests and activities that underpin those claims which extend beyond the boundary of the CMA are existing interests in terms of paragraph (a) of the definition. These are essentially the same activities and interests described in the CIAs (**Appendix F**) and summarised above.

5.2.7 Summary of Persons with Existing Interests

Based on the definition of existing interests in section 4 of the EEZ Act, those parties that are considered to have existing interests for the purposes of this consent application are:

- Ngāti Ruanui; and
- Ngāruahine.

5.3 Summary of Engagement Undertaken

5.3.1 Engagement

Beach has engaged with a variety of groups during the development of this marine consent application, including iwi, local and central government, and interested parties/groups. The extent of this engagement and the feedback received is summarised in **Appendix G**.

Beach is committed to working in partnership with iwi and to ongoing engagement with interested groups throughout the drilling programme.

Beach had envisaged submitting this application at an earlier stage, however, after initial engagement and recognition that the time constraints were challenging, made a decision to delay lodgement of the application to ensure iwi were fully informed, questions responded to, and cultural processes adhered to. This included providing a full version of the draft Kupe Phase 2 Development Drilling Programme Consent Application and IA.

5.3.2 Recommendations from Cultural Impact Assessments

As discussed in **Section 4.4**, Beach commissioned a CIA from Te Runanga o Ngāti Ruanui and Ngāruahine. In addition, Ngāti Manuhiakai voluntarily prepared and provided a separate CIA. These CIAs are included in **Appendix F**. **Table 16** presents the various recommendations made by Ngāti Ruanui, Ngāruahine, and Ngāti Manuhiakai as well as Beach's responses to the recommendations.

Table 16 Recommendations from Cultural Impact Assessments and Beach's Responses

Cultural Impact Assessment	Recommendation	Beach's Response
Ngāti Ruanui	That identified culturally significant areas, habitats of taonga species, indigenous flora and fauna, sensitive benthic habitats, nursery grounds of juvenile fish, migratory and foraging grounds of marine seabirds and mammals be protected and excluded from the proposed drilling and discharge affected area.	Beach understands that the proposed drilling and area predicted to be affected by the discharges that are the subject of this application will not affect any identified culturally significant areas. In the event that any are present in the Kupe IAA, then they may be affected but it will be impossible to exclude them from effects, however active discussion will occur with Ngāti Ruanui where this occurs.
	That the decision-maker requires the applicant to provide a sampling programme and programme of analyses of the bulk samples prepared in partnership with Ngāti Ruanui, prior to commencing drilling work.	The proffered conditions include a requirement that an EMP be developed in partnership with Ngāti Ruanui. The EMP will outline the proposed sampling processing and analyses of collected samples.
	The sampling programme and programme of analyses shall, as a minimum, include: • Photos of the sample sites before and after sampling; • Sampling exclusion where photos of sample sites show evidence of culturally significant sites, habitats of taonga species, sensitive habitats, indigenous flora, and fauna. • Sample description (including geological descriptions, photographic documentation, sample weights); 3.4 Size fraction separation (8mm) and description of major constituents (nodules, carbonate, erratic, shell material); • Geochemistry of major elements; • Petrology and grain size descriptions; • Geotechnical testing (including abrasion and point load testing, and in situ density readings); • Environmental testing, including sediment chemistry and elutriate testing.	

Cultural Impact Assessment	Recommendation	Beach's Response
	That the decision-maker requires the applicant to provide the outcome of the bulk samples' analyses prepared alongside Ngāti Ruanui, prior to commencing drilling work.	
	Ngāti Ruanui will be resourced to design a cultural health monitoring framework (CHMF) based on mātauranga Māori that will be implemented in parallel to a western science-based model. This monitoring will be part of compliance of any consent and is required to be a consent condition with clear review triggers if the CHMF results identify any deterioration in the mauri of the moana and its whanau.	The proffered conditions include a requirement that an EMP be developed in partnership with Ngāti Ruanui. Further discussions will occur to determine the nature of the requested CHMF and, where both Beach and Ngāti Ruanui considers this appropriate, it will be incorporated into the EMP.
	Ngāti Ruanui will be resourced to co-lead this monitoring framework of both western science and mātauranga Māori methods.	Beach proposes to have further discussions with Ngāti Ruanui in terms of this recommendation to ensure an agreed outcome acceptable to both parties.
	That the decision-maker requires the applicant to provide an Environmental Monitoring Plan (EMP) prepared alongside Ngāti Ruanui, prior to commencing exploration work. The EMP shall be prepared in accordance with the permit conditions, and shall (as a minimum) include details in respect of: • The acquisition of environment baseline information and cultural indicators; • The implementation, timing, and resourcing of the CHMF and all monitoring that must include Ngāti Ruanui; • The gathering of information that assists in assessing the adverse effects of the permit holder's activities on the affected marine environment; • The triggers and agreed process with Ngāti Ruanui for any 'stop work' directives as a result of adverse effects being detected in the monitoring framework; • The key contacts for all parties involved in the monitoring.	The proffered conditions include a requirement that an EMP be developed in partnership with Ngāti Ruanui. Further discussions will occur to determine the nature of the requested contents of the EMP with both parties working together to agree the contents.

	• That a Ngāti Ruanui Kaitiaki Group be established and that the consent holder shall, convene, and fund an inclusive hui of Ngāti Ruanui for the purpose of facilitating the establishment of a Ngāti Ruanui Kaitiaki Group (NRKG) of no more than 5 and no fewer than 3 representatives of Ngāti Ruanui. Any casual vacancies on the NRKG shall be filled by the entity who has a vacancy through their own appointment processes.
	• Twice each year, the consent holder will convene a meeting with members of the NRKG to discuss and obtain feedback on any cultural and environmental effects arising from the monitoring reports that should be presented at each hui.
	• The meetings shall be conducted in good faith and have the following objectives:
	  ◦ Facilitating information flow between the consent holder and Ngāti Ruanui regarding the operation and environmental effects of the consent holder's activities associated with the STB (including new information, results of monitoring and any studies relevant to such effects);
	  ◦ Identifying any issues of concern that have arisen during the previous year and to discuss appropriate measures to address issues raised;
	  ◦ Providing Ngāti Ruanui with a work plan for works each year including the EMP; and
	  ◦ Making recommendations for the consent holder and the Peer Review Panel to consider in relation to any issues identified in terms of (b) above. (please see the establishment of the peer review panel further in these recommendations).
	  ◦ the consent holder shall meet with the NRKG to discuss proposed changes to the workplan and to seek input from the NRKG on any cultural effects and implications of those changes.
	• There should be established a Peer Review Panel that independently reviews monitoring reports provided on the activities of Beach Energy. This panel should include two appointments made by Ngāti Ruanui.
	• The consent holder shall assist the Ngāti Ruanui Peer Review Panel Representative and NRKG to fulfil its objectives by, among other things:
	  ◦ Arranging an appropriate venue in the local area for the meetings;
		Beach does not consider the establishment of a Kaitiaki Group is required for this short duration activity alone. Beach proposes to have further discussions with Ngāti Ruanui on the establishment of such a group which would cover not only the development drilling programme but encompass Beach's wider activities within Taranaki. Beach sees real value in such a group being established, enhancing our existing relationship, but not as a condition of this marine consent.

Cultural Impact Assessment	Recommendation	Beach's Response
	◦ Ensuring its senior environmental and operational advisors attend the formal meetings; and ◦ Providing summary information on the workplan and EMP for the members. • The consent holder shall provide reasonable administrative and logistical support to facilitate the functions of the NRKG, and provision of a contribution towards attendance at the meetings, any special meetings convened, and attendance at any hui required for reporting back to Ngāti Ruanui. • These meetings are to occur for the full length of the consent and are to be drafted as a consent condition.	
	• A mitigation package to be negotiated with Ngāti Ruanui and Beach Energy regarding cultural and environmental impacts that cannot be avoided or mitigated.	Beach proposes to have further discussions with Ngāti Ruanui in terms of this recommendation.
Ngāruahine	In the absence of quality baseline information we require that the applicant establish and maintain a monitoring programme which involves both Ngāruahine and Ngāti Ruanui. Such a programme will identify baseline data prior to the commencement of works for: • Pelagic Fish; • Diadromous Native Fish; • Marine mammals; • Seabirds (both migratory and non-migratory); • Sea water quality; • Benthic ecosystems to a range of 2kms of the proposed drilling site(s). The monitoring programme will integrate both western science and mātauranga Māori methods	The proffered conditions include a requirement that an EMP be developed in partnership with Ngāruahine. Further discussions will occur to determine the nature of the requested contents of the EMP with both parties working together to agree the contents.

Cultural Impact Assessment	Recommendation	Beach's Response
	• Ongoing monitoring will measure changes to the baseline overtime and be reviewed by the Kaitiaki Group • This Kaitiaki Group will contain equal representation from Ngāti Ruanui, Ngāruahine and the applicant • The Kaitiaki Group will have the power to stop any drilling activities contained in this application based on their review of monitoring information	Beach does not consider the establishment of a Kaitiaki Group is required for this short duration activity alone. Beach proposes to have further discussions with Ngāruahine on the establishment of such a group which would cover not only the development drilling programme but encompass Beach's wider activities within Taranaki. Beach sees real value in such a group being established, enhancing our existing relationship, but not as a condition of this marine consent.
	The applicant will work to ensure that there is: • Adequate information provided toNgāruahine Hapū on monitoring results; and • Actively seek their feedback on those results.	The proffered conditions include a requirement that an EMP be developed in partnership with Ngāruahine. Further discussions will occur to determine the nature of the contents of the EMP with both parties working together to agree the contents.

Cultural Impact Assessment	Recommendation	Beach's Response
Ngāti Manuhiakai	Recommended condition: The Consent Holder shall convene and resource a Kaitiaki Forum. This Forum shall commence prior to commencement of works on site for the duration of the project. The function and purpose of the Kaitiaki Forum shall be formally agreed by the Consent Holder and Ngāti Manuhiakai and formally documented in a Forum Collaboration Agreement. This Agreement shall include, but not be limited to: a) reference to the Cultural Impact Assessment Kupe Phase 2 Development Drilling Programme; dated March 2022; prepared by Ngāti Manuhiakai b) the entities to be represented on the forum, and number of representatives; c) the frequency at which the forum will meet; d) the decision-making process to be utilised in the forum; and e) a dispute resolution clause. Advice Note: Given the scale of the development it is anticipated that a number of changes will be made through the construction phase and beyond. A Kaitiaki Forum enables the Consent Holder to obtain the necessary cultural expertise to inform those decisions, as well as providing for the role of Mana Whenua as Kaitiaki in managing, avoiding, remedying and mitigating the effects of the consented development.	Beach does not consider the establishment of a Kaitiaki Group is required for this short duration activity alone. Beach proposes to have further discussions with Ngāti Manuhiakai on the establishment of such a group which would cover not only the development drilling programme but encompass Beach's wider activities within Taranaki. Beach sees real value in such a group being established, enhancing our existing relationship, but not as a condition of this marine consent.
	Restricting the use of explosives and the discharge of further material (e.g faulty cement and deck drainage) and disposing of this on-shore, acknowledging the extremely low likelihood of this being required.	Beach will restrict the use of explosives as it is a contingent activity as described in Section 2.2.10.03 of the IA. Disposing of faulty cement and deck drainage on-shore is impractical and the adverse effects of these discharges have been assessed as negligible.
	Co-development and implementation of an Environmental Management Plan (EMP) with Ngāti Manuhiakai.	

Cultural Impact Assessment	Recommendation	Beach's Response
	The EMP should also include the project's adaptive co-management strategy including when adaptive co-management is warranted (ie trigger points for additional management) and how it will be implemented.	The proffered conditions include a requirement that an EMP be developed in consultation with Ngāti Manuhiakai. Further discussions will occur to determine the nature of the requested involvement in the monitoring.
	The EMP should also include Key Performance Indicators (KPIs) and cultural indicators which will determine the project's success in meeting a position of no net loss or net gain with respect to mauri	
	Recommended condition: The Consent Holder shall co-design and implement the Environmental Management Plan which includes an adaptive co-management strategy with Ngāti Manuhiakai to provide an opportunity for mātauranga to inform the Plan and its implementation.	
	Ngāti Manuhiakai recommends the inclusion of a condition that requires the resourcing of a hapū member, suitably qualified and experienced to monitoring impacts on mauri, to undertake the role of Marine Mammal and Seabird Observer including monitoring contingent activities (e.g. the use of explosives and the discharge of faulty cement and deck drainage). This should be specified explicitly, as opposed to being contained within the EMP more generally.	In principle Beach supports the use of Marine Mammal Observers and will explore the opportunity to grow that particular skill set in Taranaki given the upcoming work (including decommissioning) for all operators. Beach will continue to engage with Ngāti Manuhiakai on this recommendation and details of such monitoring and personnel will be discussed as part of Ngāti Manuhiakai and Beach's ongoing relationship. Results of this further discussion as it relates to the proposed development drilling, would be outlined in the EMP which will be developed in consultation with Ngāti Manuhiakai.

Cultural Impact Assessment	Recommendation	Beach's Response
	Ngāti Manuhiakai understand from the application is that time is the primary tool that will enable the seabed and biodiversity to return to a more natural state post drilling. Success of this is determined through the EMP process. The application considers that this should occur in a relatively short timeframe and has based the length of consent (out to 2028) to conservatively provide for that. Ngāti Manuhiakai support this approach. In the instance that this is not achieved, and a longer time period is required (depending on what the EMP considered 'success' to include) understanding the mechanisms available to extend that timeframe or consider other offsets or environmental compensation may be available in line with an adaptive co-management approach are recommended. Ngāti Manuhiakai continue to advocate for this area to be excluded from commercial fisheries and other extractive industries until such time as that is achieved.	The 'Safety Zone' (exclusion zone) that extends from each point of the outer edge of the Kupe WHP to a distance of 500 m will remain in place beyond the duration of this marine consent.

6 Economic Benefit

Under section 59(2)(f), a Marine Consent Authority must take into account the economic benefit to New Zealand of allowing the application. Potential economic benefits arising from the Kupe Phase 2 Development Drilling Programme could be significant on a regional and national scale.

Beach commissioned Insight Economics to assess the economic impacts from the Kupe Phase 2 Development Drilling Programme (Colegrave & Chaumeil, 2022) (**Appendix H**).

The economic impacts report notes that, if successful, the proposed campaign will enable significant incremental field production, which itself will generate material economic benefits, including:

- **Production-Related Jobs and Incomes** – maintained employment for 59 fulltime equivalent (**FTE**) New Zealand staff through to decommissioning, which translates to total wages/salaries of $88 to $106 million. Plus, extra production will support indirect employment by the field and its key partners/suppliers.
- **Demand-Side (Consumption) Impacts** – the supply of additional gas from Kupe will also enable major users to continue their productive processes and thereby keep employing hundreds of New Zealand workers for a longer period, plus it delays the need for smaller/domestic customers to convert to appliances with different fuel sources.
- **Support for Just Transition** – additional production will support a just transition away from fossil fuels until other, cleaner industries establish locally and provide new employment options for those currently working in the O&G sector.
- **Fiscal Benefits to the Crown** – Beach estimate that extra production (from one additional well) will result in extra tax, royalties, and levies of $80 to $90 million.
- **Gas Market Impacts** – extending Kupe's field life will bolster competition and thereby help keep wholesale and retail gas prices as low as possible for the benefit of its users.
- **Avoidance of Higher Carbon Alternatives** – additional supply may help dual-fired plants (such as electricity generators) to minimise or avoid the use of dirtier fuels, such as coal, which emit about twice the carbon of gas per unit of energy delivered.
- **Economic Efficiency of Maximising Existing Assets/Investments** – extra field life will achieve high degrees of economic efficiency because it will leverage existing field investments and have minimal requirements of its own (beyond the drilling campaign).
- **Electricity Price Stability** - gas is the largest source of non-renewable electricity generation, so its price flows through to wholesale electricity prices in times of peak demand. Accordingly, greater gas supply will help maintain wholesale gas and electricity prices.
- **Export Earnings** – additional condensate production (and some LPG) will be exported and hence earn export receipts while helping to improve our trade balance.

This assessment utilised data supplied by Beach in relation to the costs associated with the Kupe Phase 2 Development Drilling Programme (**Table 17**), with a share of each expenditure item allocated to the Taranaki region (as the study area). These estimates of expenditure in the Taranaki region are then mapped to various sectors of the economy and overlaid with multipliers to estimate the overall beneficial effects from drilling a well, including subsequent flow-on effects.

Table 17 Estimated cost for both development wells

Campaign elements	Estimated total cost in NZD $m	Taranaki share of expenditure	Taranaki spend NZD $m
Rig mobilisation / demobilisation	$31.4	0%	$0.0
Well engineering planning	$10.0	20%	$2.0
Regulatory approvals	$2.4	90%	$2.1
Office support / comms / overheads	$1.7	100%	$1.7
Site surveys	$3.6	80%	$2.9
Supply base, transportation, and storage	$1.9	70%	$1.3
Rig assurance and modifications	$0.8	20%	$0.2
Pre-spud preps and drilling	$84.0	30%	$25.2
Completions	$27.6	25%	$6.9
Rig down and move off	$4.6	20%	$0.9
Total	**$168.0**	**26%**	**$43.2**

The estimate cost of drilling the first development well is approximately NZ$106 million, with the second development well costing approximately NZ$62 million, for a total of approximately NZ$168 million. The lower cost for the second development well reflects the fact that the MODU will already have been mobilised and in place. These costs are broken down into ten campaign elements, each of which have variable percentages of costs being spent within the Taranaki region. The majority of the expenditure is associated with the pre-spud preparations and the drilling itself, being 50% of the overall cost of the Kupe Phase 2 Development Drilling Programme, of which, approximately NZ$25.2 million is assumed to be spent within the Taranaki region. Overall, it is estimated approximately 26% of the overall cost (or NZ$43.2 million) of the Kupe Phase 2 Development Drilling Programme will be spent within the Taranaki region, particularly through suppliers and services providers based within the region.

The expenditure within the Taranaki region was then mapped to the sectors of the regional economy based on the types of activities involved (**Table 18**). As can be expected, 'mining support services' is allocated the largest portion of the expenditure.

Table 18 Mapping of expenditure to sectors of regional economy

Sector	Total NZD $m
Mining support services	$25.0
Basic material wholesaling	$5.8
Machinery and equipment wholesaling	$5.8
Scientific, architectural, and engineering services	$1.9
Legal and accounting services	$1.5
Local government administration services	$0.8
Fabricated metal product manufacturing	$0.8
Heavy and civil engineering construction	$0.8
Other transport	$0.8
Total	**$43.2**

After a multiplier analysis has taken place, the regional economic boost from the Kupe Phase 2 Development Drilling Programme (as outlined in **Table 19**) equates to:

- Regional Gross Domestic Product (**GDP**) by $20.9 million;
- Employment by 164 FTE-years, which is the number of people employed full-time multiplied by the duration of that employment. For example, 10 FTE-years could mean two people employed full-time for five years, or 20 people employed full-time for half a year; and
- Household incomes (i.e. total wages and salaries paid to workers) by $11.0 million.

Table 19 Estimated national economic benefits from the Kupe Phase 2 Development Drilling Programme

Impact Measure	Direct	Flow-on	Total
Regional GDP (NZ$ millions)	$15.4	$5.5	$20.9
Employment (FTE-years)	117	47	164
Household incomes (NZ$ millions)	$8.9	$2.1	$11.0

Note: Direct effects = the direct economic effects of the entity, plus the economic effects of their immediate suppliers

Flow-on effects = the broader economic impacts of the wider supply chain that support the project's immediate suppliers, including additional spending by people employed as a result of the project (either directly or indirectly).

The economics impacts report shows that the proposed drilling campaign will have significant, quantifiable, impacts on the national and regional economy, both in its own right, and particularly via the additional production enabled.

7 Impact Assessment – Potential Environmental Effects

7.1 Introduction

This section presents an assessment of the actual and potential effects on the environment and persons with existing interests that may arise from the activities which are the subject of this consent application. This section has been split between those activities under the marine consent and those under the marine discharge consent due to the differing ERA methodologies used for each.

The adverse effects on persons with existing interests, potential effects on human health, potential effects outside the EEZ and any potential cumulative impacts are assessed in a holistic manner, including all activities associated with this consent application (i.e. both marine consent and marine discharge consent aspects).

While the focus of this section is on the activities for which consent is being sought; that is, those activities restricted by section 20 and 20B of the EEZ Act, there are a few 'unplanned' activities that could possibly occur during the Kupe Phase 2 Development Drilling Programme. An assessment of potential effects from those unplanned activities is presented (**Section 7.8**). Section 39 of the EEZ Act outlines what information needs to be included within an IA, and it is questionable whether the impacts of unplanned activities which are unlikely to occur (and are actively avoided) should be included as they are not activities for which consent is being sought. However, an assessment of the possible effects from these unplanned activities is included out of an abundance of caution because whilst they have a very low probability of occurring, some may result in high potential impacts.

In relation to the seasonality of potential receptors found in the marine environment in and around the Kupe IAA, it is difficult to determine specific seasonal trends based on the available information. However, the assessment has been undertaken on the basis that all those species identified in **Section 4.3** will be present when drilling occurs to account for this uncertainty – this results in a 'worst-case' assessment because it is very unlikely that all of these species (receptors) will be present at the time the activities will occur.

7.2 Planned Marine Consent Activities

7.2.1 Environmental Risk Assessment Methodology

This assessment is based on a qualitative ERA which assesses the relative significance of the actual and potential effects from the activities associated with the Kupe Phase 2 Development Drilling Programme on the environment and persons with existing interests by considering the likelihood of an effect occurring and its potential consequence.

The joint Australian & New Zealand International Standard Risk Management – Guidelines, (AS NZS ISO 31000:2018) (ISO, 2018) have been used to develop the ERA. In particular, the ERA methodology used has been adapted from MacDiarmid *et al.* (2012), which sets out a risk assessment framework for activities in New Zealand's EEZ and extended continental shelf. Guidance from Clark *et al.* (2017) has also been used to refine the ERA methodology so that it is specific and relevant to this consent application.

Table 20 outlines the criteria used in the ERA to assess consequence levels – this table being adapted from MacDiarmid *et al.* (2012); specifically, the consequence levels within Table 2-2 within MacDiarmid *et al.* (2012) have been used with some modifications to the descriptions so that the matrix and criteria are relevant to this consent application, albeit with the same intent as the original descriptions. An example of this is in relation to the "Proportion of Habitat Affected" being the equivalent to "Scale". MacDiarmid *et al.* (2012) used a percentage of habitat for the proportion of habitat affected; however, scale of effect is deemed to be more appropriate here on account of the small IAA.

The rankings provided consider the different receptors in the marine environment that could potentially be affected by the proposed activities.

The ERA was undertaken using all available literature, reports, past experience, and expert judgement. To summarise, the main steps undertaken for this ERA process were:

- Identify the potential sources of environmental risk (e.g. magnitude, scale, frequency, and intensity);
- Assess the potential consequences for each risk across all potential environmental receptors (with the operational procedures and proposed mitigation measures in place) - based on the criteria in **Table 20**;
- Assess the likelihood of a consequence occurring for each receptor - based on the criteria in **Table 21**;
- Assign an overall classification of risk for any residual impacts, being the consequence score multiplied by the likelihood score – the resultant risk categories are presented in **Table 22** and the respective rank descriptions described in **Table 23**; and
- Assign a predicted magnitude of environmental effect as described in the right-hand column of **Table 23** – it should be noted that, for the purposes of this ERA, the 'Negligible' effect category incorporates all effects that are less than negligible, which includes 'no effects' and '*de minimis*'[23] effects.

[23] *De minimis* is a shorthand way of expressing the full Latin maxim "*de minimis non curat lex*", which is usually translated as "the law is not concerned with trifles". In the present context, it means that an adverse effect or consequence that is so trifling that the law should regard it as of no consequence.

Table 20 Criteria for assessing potential consequence levels

Consequence level	Scale	Duration and Recovery	Populations and Protected Species	Habitat and Ecosystem Function	Socio-Economic
0 – Negligible	Highly localised effect (<1 km^2).	Temporary duration (days-weeks). No recovery period necessary	No predicted adverse effects to populations. Almost no protected species impacted.	Undetectable, affecting <1% of original habitat area. Ecosystem function unaffected outside of natural variation.	No disruptions to normal activities.
1 - Minor	Localised effect (1-5 km^2).	Short term duration (weeks-months). Rapid recovery would occur once activity stops (within weeks).	Possible adverse effect to populations, but not sufficient to be detectable. Some individuals of protected species may be impacted but no impact on their population.	Measurable but localised, affecting 1-5% of original habitat area. Minor changes to ecosystem function.	Short term disruptions to normal activities (weeks to months).
2 - Moderate	Medium scale effect (5-100 km^2).	Medium term duration (months). Short term recovery period required once activity stops (within months).	Detectable impacts to populations. Could affect seasonal recruitment but does not threaten long-term viability. Some population level effects may become apparent for protected species.	Potential impacts more widespread, affecting 5-20% or original habitat area. Moderate changes to ecosystem function.	Medium term disruptions to normal activities (months).
3 - Severe	Large scale effect (100-500 km^2).	Long term duration (years). Substantial recovery period required once activity stops (within years).	Impacts to populations are clearly detectable and may limit capacity for population increase. Population level impacts are clearly detectable for protected species.	Widespread impacts, affecting 20-60% of original habitat area. Severe changes to ecosystem function.	Long term disruptions to normal activities (years).
4 - Major	Very large-scale effect (500-1,000 km^2).	Extensive duration (years-decades). Substantial recovery period required once activity stops (years to decades).	Long-term viability of populations is clearly affected. Local extinctions are a real possibility if activity continues. Serious conservation concerns for protected species.	Activity may result in major changes to ecosystem or region, affecting 60-90% of original habitat area. Major changes to ecosystem function.	Extensive disruptions to normal activities (years-decades).
5 - Catastrophic	Regional effect (>1,000 km^2).	Very extensive duration (decades). Extremely long recovery period (> decades) or no recovery predicted.	Local extinctions are expected in the short-term. Very serious conservation concerns for protected species.	Activity will result in critical changes to ecosystem or region, affecting virtually all original habitat. Total collapse of ecosystem.	Very extensive disruptions to normal activities (decades).

Table 21 Criteria for assessing consequence likelihood

Level/Score	Description	Likelihood of exposure
1	Remote	Extremely unlikely but theoretically possible.
2	Rare	May occur, but only in exceptional circumstances.
3	Unlikely	Not likely to occur in normal circumstances.
4	Possible	Could occur at some time.
5	Likely	Will probably occur in normal circumstances.
6	Certain	Is expected to occur in most circumstances and has a history of occurrence.

Table 22 Overall risk of residual impacts

		Consequence Level					
		0 Negligible	1 Minor	2 Moderate	3 Severe	4 Major	5 Catastrophic
Likelihood of Consequence	1 – Remote	Negligible (0)	Very Low (1)	Very Low (2)	Low (3)	Low (4)	Low (5)
	2 – Rare	Negligible (0)	Very Low (2)	Low (4)	Moderate (6)	Moderate (8)	Moderate (10)
	3 – Unlikely	Negligible (0)	Low (3)	Moderate (6)	Moderate (9)	High (12)	High (15)
	4 – Possible	Negligible (0)	Low (4)	Moderate (8)	High (12)	High (16)	Extreme (20)
	5 – Likely	Negligible (0)	Low (5)	Moderate (10)	High (15)	Extreme (20)	Extreme (25)
	6 – Certain	Negligible (0)	Moderate (6)	High (12)	Extreme (18)	Extreme (24)	Extreme (30)

Table 23 Risk ranking description

Risk Ranking	Potential Impact	Predicted Magnitude of Environmental Effect
Extreme (18-30)	Extreme Risk – unacceptable for project to continue under existing circumstances. Requires immediate action. Equipment could be destroyed with large environmental impact as a result of the activity.	Very Significant.
High (12-16)	High Risk (intolerable risk) – where the level of risk is not acceptable and control measures are required to move the risk to lower the risk categories. Medium environmental impact from the activity.	Significant.
Moderate (6-10)	Moderate Risk – requires additional control measures where possible or management/communication to maintain risk at less than significant levels. Small environmental impact from the activity. Where risk cannot be reduced to 'Low' control measures must be applied to reduce the risk as far as reasonably practicable. Requires continued tracking and recorded action plans.	Minor.
Low (3-5)	Low Risk – where the level of risk is broadly acceptable and generic control measures are already assumed in the design process but require continuous monitoring and improvement.	Less than Minor.
Very Low (1-2)	Very Low Risk – where the level of risk is acceptable and no specific control measures are required.	Almost Negligible.
Negligible (0)	Negligible Risk – no intervention or further monitoring is required. Negligible (at worst) environmental impact.	Negligible.

7.2.2 Actual and Potential Effects from Planned Marine Consent Activities

The actual and potential effects from the planned marine consent activities associated with the Kupe Phase 2 Development Drilling Programme on the receptors that are considered relevant to that activity have been assessed in the following sections:

- Pre-drill works (**Section 7.2.3**);
- Installation, presence, and removal of the MODU (**Section 7.2.4**);
- Drilling operations (**Section 7.2.5**);
- Deposition of drill cuttings (**Section 7.2.6**);
- ROV works (**Section 7.2.7**);
- Formation evaluation (**Section 7.2.8**);
- Supporting activities (**Section 7.2.9**);
- Environmental monitoring (**Section 7.2.10**); and
- Contingent activities (**Section 7.2.11**).

In addition to the potential effects on the environment from specific activities identified in the sections listed above, the potential effects from the Kupe Phase 2 Development Drilling Programme as a whole, on various matters, are assessed in the following sections, including:

- Potential adverse effects on persons with an existing interest (**Section 7.4**);
- Effects on human health from the planned activities (**Section 7.5**); and
- Cumulative effects (**Section 7.7**).

As part of the assessments, the measures that Beach will implement to avoid, remedy, or mitigate environmental effects to ALARP are included within each of the sections, with a summary of these measures in **Section 7.9**.

7.2.3 Pre-Drill Works

Pre-drill works are required prior to the arrival of the MODU(s) at the well site. These pre-drill works may include seabed surveys (geotechnical coring and CPT) and site clearance utilising an ROV (described in greater detail in **Section 2.2.1.1**).

In addition to these activities, there are various other pre-drill works that may be undertaken that do not require marine consent (such as shallow seismic, multi-beam sonar, and/or side-scan surveys). As these activities do not require marine consent, they have not been considered as part of this ERA.

The seabed disturbance associated with the pre-drill works has the potential to affect both the pelagic and benthic environs, each of which are discussed below.

7.2.3.1 Area of Potential Impact

As discussed in **Section 2.2.1.1**, the area of seabed disturbance and sediment removal for both coring and CPT is minimal due to the small size of the equipment utilised.

As an example, a typical piston coring device utilised in previously approved work extracted three cores, with 67 mm internal diameters and lengths of ~5 m, being recovered from the seabed. Based on these dimensions, a full core sample from this sampler collects approximately 0.018 m^3 of sediment per core. In some situations, more than one core may be attempted per site where insufficient penetration or recovery is achieved. This volume of sediment disturbance is insignificant in terms of the scale of disturbance.

In terms of the CPT, this may be undertaken in the area where the MODU is proposed to be installed and can result in the disturbance of approximately 9 m^2 from the heavy piece of equipment used (with dimensions of 3 m x 3 m).

7.2.3.2 Potential Effects

7.2.3.2.1 Pelagic Environs

Pre-drill works would disturb the seabed and would result in some re-suspension of sediment which would cause an increase in turbidity in the water column.

Consequence – Any increase in suspended sediment and corresponding reduction in water quality within the water column from pre-drill works will be highly localised around the survey equipment. Any fine sediment suspended within the water column will disperse in the nearby vicinity of the disturbance with the aid of near-seabed currents and will naturally settle out of the water column over time. As outlined within **Section 4.2.9**, the sediment in the Kupe IAA is predominantly sand sized particles, meaning any disturbances and associated suspension of fine sediment will be reduced due to there being a small proportion of this finer grained material. The small amount of suspended sediment arising from pre-drill works will have *negligible* ecological effects on pelagic organisms given the highly localised nature (i.e. < 1 km^2) and short-term duration of the effects. In addition, these activities are only required to be undertaken once prior to the commencement of drilling operations.

Likelihood – Due to the highly localised nature of these activities, the likelihood that effects on the pelagic environment result from the pre-drill works is reduced, equating in a *likely* categorisation.

As the consequence of effects from the pre-drill works on the pelagic environment is *negligible*, and it is *likely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Pre-drill works – effects on the pelagic environment	0 – Negligible *Highly localised and short-term*	5 – Likely *Will probably occur in normal circumstances*	0 – Negligible	Negligible

7.2.3.2.2 Benthic Environs

The pre-drill works will physically disturb the benthic environment, and directly remove benthic sediments in the case of geotechnical coring. This disturbance could result in the direct smothering from disturbed sediments that settle back on the seabed, or result in crushing of benthic fauna should they be in the location of the pre-drill works.

Consequence – The direct crushing of benthic fauna from the survey equipment will be limited to a highly localised area (i.e. up to 9 m^2 for the CPT, and much less for geotechnical coring). Any potential effects outside of the immediate vicinity of this disturbed area will be as a result from the deposition of suspended sediment that will settle on the seabed over time. This area of deposition will be highly localised, and likely immeasurable, especially after the drilling activities occur with a resultant deposition of drill cuttings on the seabed (discussed in **Section 7.2.6**).

Post-drill monitoring will be undertaken after the drilling operations have completed which will be utilised to assess the level of disturbance and subsequent recovery of the benthic environment. However, it is highly unlikely that the disturbance from the pre-drill works will be able to be differentiated from the greater disturbance associated with other drilling activities, namely the deposition of drill cuttings which are assessed in detail within **Section 7.2.6**.

Based on the above discussions, the highly localised effects (i.e. < 1 km^2) from the pre-drill works result in a *negligible* consequence.

Likelihood – These highly localised effects on the benthic environment from the pre-drill works will probably occur in normal circumstances; therefore, this equates to a *likely* categorisation.

As the consequence of effects from the pre-drill works on the benthic environment is *negligible*, and the effects are *likely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Pre-drill works – effects on benthic environment	0 – Negligible *Highly localised and short-term*	5 – Likely *Will probably occur in normal circumstances*	0 – Negligible	Negligible

7.2.3.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

In order to avoid, remedy, or mitigate potential adverse effects from the pre-drill works, the number of the pre-drill works will be limited to the minimum required in order to complete the operations such that the spatial extent of the disturbance is limited as far as practicable.

7.2.4 Installation, Presence, and Removal of MODU

As outlined within **Section 2.2.2**, a specific MODU has not been contracted to undertake the drilling associated with the Kupe Phase 2 Development Drilling Programme. However, given the water depth, a jack-up MODU will be used. The MODU will be in place alongside the Kupe WHP for up to 95 days to undertake drilling and formation evaluation activities. As this consent application is for the drilling of up to two development wells at the Kupe WHP, this time period could therefore be double (i.e. 190 days) for the drilling period.

As part of this assessment, the potential for a soft-pinning operation has been included as this may be necessary as part of the installation process. As outlined in **Section 2.2.2.2**, this process requires at least one of the legs of the MODU, but possibly up to four legs (depending on the number of legs the MODU has), being lowered until the bottom of its spudcan is only just touching the seabed.

Potential environmental effects resulting from the physical presence in regard to biological receptors include interactions with marine mammals, seabirds, fish, and cephalopods. The physical presence of a MODU is not expected to have any adverse effects on plankton and primary productivity or benthic invertebrates; however, the physical disturbance (rather than presence) associated with the MODU will inevitably result in adverse effects on benthic communities.

7.2.4.1 Area of Potential Impact

The area of potential impact for the installation and removal of a MODU is correlated with the size and number of legs in contact with the seabed. Based on the areas provided within **Section 2.2.2**, the area of disturbance is likely to be between 720 and 960 m^2 (for a three and four legged MODU, respectively). In addition, should soft-pinning be required, there is a potential that this area of disturbance is double, dependant on how many legs are required to be lowered as part of the "stop" point.

7.2.4.2 Potential Effects

7.2.4.2.1 Pelagic Environs

Water Quality

Disturbance of the seabed from the placement and removal of the MODU will result in the suspension of sediments into the water column. However, based on the currents near the seabed (**Section 4.2.3**), any sediment released into the water column from the deployment and removal of the legs will be dispersed with water movement and settle out quickly.

Consequence – Any disturbance to the seabed from the placement and removal of the MODU, and the associated reduction in the surrounding water quality from increased suspended sediment, will be highly localised in and around the immediate footprint of the spud cans (i.e. < 1 km^2). This reduction in water quality will also be restricted to the time that the installation and removal occurs, with the settlement of suspended sediments expected to occur quickly, and the reduction in water quality ceasing once the MODU is in place and removed. Accordingly, the consequence of effects has been assessed as *negligible*.

Likelihood – The likelihood of effects from this activity has been assessed as *likely* as this reduction in water quality will probably occur in normal circumstances.

As the consequence of effects from the installation and removal of the MODU on water quality is *negligible*, and it is *likely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Installation and removal of MODU – effects on water quality	0 – Negligible *Highly localised, short term and temporary/ intermittent*	5 – Likely *Will probably occur in normal circumstances*	0 – Negligible	Negligible

Marine Mammals

The physical presence of a MODU in the water column could displace marine mammals from a small area for the duration of its deployment. This displacement, however, is predicted to only affect large cetaceans as the movement of small cetaceans and pinnipeds is virtually unimpeded by MODU presence (Gales, 1982). In addition, Gales (1982) reports that whales can either ignore or easily avoid MODUs without appreciable change in their behaviour. During the Kupe Phase 2 Development Drilling Programme the MODU will be positioned alongside the existing Kupe WHP and the jacket structure of the platform already acts to displace marine mammals from parts of the water column at this location.

The MODU presence could also act as an attractant to some species. New Zealand fur seals are frequent visitors to oil platforms in offshore Taranaki waters. There are three possible reasons for this attraction, the first being that physical structures in the water column serve as 'fish aggregating devices' which can increase prey availability for marine mammals. Physical structures may also provide pinnipeds with haul-out opportunities (depending on MODU hull design etc.) or simply represent a source of curiosity. It is therefore possible that New Zealand fur seals may be attracted to the MODU.

Physical structures in the marine environment can also increase the potential risk of collision or entanglement for marine mammals; although, marine mammals are typically highly aware of their surroundings and possess exceptional abilities to detect and avoid obstacles in the water column. Despite these abilities, obstacles in the marine environment can represent a risk which varies according to the factors listed in **Table 24** (following Wilson *et al*. (2007)).

Table 24 Risk factors for marine mammal collision or entanglement

Risk Factor	Notes
Species	Of the large whales, right whales have limited ability to control their buoyancy which increases their susceptibility to collision. Seals and dolphins are typically highly manoeuvrable and capable of rapid turns to avoid obstacles.
Size	Generally, it is assumed that the larger the animal the less able it is to manoeuvre through spatially restricted areas. Also, most large marine mammals are accustomed to deeper offshore environments where exposure to obstacles is relatively infrequent.
Sensory Perception	Dolphins and toothed whales navigate by echolocation. The mechanism for navigation in baleen whales is not well understood; however, the use of low frequency sounds is a possibility and navigation abilities are highly refined.

Risk Factor	Notes
Age	Young animals may not recognise an obstacle as a threat, whilst old animals may have compromised abilities to detect the threat or escape from it once perceived.
Health	As with old animals, diseased animals may have compromised abilities to detect and/or escape from threats.
Behaviour	Marine mammals can be curious, and seals and dolphins in particular often approach unfamiliar objects.
Population Density	Probability dictates that the greater the density of animals in an area, the greater the chance of collision.
Oceanic Conditions	Turbidity may affect the ability of some marine mammals to visually detect obstacles, and high current flow rates can increase collision rates. Anthropogenic sounds may also affect echo-locating abilities.
Nature of Obstacle	Solid, stationary obstacles are more easily detected by echolocating marine mammals as they have higher acoustic reflectivity. Proximity and relative orientation to other objects can affect escape options.

Collisions of marine mammals are typically associated with ships as discussed in **Section 7.2.9.2.1** and entanglements of New Zealand marine mammals are typically associated with fishing methods that use ropes/lines and or nets (Laverick *et al.*, 2017). In particular, the use of a jack-up MODU during the Kupe Phase 2 Development Drilling Programme will eliminate the need for mooring lines, thereby reducing the risk of entanglement. The legs of the MODU will be solid and highly detectable by marine mammals. Beach notes that no collisions or entanglements of marine mammals with the Kupe WHP structures have been reported since 2007.

It is recognised that noise from support vessels may affect marine mammals during MODU installation and removal; this effect is discussed in detail in **Section 7.2.9**.

Consequence – Although there is potential for displacement of larger cetaceans by the physical presence of the MODU, the consequence of this is considered to be *negligible* due to the highly localised area of the displacement (i.e. < 1 km^2) in comparison to the vast home ranges of most marine mammals, the availability of alternative habitat in surrounding waters, and the temporary nature of any displacement (i.e. up to 95 days per well). Collision and entanglement effects are also predicted to be *negligible* as the legs of the MODU are solid, detectable structures.

Likelihood – Adverse effects on marine mammal populations are considered to be *rare* from the installation, removal and physical presence of the MODU because effects would only occur at an individual level and threatened species are not routinely expected in close proximity to the Kupe WHP.

As the consequence of effects from the installation and removal of the MODU on marine mammals is *negligible*, and the likelihood is *rare*, the environmental risk of adverse effects occurring is assessed as ***negligible***, and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Installation and removal of MODU – effects on marine mammals	0 – Negligible *Highly localised, short term and temporary*	2 – Rare *May occur but only in exceptional circumstances*	0 – Negligible	Negligible

Seabirds

Although seabirds are not generally considered a pelagic species, the potential effects from the presence of the MODU on seabirds are included here due to their use of the upper parts of the water column for feeding, and also the sea surface for resting. In addition, the presence of the MODU may result in interactions with seabirds through bird strike or disorientation from the lighting at night.

Consequence – The installation of the MODU is not considered to result in potential effects on seabirds (due to the primarily benthic effects from this activity); therefore, the following discussion focuses on the presence of the MODU. Effects resulting from the presence of the MODU may be positive or negative.

Examples of positive effects include the attraction and concentration of prey in the immediate vicinity of the MODU or provision of roosting refuge at sea (Wiese *et al.*, 2001). Seabirds are highly visually oriented animals (Merkel, 2010), and are known to be attracted to offshore structures such as MODUs due to structural stimuli, increased concentrations of food, oceanographic processes, and lights and flares (as referenced in Wiese *et al.*, 2001). Authors have recorded densities from seven times (e.g. Tasker *et al.*, 1986; Baird, 1990) up to 19-38 times (Wiese & Montevecchi, 2000 in Wiese *et al.*, 2001) greater around platforms than surrounding waters.

MODUs are large, highly visible structures with the visibility at night being further enhanced by lighting onboard the MODU, and hydrocarbon flaring during well testing. Seabirds that forage at night on bioluminescent prey, such as storm petrels and other birds from the order procellariformes, are naturally attracted to light sources, with attraction further enhanced by fog, haze or drizzle (Wiese *et al.*, 2001). Attracted and disoriented seabirds may fly into the MODU leading to injury or death. Documented mortalities of this kind have been higher during migration periods when large numbers of birds are forced to a lower flight path or to the sea surface by inclement weather (Crawford, 1981).

Merkel (2010) reported on bird strikes in coastal and offshore waters off Southwest Greenland, an area of international importance to wintering seabirds, and found 76% of events to occur within 4 km from land. This could be considered a mitigating factor due to the distance of the Kupe Phase 2 Development Drilling Programme from the shore, i.e. approximately 30 km from shore to the Kupe WHP where the drilling will occur.

Some species may be displaced from their feeding habitat through avoidance of the MODU and disturbance from approaching support vessels (Ronconi *et al.*, 2015). Seabirds have been shown to respond to vessel traffic by avoidance of heavily used areas and disruption of feeding behaviours (Schwemmer *et al.*, 2011; Velando & Munilla, 2011). The effects of displacement are considered to be insignificant on account of the extremely small area of potential displacement compared to the wider surrounding habitat, the temporary nature of displacement, and the plentiful amount of alternative habitat in which there are no obstructions.

Due to the highly localised area of potential impact (i.e. < 1 km^2), and the temporary nature in which these impacts will occur, it is considered that there are *negligible* consequences to seabirds from the installation, presence, and removal of the MODU.

Likelihood – Operators within the Taranaki Bight have recorded low incidents of interactions with seabirds; for example, since 2015 OMV New Zealand Limited (previously Shell Todd Oil Services Limited) has reported one unidentified dead petrel on the Māui-B platform (Thompson, 2017). Seabird mortality as a result of a collision may be under-reported as it is unknown how many birds are killed but not recovered. Based on this, collisions between seabirds and the MODU, or disorientation of seabirds from MODU lighting has been assessed as *rare*.

As the consequence of impacts from the installation, presence, and removal of the MODU on seabirds is *negligible*, and it is considered a *rare* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Installation and presence of MODU – effects on seabirds	0 – Negligible *No predicted adverse effects to populations*	2 – Rare *May occur, but only in exceptional circumstances*	0 – Negligible	Negligible

Fish

Aggregations of fish around offshore platforms have been demonstrated during a number of studies, including Fabi *et al.* (2004) who observed higher fish species richness and diversity surrounding two gas platforms within the first year after installation. In addition, artificial structures are used as fish aggregation devices throughout many regions (Pollard, 1989).

It is worth noting that the MODU will be positioned alongside the Kupe WHP to undertake the proposed drilling, hence, the jacket structure of the platform already acts as a fish aggregation device at this location.

Consequence – It is unlikely that the MODU will attract significantly more fish to the area due to the short-term duration the MODU will be in place (i.e. up to 95 days for each well drilled) and the fact that the Kupe WHP is already in place, effectively acting as an existing fish aggregation device. Any potential adverse effects associated with this aggregation are assessed as being *negligible*.

Likelihood – The likelihood of any additional adverse effects on fishes from the installation, presence, or removal of the MODU have been assessed as *remote* due to the current scenario (i.e. with the existing Kupe WHP in place) already acting as a fish aggregation device and any additional adverse effects are extremely unlikely, but theoretically possible.

As the consequence of effects from the installation and presence of the MODU on fish is *negligible*, and it is considered a *remote* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Installation and presence of MODU – effects on fish	0 – Negligible *No predicted adverse effects to populations*	1 – Remote *Extremely unlikely but theoretically possible.*	0 – Negligible	Negligible

7.2.4.2.2 Benthic Environs

Benthic Communities

Consequence – Benthic infauna communities and epifauna communities, including invertebrates, benthic fish (i.e. flatfish), and octopuses, are most likely to be affected by the installation of a MODU via the mortality of individuals in the specific location of the placement of the spudcans due to crushing. This is more likely for sessile and immobile species and will temporarily displace adjacent mobile species.

Permanent platforms associated with oil and gas activities with structures acting as artificial reefs, adding hard substrate for colonisation and acting as 'stepping stones' in an otherwise soft sediment environment (Macreadie *et al.*, 2011) if they remain for a long period of time. This is expected to be the case with the existing Kupe WHP. However, due to the timeframes proposed for the Kupe Phase 2 Development Drilling Programme, it is not expected that significant benthic communities, protected species, or sensitive environments will colonise the legs of the MODU and therefore would not be affected by the presence of the MODU[24] over what is currently exhibited by the existing Kupe WHP.

Sediment resuspension will also occur as a result of MODU installation and removal. Sediment suspension and the subsequent deposition of sediments can also affect benthic biota by clogging feeding apparatus, influence respiration rates, burying individuals and modifying sediment size characteristics which can influence the habitability of an area for some species (Hewitt and Pilditch 2004, Trannum *et al*. 2010, 2011, Tjensvoll *et al*. 2013). These impacts can reduce the fitness and condition of biota, modify community structure and in some cases may result in mortality (Norkko *et al*. 2002; Trannum *et al*. 2010, 2011).

Any disturbance to the seabed will only occur in the immediate footprint of the spudcans on the base of the legs of the MODU, which equates to a maximum area of disturbance of 960 m^2 if a four-legged jack-up MODU were used and 720 m^2 if a three-legged MODU is used. In addition to this, should soft-pinning be required, this disturbance could double, depending on the number of legs required for this soft-pinning operation, therefore equating to up to 1,920 m^2.

Depressions remaining in the seabed will recover following the removal of the MODU due to the surrounding currents and biological activity. Given the highly localised and temporary nature of these impacts, it is considered that the consequence of the installation, presence and removal of the MODU on benthic communities will be *negligible*.

Likelihood – The likelihood of effects has been assessed as *certain* as these types of effects are expected to occur in most circumstances.

As the consequence of effects from the installation of the MODU on benthic environs is *negligible*, and it is considered *likely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Installation and presence of MODU – effects on the benthic environment	0 – Negligible *Highly localised effect (< 1 km²), affecting less than 1% of original habitat area*	6 – Certain *Is expected to occur in most circumstances and has a history of occurrence.*	0 – Negligible	Negligible

[24] The potential biosecurity effects that could arise by virtue of the MODU being present in the IAA are dealt with in **Section 7.8.4**

7.2.4.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from the installation, presence, and removal of the MODU:

- The MODU will only be on location as a part of the Kupe Phase 2 Development Drilling Programme temporarily;
- All food waste will be comminuted before being discharged overboard to avoid attracting seabirds; and
- Various measures will be implemented to minimise potential adverse effects on seabirds from nocturnal (night-time) lighting utilised on the MODU (and other support vessels), including:
  - Deck light use will be limited to the minimum time and illuminated areas required for safe operations;
  - Deck lights will be directed downwards onto work areas and shielded where practicable to reduce peripheral light emissions;
  - Deck lighting will be mounted as low as possible to minimise the illuminated area;
  - Where possible, deck lights will be directed away from reflective surfaces;
  - Search lights will only be used in emergencies;
  - Blinds or curtains will be kept drawn on all portholes and windows at night (where practicable);
  - Decks shall be kept as free from clutter and/or non-essential items as possible to reduce the entanglement and entrapment potential for seabirds that do become involved in a bird strike incident; and
  - Periodic reviews of on-board lighting and behaviour will be undertaken.

7.2.5 Drilling Operations

The drilled holes associated with the Kupe Phase 2 Development Drilling Programme will be up to 42 inches (107 cm) diameter at the top of the well (seabed), and down to a minimum of six inches (15.2 cm) diameter at the bottom of the well. This section focuses on the physical components of the drilling operations, including noise and vibrations. The potential environmental effects associated with the deposition of drill cuttings are presented in **Section 7.2.6**.

The vibrations from the drilling activity have the potential to affect the biological environment, particularly on receptors in the pelagic (marine mammals, seabirds, fish, cephalopods) covered in **Section 7.2.5.2.1**, and benthic environments in **Section 7.2.5.2.2**. Seabirds have been included in the pelagic section due to their close ties with the pelagic environment in the IAA.

7.2.5.1 Area of Potential Impact

The area of potential impact for the physical component (including noise and vibration) of the drilling operations will depend on drilling and noise characteristics (such as intensity and duration), bathymetry of the area, and traits of the organism/s being potentially affected.

For benthic organisms, direct physical impacts of drilling will not occur as the drilling associated with the Kupe Phase 2 Development Drilling Programme will occur within the existing conductor slots at the Kupe WHP (i.e. there is no physical disturbance of the drill bit outside of these existing conductors).

Offshore drilling can produce nearly continuous noise at predominantly low- to mid-frequencies, where low-frequency noise has long-range propagation as it experiences little attenuation, while medium frequencies have a limited propagation due to greater attenuation. Noise generated by well construction and drilling activities will alter the ambient noise levels in the marine environment (as a result of well construction, and operation of compressors and other ancillary equipment), although such noises are expected to be localised and will only affect the ambient environment for the duration of the drilling period.

Equinor (2019) indicated the underwater sound levels from drilling to be 157 – 162 dB re 1µPa at 1 m SPLrms; however, Equinor (2019) did not consider the potential impacts from the drilling further as the sound generated by the MODU thrusters were one of the dominant sound sources during the drilling operations associated with that study. These underwater sound levels identified by Equinor (2019) from drilling are considered further in relation to this consent application as the MODU utilised for the Kupe Phase 2 Development Drilling Programme will not produce the same thruster noise as was seen in the Equinor (2019) study.

The area of potential impact from the drilling operations itself will be dependent on the species which are subjected to the noise; as such, further discussion on this area of potential impact is included within the following sections relating to the respective receptors.

7.2.5.2 Potential Effects

Noise is generated during all phases of oil and gas exploration and may be continuous or impulsive. Most noise sources associated with oil and gas activities can be broadly classified as noise originating from machinery, propellers, hydrodynamic excitation of structures (turbulent flow), and/or impulsive sound (explosives) (Parsons *et al.*, 2004). Underwater machinery noise is the result of mechanical vibrations that enter the sea through the MODU's hull (Parsons *et al.*, 2004); therefore, the design and construction of the MODU in combination with local oceanographic conditions will affect the path of the sound into the water column and the level of transmission (Parsons *et al.*, 2004).

Noise radiated by a platform may depend on a number of factors such as size and shape of its underwater surfaces, construction materials, structural configuration, type of machinery and power, the machinery coupling to structure, machinery operating speeds, and muffling of engine exhausts (Gales, 1982). In general, the larger the surface area in contact with the water, the more noise an object will transmit. For this reason, semi-submersible MODUs transmit more noise into the water column than jack-up MODUs, but MODUs operating in open-water conditions will easily transmit sound (Parsons *et al.*, 2004).

7.2.5.2.1 Pelagic Environs

Marine Mammals

Underwater noise will arise from several of the planned activities associated with the Kupe Phase 2 Development Drilling Programme, these being: 1) noise generated from drilling; and 2) noise generated from the use of DP by support vessels. The potential effects associated with drilling noise are discussed here, and the potential effects associated with DP use by the support vessels are addressed in **Section 7.2.9**.

Marine mammals produce sound not only for communication with conspecifics (e.g. Quick & Janik, 2012), but also for foraging, navigation, reproduction, parental care, avoidance of predators, and to gain an overall awareness of the surrounding environment (Thomas *et al.*, 1992; Johnson *et al.*, 2009). Toothed whales and dolphins use echolocation to forage and navigate, whilst all marine mammals use passive listening to gather useful navigational cues (e.g. the sound of waves breaking on coastline etc.). Therefore, underwater noise generated by human activity (e.g. shipping, seismic surveys, drilling, construction/decommissioning of facilities, coastal development etc.) has the potential to impact marine mammals. Effects are typically perceptual, behavioural, or physical.

<u>Perceptual Effects</u>

The main perceptual effect is auditory 'masking' of important biological sounds (i.e. the reduced ability of marine fauna to perceive natural acoustic signals used by conspecifics for communication, navigation, predator avoidance, foraging etc.) (e.g. Erbe & Farmer, 2000). Marine mammals must be able to perceive and effectively respond to biologically important sounds. Anthropogenic noise can interfere with the perception of these sounds. Such interference is referred to as 'masking'. The likelihood of masking is determined by how much overlap occurs between the frequency of animal vocalisations and the frequency of anthropogenic sounds (Richardson *et al*., 1995). Low frequency noises (e.g. engine noise from large ships) are more likely to lead to masking as these noises travel more readily through water than high frequency noises. These low frequency noises typically impact baleen whales that predominantly use low frequency sounds to communicate (Simmonds *et al.*, 2004).

Even activities that emit relatively low intensity underwater noise can cause masking, but the biological significance of any effect will largely depend on the significance of the habitat affected and the duration of the effect, where ongoing masking in habitats of high importance having the greatest ecological significance. However, some species are known to counter effects of masking by changing their vocalisation behaviour to compensate. For example, with increasing ambient noise right whales increased the frequency of their vocalisations (Parks *et al*., 2007), bottlenose dolphins increased calling rate (Buckstaff, 2004) and killer whales increased call durations (Foote *et al.,* 2004).

<u>Behavioural Effects</u>

The main behavioural effects observed in response to underwater noise are the interruption of behavioural patterns (e.g. feeding, breeding, migrating, or resting) (e.g. Finneran *et al*., 2000) and the displacement from habitat (e.g. Thompson *et al*., 2013). Temporary avoidance is the most commonly reported behavioural response by marine mammals in the vicinity of high intensity acoustic disturbance (Stone & Tasker, 2006); however, some species appear to be attracted to low/medium intensity disturbance (e.g. Wursig *et al.*, 1998; Simmonds *et al*., 2004). Avoidance behaviours may culminate in marine fauna being displaced from habitat and detrimental effects could be expected if this displacement occurs from optimal habitat in the long-term.

New Zealand fur seals are known to be present at the Kupe WHP; however, pinnipeds are not as sensitive to underwater noise as whales and dolphins as they are an otariid and have small ear flaps, which have muscles and a cartilage valve along the external ear canal function to close the ear canal to water (Southall *et al.,* 2007); hence, they are expected to tolerate and habituate to anthropogenic noise more readily.

<u>Physical Effects</u>

Potential physical effects to marine mammals from underwater noise include physiological stress responses (e.g. Romano *et al*., 2004), organ damage (Cox *et al.*, 2006), and permanent or temporary hearing loss (DOC, 2013; Lucke *et al*., 2009). However, the sound intensity (energy levels, frequencies and duration) required to produce these physical effects is unknown for most marine fauna (Richardson *et al.*, 1995), but NMFS (2018) provide recent estimates of noise thresholds required to elicit hearing damage: permanent threshold shift (**PTS**) and temporary threshold shift (**TTS**). Physical damage to date has only been associated with very high intensity underwater noise such as military sonar (Cox *et al.*, 2006; Ketten, 2014). Most mobile species, if given the opportunity, are thought to avoid the range in which physical effects occur.

<u>Assessing Effects of Noise on Marine Mammals</u>

Whether or not an effect will occur, and the magnitude of any effect depends on a suite of factors, including noise characteristics (frequency, volume, intensity, duration etc.), bathymetry (water depth, seabed gradient etc.), and species and life history stage (Simmonds *et al*., 2004). Detrimental impacts are generally greatest for marine mammals when:

- The frequency of the anthropogenic noise overlaps with the frequency of animal vocalisations resulting in masking (Erbe *et al*., 2016);
- The volume and intensity of the anthropogenic noise is high, and the duration is long (McGregor *et al*., 2013);
- The noise occurs in shallow or confined waters that provides habitat to resident animal populations with small home ranges (Forney *et al*., 2013);
- The marine mammal population is already of conservation concern (Weilgart, 2007); or

- Animals are subject to noise during periods of critical life history (e.g. breeding, feeding, resting, migrating etc.) (Dunlop *et al.,* 2017).

To assess the potential impacts of the noise generated by drilling operations during the Kupe Phase 2 Development Drilling Programme on marine mammals it is necessary to understand:

- The likely characteristics of the anthropogenic noise;
- The distribution of marine mammals in and around the proposed drilling location (see **Section 4.3.6**); and
- The relative importance of this area to them.

In general, marine mammal species that could be present in (**Table 25**) are those that utilise open water habitat and have large home ranges. The exception to this is Māui's/Hector's dolphins which are small coastal dolphins with a relatively small home range, but with extremely low population densities along the South Taranaki coast (Currey *et al.*, 2012; Roberts *et al.*, 2019). The species that are expected to have a likely or possible occurrence are listed in **Table 25** alongside the functional hearing group that they belong to.

Table 25 Functional hearing groups of marine mammals occurring within and around PML 38146

Common name	Marine mammal hearing group (NMFS, 2018)	Generalised Hearing Range (NMFS, 2018)	Likelihood of presence
Blue whale	Low Frequency (LF)	7 Hz to 35 kHz	Possible
Humpback whale	Low Frequency (LF)	7 Hz to 35 kHz	Possible
Southern right whale	Low Frequency (LF)	7 Hz to 35 kHz	Possible
Fin whale	Low Frequency (LF)	7 Hz to 35 kHz	Possible
Minke whale	Low Frequency (LF)	7 Hz to 35 kHz	Possible
Pygmy right whale	Low Frequency (LF)	7 Hz to 35 kHz	Possible
Common dolphin	Mid Frequency (MF)	150 Hz to 160 kHz	Likely
Killer whale	Mid Frequency (MF)	150 Hz to 160 kHz	Likely
Long-finned pilot whale	Mid Frequency (MF)	150 Hz to 160 kHz	Possible
Māui/Hector's dolphins	High Frequency (HF)	275 Hz to 160 kHz	Possible
New Zealand fur seal	Otariid Pinnipeds (OW)	60 Hz to 39 kHz	Certain

Noise during drilling operations originates from ground vibrations created at the interface between the drill head and the rock, mechanical vibration of the drill in the water, and that is transmitted from the drill platform. The only study that specifically measured the sounds produced by a jack-up MODU engaged in oil and gas drilling is Todd *et al.* (2020b) who measured the near-field sound pressure levels of the *Noble Kolskaya* operating at a 40 m water depth site in the North Sea. This study found that:

- The MODU produced sound pressure levels of 120 dB re 1 µPa in the frequency range of 2-1,400 Hz;
- Most sound is emitted below 100 Hz, but high frequency components up to 8 kHz were detected;
- The low frequency components were the highest recorded received levels, where the strongest median sound level densities noted were below 4 Hz;
- Received levels varied over short timeframes on account of variations in drilled substrate;

- A strong 2.8 Hz tonal (representing the rotation of the drill stem itself) was recorded at a received level of 141 dB re 1 µPa +/- 1 dB at ca. 60 m when hard rock formations were encountered;
- MODU sound pressure levels fell rapidly above 8kHz; and
- It was estimated that harbour porpoises (a high frequency cetacean) can detect the higher frequency components of drilling noise out to approximately 70 m from the source, but that drilling noise is unlikely to mask the sounds of this species used for foraging or communication.

Based on these findings, the loudest component of drilling noise expected from the Kupe Phase 2 Development Drilling Programme will be in the low frequency range, meaning that the effects of drilling noise are predicted to be greatest for low frequency baleen whales nearby. As outlined in **Section 4.3.6**, while the presence of baleen whales is possible in the vicinity of the proposed drilling operations, in the most part these species would be expected further offshore. Southern right whales, however, could be present in shallow coastal water during their winter breeding season.

While Todd *et al.* (2020b) does not make any measurements or predictions about the effects of drilling noise on baleen whales, these authors reported that the strongest sound components were < 4 Hz, which occurs below the generalised hearing range reported for baleen whales (**Table 25,** NMFS, 2018).

Information relating to baleen whale responses to drilling noise is very limited. Dahlheim (1987; as reviewed by Moore and Clark, 2002) documented gray whale response to playback recordings of drilling platforms and reported a 0.1 probability of avoidance for sounds between 110 and 120 dB re 1 µPa (rms), a 0.5 probability of avoidance for 117 – 123 dB re 1 µPa (rms) and a 0.9 probability for levels > 127 dB re 1 µPa (rms). Based on these findings, and in conjunction with the MODU noise measurements made by Todd *et al.* (2020b), strong baleen whale avoidance reactions would be predicted to occur within a few hundred metres of the source, with moderate avoidance possible beyond this. While avoidance behaviours could be energetically costly to whales, the benefit is that they serve to protect individual whales from physiological effects; hence PTS or TTS from drilling noise is not anticipated for baleen whales during the Kupe Phase 2 Development Drilling Programme. Along with avoidance behaviours, masking of baleen whale vocalisations around the MODU are likely given the overlap between their low frequency calls and drilling noise.

Effects on mid-frequency species (common dolphins and killer whales) are of limited concern as most drilling sound is emitted below 100 Hz which is outside the hearing range for these species (**Table 25**), and sound pressure levels of drilling noise fall rapidly at the higher frequencies which may overlap with the vocalisations of these species.

The species of interest to Todd *et al.* (2020b) was the harbour porpoise, a high frequency cetacean. This species provides an excellent proxy for the threatened Māui's/Hector's dolphins that could have a possible presence in the vicinity of the Kupe IAA, as both species belong to the same functional hearing group (**Table 25**). In particular, harbour porpoises are considered to be highly sensitive to underwater noise, so are routinely used as a reference species from which the potential effects on other high frequency cetaceans are inferred (Southall *et al.*, 2019). The highest received levels of drilling noise measured by Todd *et al.* (2020b) occurred below 100 Hz, i.e., well below the generalised hearing range of Māui's/Hector's dolphins (**Table 25**). While high frequency components up to 8 kHz were measured by Todd *et al.* (2020b), the amplitude (volume) of sound at < 500 Hz was substantially lower. In relation to harbour porpoises, these authors concluded that higher frequency components of drilling noise would be detected out to approximately 70 m from the source, but that drilling noise was unlikely to mask echolocation clicks or sounds used for communication. Based on these findings, it is likely that the detection range and predicted effects for Māui's/Hector's dolphins from the proposed Kupe Phase 2 Development Drilling Programme will be similar: i.e., the noise will be audible in close proximity to the MODU, but no hearing damage is expected, and masking is unlikely.

While it is important to assess the noise from drilling on marine mammals, drilling noise must be considered in the context of associated operational noises, where Todd *et al.* (2020b) found that noise levels from support vessels were generally 20 dB higher than any levels measured from MODU operations alone within the 25 Hz to 1 kHz frequency band; but that drilling levels were higher at lower frequencies. While the sound profile from the jack-up MODU as described by Todd *et al.* (2020b) is of high relevance to the Kupe Phase 2 Development Drilling Programme, this study highlights that vessel noise typically represents the loudest and most pervasive auditory component associated with a drilling programme. A thorough description of the potential noise effects from support vessels is presented in **Section 7.2.9**.

While hearing damage to marine mammals is not anticipated from drilling operations during the Kupe Phase 2 Development Drilling Programme, it is possible that some marine mammals in the immediate vicinity of the MODU may be subject to masking, and minor behavioural changes (e.g. temporary displacement) as a result of drilling noise; however, these effects are unlikely to be of ecological relevance to marine mammals on account of:

- The open water nature of the drill site which provides animals with ample opportunity to move away from the noise source into alternative habitat in the wider Taranaki region;
- The fact that no threatened species are solely reliant on habitat in the Kupe IAA;
- The short-term nature of the drilling activities (approximately 95 days on location per well, albeit the drilling activities will not be continuous over this time); hence any effects will be short-term/temporary in nature; and
- No detectable population effects are predicted.

Consequence – The effects on marine mammals from drilling operations will have a localised effect and any noise in the water column would stop as soon as drilling activity stops. The consequence is assessed as *minor* as some individuals of protected species may exhibit behavioural reactions or be subject to low level masking. No impact on their populations is predicted.

Likelihood – Effects of drilling operations on marine mammals have been assessed as *likely* to occur in close proximity to the MODU.

As the consequence of effects from the drilling operations on marine mammals is *minor*, and it is considered *likely* to occur, the environmental risk of adverse effects occurring is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Drilling operations – effects on marine mammals	1 – Minor *Localised effect and effects will cease when drilling ceases*	5 – Likely *Will probably occur in normal circumstances*	5 – Low	Less than minor

Seabirds

Seabirds have been included in the pelagic section as this is considered the most appropriate location for their assessment due to their close ties with the pelagic environment in offshore areas for both food and migratory pathways.

Very little information exists about the effects of underwater noise on seabirds (Braun, 2016). In particular, no information exists on the potential effects of underwater drilling noise on birds. However, a small number of studies have investigated the effects of noise from seismic surveys on seabirds, which, in the absence of any drilling-related studies, are useful as an absolute worst-case scenario proxy for underwater drilling noise, on the basis that the noise from seismic surveys is typically much louder (i.e. 180 dB re 1 µPa at 200 m, as stated in Shell Taranaki Limited, 2018) than the noise generated from drilling (i.e. 117 dB re 1µPa at 125 m, as stated in McCauley, 1998). In addition, hearing sensitivity and hearing frequency range in birds is typically less than most mammals (Dooling *et al.*, 2000) and seabirds on the sea surface are afforded some protection from underwater noise on as noise levels at the surface are lower than those in the water column; a phenomenon known as the "Lloyd Mirror Effect" (Carey, 2009).

On account of their inability to fly, penguins could be somewhat more vulnerable to underwater noise than other seabirds. Pichegru *et al.* (2017), reported that African penguins sometimes avoided foraging near seismic surveys and that when avoidance occurred, foraging effort was displaced by up to 12 km. On this basis, it is possible that little penguins (the only penguin species expected in the STB) could avoid foraging in the immediate vicinity of the MODU when drilling is underway. However, if any avoidance occurs, it is predicted to be much less than that observed for seabirds during seismic operations on account of the lower source volume of drilling operations.

Consequence – The effects on seabirds from drilling operations (i.e. underwater noise) will be highly localised (<1 km^2) and short-term in nature. There are no predicted adverse effects to seabird populations, and any potential for effects would stop when drilling ceases. Therefore, consequence of noise on seabirds is considered to be *negligible*.

Likelihood – The likelihood of any effects occurring on seabirds from drilling operations is considered to be *rare* as they may occur, but only in exceptional circumstances. Flighted seabirds will be protected by the Lloyd Mirror Effect.

As the consequence of effects from the drilling operations on seabirds is *negligible*, and it is considered a *rare* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Drilling operations – effects on seabirds	0 – Negligible *Highly localised effects (< 1 km²), no predicted adverse effects to populations*	2 – Rare *May occur, but only in exceptional circumstances*	0 – Negligible	Negligible

Fish

Fish utilise sound for navigation and selection of habitat, mating, and communication (Bass & McKibben, 2003), and although fish lack an inner ear like mammals and birds, they have dedicated sound-detection organs or otoliths (Popper & Fay, 1993). On account of this underwater noise can elicit physiological, behavioural and perceptual effects in fish.

Observed physiological effects include increased stress levels (e.g. Santulli *et al*., 1999; Smith, 2004; Buscaino *et al*., 2010), temporary or permanent threshold shifts (e.g. Smith, 2004; Popper *et al*., 2005), and damage to sensory organs (McCauley *et al*., 2003). Fish will typically move away from a loud acoustic source if they experience discomfort, minimising their exposure and the potential for physiological effects (Vabø *et al*., 2002; Pearson *et al*., 1992; Wardle *et al*., 2001; Hassel *et al*., 2004; Boeger *et al*., 2006).

The presence or absence of a swim bladder in fish is a major factor in determining the susceptibility of fish to acoustic disturbances. Species with swim bladders or other gas-filled chambers are generally more sensitive to sound and more likely to suffer adverse effects. Popper *et al.* (2014) developed guidelines to predict the threshold levels at which underwater noise may cause physiological damage to fish. Using fish with a swim bladder as a worst-case scenario (i.e. the most sensitive fish hearing group), mortality and potential mortal injury is estimated to occur at levels greater than 207 dB re 1 µPa. Source levels of 142-145 dB re 1µPa rms @ 1m (30 – 2000 Hz) for a jack-up MODU were measured by Erbe & McPherson (2017) for a geotechnical drilling project off Western Australia. While oil and gas drilling may produce slightly higher source levels (i.e. Todd *et al.*, 2020b, documented sound pressure levels of up to 141 dB re 1 µPa +/- 1 dB at ca. 60 m from a jack-up MODU) exceedances of the injury threshold for fish are not expected during the Kupe Phase 2 Development Drilling Programme.

In general, there is little evidence of long-term behavioural disruption in fish due to underwater noise. In contrast, short-term responses are relatively common, and include startle responses (Pearson *et al*., 1992; Wardle *et al*., 2001; Hassel *et al*., 2004; Boeger *et al*., 2006), modification in schooling patterns and swimming speeds (Pearson *et al*., 1992; McCauley *et al*., 2000; Fewtrell & McCauley, 2012), freezing (Sverdrup *et al*., 1994), and changes in vertical distribution within the water column (Pearson *et al.,* 1992; Fewtrell & McCauley, 2012). Although studies to date do not yield completely coherent results, they suggest that fish may stop foraging and start swimming down the water column (Slabbekoorn *et al*., 2019), although Hassel *et al.* (2004) found evidence of habituation to underwater noise through time based on a decrease in the degree of startle response.

Many fish species produce sounds for communication, with vocalisations typically within a frequency band of 100 Hz to 1 kHz (Ladich *et al*., 2006; Bass & Ladich, 2008). While there have been no studies into the masking of fish communications by drilling noise, boat noise has reportedly caused masking in some species (e.g. Picciulin *et al*., 2012).

Consequence – Based on the above, noise and vibrational effects on fish from drilling operations will be highly localised (<1 km²) and short-term in nature (the effects will cease as soon as drilling ceases). As a result, the consequence of noise and vibrational effects on fish is considered to be *negligible*.

Likelihood – While no physiological effects are expected, the likelihood of behavioural and masking effects on fish is assessed as *possible*. Although effects could occur at some time, as commonly seen around the world, and in New Zealand, most fish are generally attracted to MODUs. Schooling pelagic fish are commonly observed surrounding the existing well head platforms and FPSOs in the Taranaki Basin. This indicates that noise and vibrations involved with the running of these facilities do not displace fish permanently from surrounding areas.

As the consequence of effects from the drilling operations on fish is *negligible*, and it is considered a *possible* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Drilling operations – effects on fish	0 – Negligible *Highly localised effects (< 1 km²), no predicted adverse effects to populations*	4 – Possible *Could occur at some time*	0 – Negligible	Negligible

Cephalopods

All cephalopods have a pair of statocysts located within the cephalic cartilage (Solé *et al*., 2019) which act to regulate cephalopod behaviour such as locomotion, posture, balance, and movement in the water column (Young, 1989). Controlled exposure experiments have been undertaken on captive cephalopods to determine possible physiological effects of underwater noise. André *et al* (2011) exposed four species of cephalopod (two squid and two octopuses) to low-frequency sounds with SELs up to 175 dB re 1µPa^2-s. All exposed animals exhibited similar changes to the sensory hair cells of the statocysts, with damage gradually becoming more pronounced in animals continuously exposed to the noise source for up to 96 hours (André *et al*., 2011).

The response of octopuses and squid to sound stimulus differs on account of their differing lifestyle; as squid are pelagic species, they respond by exhibiting avoidance behaviours, while octopuses have a generally benthic lifestyle and respond to threats by freezing in place (Packard *et al*., 1990). Kaifu *et al.* (2007) investigated the effects of sound on the octopus *Octopus ocellatus* and showed that respiration rates were suppressed during periods of exposure to low-frequency sound.

Behavioural changes in response to acoustic disturbance have been documented for cephalopods, including firing of ink sacks, avoidance behaviours, increases in swimming speed, and shifts in metabolic rates (Weilgart, 2018). However, these responses have typically been recorded in studies focusing on seismic surveys, which emit much more intense and explosive sounds compared to drilling activities.

Caged cephalopods exposed to acoustic sources demonstrated a startle response above 151 – 161 dB re 1 µPa and tended to avoid the acoustic disturbance by exhibiting surface behaviours (McCauley *et al*., 2000). The authors suggested that thresholds affecting squid behaviour occur at 161 – 166 dB re 1 µPa rms. Fewtrell and McCauley (2012) further demonstrated that a source level of 147 dB re 1 µPa was necessary to induce an avoidance reaction in squid. Fewtrell and McCauley (2012) observed other reactions, including alarm responses (such as inking and jetting away from the source), increased swimming speed and aggressive behaviour. The authors found that there was an increase in the alarm response from the squid as the acoustic release noise levels increased beyond 147 – 151 dB re 1 µPa SEL. The reaction of the animals decreased with repeated exposure to the acoustic source suggesting either habituation or impaired hearing (Fewtrell & McCauley, 2012).

Source levels of 142-145 dB re 1µPa rms @ 1m (30 – 2000 Hz) for a jack-up MODU were measured by Erbe & McPherson (2017) for a geotechnical drilling project off Western Australia. While oil and gas drilling may produce slightly higher source levels (i.e. Todd *et al.*, 2020b, documented sound pressure levels of up to 141 dB re 1 µPa +/- 1 dB at ca. 60 m from a jack-up MODU) exceedances of the startle and behavioural thresholds for cephalopods are not expected during the Kupe Phase 2 Development Drilling Programme. It is, however, possible that some avoidance may occur.

Inshore octopuses that could be present around the Kupe WHP are typically solitary and demersal. While it is possible that octopuses could be subject to some effects from underwater noise, no population level effects are anticipated. The pelagic lifestyle of squid mean that they can readily move away from the highest sound levels close to the acoustic source and avoid physiological damage.

Consequence – Noise and vibrational effects on cephalopods from drilling operations will be highly localised (<1 km^2) and short-term in nature. No adverse population effects are predicted. As such, the consequence of noise and vibrational effects on cephalopods is considered to be *negligible*.

Likelihood – The likelihood of any effects (e.g. avoidance behaviour) on cephalopods from noise and vibration from the drilling operations is assessed as being *unlikely*.

As the consequence of effects from the drilling operations on cephalopods is *negligible*, and it is considered an *unlikely* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Drilling operations – effects on cephalopods	0 – Negligible *Highly localised effects (< 1 km^2), no predicted adverse effects to populations*	3 – Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

7.2.5.2.2 Benthic Environs

As the proposed drilling will occur through the existing conductors at the Kupe WHP, the direct mortality of sessile and slow-moving organisms through crushing by the drill bit will not occur.

Recently there has been much focus in the effects of underwater noise exposure to invertebrate species of commercial interest. However, studies have largely focussed on effects of seismic surveys which use a much higher source level than that which will be expected from drilling operations (260 vs 142-145 dB re 1µPa rms @ 1m; Hildebrand, 2009; Erbe & McPherson, 2017). It is noteworthy that even following such exposure to high intensity underwater noise levels, no evidence of increased mortality was documented for scallops (Parry *et al.*, 2002; Harrington *et al.*, 2010), clams (La Bella *et al.*, 1996), or lobsters (Payne *et al.*, 2007; Day *et al.*, 2016), neither were there mortality-associated population effects such as reduced abundance in reef-associated invertebrates (Wardle *et al.*, 2001), snow crabs (Christian *et al.*, 2003), shrimp (Andriguetto-Filho *et al.*, 2005), or lobsters (Day *et al.*, 2016). However, some physiological and behavioural effects were noted, including damaged statocysts in rock lobsters, and scallops exposed to seismic displayed a distinctive flinching response, an increase in burial rate and being slower at righting themselves than control scallops. (Day *et al.*, 2016).

While benthic organisms exposed to high levels of sound (e.g. seismic surveys) can experience some physiological and behavioural effects (see Carroll *et al.*, 2017; Day *et al*., 2016), these effects are not predicted from drilling operations because: 1) the sound pressure level of the source will be much lower; and 2) the seabed surrounding the location of the wells is composed of relatively soft substrate which absorbs sound and vibrations (Hamilton, 1976). Therefore, any noise or vibrations generated from drilling during the Kupe Phase 2 Development Drilling Programme are not predicted to propagate laterally away from the well bore at the seabed to any great extent and sound levels at the seabed are predicted to be relatively low with no significant adverse effects to benthic invertebrates anticipated. Once the drilling activities and any associated noise and/or vibrations have ceased, recolonisation by opportunistic species will commence.

Consequence – The effects on the benthic environment from the physical aspect of the drilling operations will be highly localised (<1 km^2). No mortality or population effects are predicted. Therefore, the consequence of noise and vibration effects on the benthic biological environment is considered to be *negligible*.

Likelihood – The likelihood of any effects on the benthic environment and associated communities from drilling operations, including from the generation of noise and vibrations, is assessed as being *rare*.

As the consequence of effects from the drilling operations on the benthic environment is *negligible*, and it is considered a *rare* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Drilling operations – effects on benthic environment	0 – Negligible *Highly localised effect, no predicted adverse effects to populations*	2 – Rare *Noise effects on benthic invertebrates may occur, but only in exceptional circumstances*	0 – Negligible	Negligible

7.2.5.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from the drilling operations will be in place during the Kupe Phase 2 Development Drilling Programme:

- Drilling will occur through existing conductor slots at the Kupe WHP which will limit the spatial extent of disturbance to the seabed to the minimum required in order to complete the operations; and
- Drilling operations will be undertaken in the shortest amount of time possible, whilst taking all practicable steps to minimise the risk of harm to personnel and the environment.

7.2.6 Release of Drill Cuttings

All of the drilling will occur within the existing conductors at the Kupe WHP, meaning all the cuttings are transported up to the MODU where they are separated from the drilling fluids to allow the reuse of those fluids with any remaining cuttings being sent overboard – that is, there will be no discharge of drill cuttings directly onto the seabed, all the cuttings will be discharged to the surface of the sea where they will disperse and sink through the water column to the seabed.

7.2.6.1 Area of Potential Impact

Drill cuttings will be discharged to the sea surface where they disperse and sink through the water column and ultimately settle on the seabed. Therefore, there are two primary areas of potential impact associated with the release of drill cuttings: 1) pelagic (water column); and 2) benthic (seabed).

The pelagic area of potential impact (**Section 7.2.6.1.1**) is primarily associated with the dispersion of sediment in the water column from the release of drill cuttings resulting in an increase in TSS concentration. There is also an epibenthic potential area of impact that is associated with increased TSS concentrations in the benthic boundary layer[25] at the seabed. This epibenthic potential area of impact is dealt with here as a pelagic impact to pelagic species other than primary producers such as epibenthic and demersal species of fish, cephalopods, foraging marine mammals and some zooplankton.

The primary impact associated with the dispersion of drill cuttings is their subsequent deposition on the seabed and associated benthic effects which is described in **Sections 7.2.6.2.2**.

7.2.6.1.1 Pelagic Area of Potential Impact

The area of potential impact on the pelagic environs from the release of drill cuttings primarily relates to the increase in TSS concentrations in the surrounding water column as a result of sediment plumes. However, the intensity and scale of the impacts on the pelagic environment from sediment plumes created by drill cuttings are contingent on the residency time[26] of the plume in the water column and the subsequent duration of the exposure of marine species to elevated TSS concentrations.

A set of TSS concentrations and associated residency times (**Table 26**) were adopted as indicators of sediment plume characteristics that could cause impacts (i.e. acute/chronic and lethal/sub-lethal) to the pelagic environment. The adopted TSS concentrations and their residency times around the Kupe WHP were modelled (**Appendix B**) for two scenarios: 1) initial planned well drilling; and 2) initial planned well drilling and re-spud scenario. Each of the two model scenarios were used to predict the depth-averaged area of the sediment plume that equalled and exceeded each of the TSS concentrations and associated residency times and the maximum distance from the Kupe WHP that such exceedances are predicted to occur. The figures contained within **Table 26** highlight the TSS concentrations and associated residency times for the initial planned well and re-spud scenario as a worst-case assumption – that is, the maximum areas and distances predicted from the model are presented.

[25] The benthic boundary layer constitutes the part of the water column that is directly influenced by the presence of the sediment–water interface.
[26] The length of time that a level of TSS concentration will be present in a quantity of water.

Each impact area represents the maximum area of water column that would, on average, contain greater than or equal to the given TSS concentration at the specified residency time. An added worst-case assumption was built into the calculation of the impact areas as they do not represent continuous residency times of the given TSS concentrations, but additive exposure over 100 simulated drill cutting release events. This means that the TSS concentration and residency time in any single square metre of an area of impact would have been equalled and exceeded in an episodic manner over the 100 simulations and not continuously. This is an important consideration in relation to pelagic impacts as the level of impacts associated with the parameters in **Table 26** are representative of impacts that occur after continuous exposure to elevated TSS concentrations not intermittent exposure. Given the worst-case principles that are inherent in the drill cutting modelling it is considered appropriate to use the impact areas in **Table 26** as representative approximations of the potential impacts of the drilling.

Table 26 TSS concentrations and associated residency times with the maximum predicted impact area and distances for the initial and re-spud scenario

TSS concentration (mg/L)	Exposure Duration (days)	Maximum Depth-averaged Impact Area (km^2)	Maximum Distance from Discharge Area (km)	Impact Description
2*	7	0.015	0.1	Impact threshold criterion for chronic impacts to fish larvae and zooplankton (sub-lethal impacts)
5**	1	0.0037	0.1	Impact threshold criterion for acute impacts (sub-lethal behavioural and physiological) on pelagic species
5**	7	0.0037	0.04	Impact threshold criterion for chronic impacts (sub-lethal behavioural and physiological) on pelagic species
25**	1	0.0037	0.04	Impact threshold criterion for acute impacts (some lethal impacts possible, primarily sub lethal impacts) on pelagic species

Source: * Joint Witness Statement for the Effects of the Chatham Rock Phosphate Application (EEZ000006) on Fish (2014).
** CWQG, 2003.

TSS Thresholds

The ANZECC (2018) guidelines do not provide any guidance for TSS thresholds and, as such, the Canadian Water Quality Guidelines were adopted as the best available information in respect of TSS thresholds for the purposes of this IA.

The Canadian Water Quality Guidelines for the Protection of Aquatic Life - Total Particulate Matter (CWQG, 2003) were adopted as the TSS concentrations and exposure times relevant to impacts on fish and primary producers for the purpose of this IA. These guidelines state that anthropogenic activities should not increase TSS concentrations by more than 25 mg/L over background levels (it is conservatively assumed that the background level TSS concentrations in the IAA are < 1 mg/L[27]) during any short-term exposure period (e.g. 24-hours). In addition, for longer term exposure (e.g. 30 days or more), average TSS concentrations should not be increased by more than 5 mg/L over background levels. It is noted that these guidelines were developed primarily for use in freshwater systems, but reference is made throughout the guidelines to the applicability of many of the parameters discussed to marine species.

Given that the IAA is located reasonably far from the coast, and the associated coastal sediment resuspension processes, it has been assumed that all pelagic taxa are relatively sensitive to TSS concentrations compared to their shallow water counterparts. As a result, the level of impact assumed to be commensurate with the TSS concentrations and residency times in **Table 26** will be higher than those described in the Canadian Water Quality Guidelines. This worst-case principal approach is adopted to account for the uncertainty around the sensitivity of fish and phytoplankton to sediment plumes in the IAA.

The TSS concentration and associated residency time relevant to fish larvae in **Table 26** was adopted from the most relevant existing literature (Joint Witness Statement for the Effects of the Chatham Rock Phosphate Application (EEZ000006) on Fish, 2014). These concentrations were also adopted as being relevant to impacts on zooplankton given that fish larvae are part of the zooplankton population at the stage in their life history cycle.

7.2.6.1.2 Benthic Area of Potential Impact

Previous decisions on marine consents (e.g. EEZ200010, EEZ200011) for similar drilling activities and other international studies have utilised a sediment deposition depth of 6.5 mm as a threshold for ecological effects on benthic communities (Smit *et al*., 2008; IOGP, 2016; SLR, 2019). The origin of this 6.5 mm threshold was investigated further and it appears two similar numbers are often used in the literature, namely 6.5 mm and a slightly more conservative value of 6.3 mm. Accordingly, the lower threshold of 6.3 mm has been used for the current application and has been used to consider ecological effects on benthic communities (infauna and epifauna).

Drill cutting deposition modelling (discussed in **Section 2.2.4.1**) was used to determine the depositional footprint of the drill cuttings, which has then been used to assess the extent of the impacts on environmental receptors (**Section 7.2.6.2**). The modelling adopted worst-case scenario assumptions such as a well re-spud being required. It is highly unlikely that a re-spud will be required for either of the two development wells, which makes using a deposition footprint that incorporates the added drill cuttings from a re-spud a worst-case assumption.

[27] The median surface TSS concentration is 0.4 mg/L and the median near seabed TSS concentration is less than 1 mg/L, as discussed in **Section 4.2.6**.

The deposition modelling was undertaken specifically for the Kupe WHP location, and using the 6.3 mm deposition threshold, the maximum distance from the well that 6.3 mm of deposition was predicted to occur was 0.3 km. The predicted worst-case depositional footprint covers an area of 0.12 km^2 based on this modelling scenario (with 0.081 km^2 being the more likely maximum area based on drilling just the initial development well without a re-spud, refer to **Table 6**).

7.2.6.2 Potential Effects

The discharge and deposition of drill cuttings has the potential to affect pelagic and benthic communities. The following sections assess these effects and presents the ERAs for both pelagic and benthic environs.

7.2.6.2.1 Pelagic Environs

Impacts on pelagic species are expected to be primarily sub-lethal and result in behavioural impacts such as avoidance or physiological impacts such as changes in histology or respiratory impairment. It is possible that some small bodied organisms or organisms that are in very close proximity to the drill cutting release source that become inundated by the resulting sediment plumes may be lethally impacted.

Primary Production

Consequence – Any impacts on primary producers (hereinafter referred to phytoplankton as no macroalgae are present in the IAA), that may arise from the sediment plumes produced by drill cuttings would largely be attributed to light reduction and subsequent limiting of photosynthesis.

With respect to the potential for lethal impacts on phytoplankton it is estimated that TSS plume concentrations would need to be greater than or equal to 25 mg/L for at least 24 hours (1 day) continuously. Based on the predicted area of impact associated with a 25 mg/L TSS concentration at 24 hours (**Table 26**) the worst-case scenario is that phytoplankton could be lethally impacted in an area of 0.0037 km^2.

Another important consideration is the transient nature of phytoplankton. Phytoplankton are transported by a combination of ocean, tidal and wind currents which are dynamic and high energy in both IAA. Therefore, it is unlikely that any phytoplankton would be present in any portion of the water column for long enough (24 hours) to be lethally impacted by a sediment plume.

Ultimately, even if it is assumed that the worst-case scenario the lethal impacts will occur, the impacts on phytoplankton in the IAA from drill cutting sediment plumes will be highly localised, temporary, and undetectable at the population level.

Sub-lethal impacts on phytoplankton will primarily arise from periodic reduction of light intensity in the water column which could influence phytoplankton productivity. This level of impact could be detrimental for the impacted individuals as it would be energetically costly for them to be deprived of ambient light levels during the daytime. These sub-lethal impacts could be acute (≤ 24 hours) or chronic (> 24 hours) and could arise at TSS concentrations in excess of 5 mg/L. The worst-case scenario impact area in **Table 26** associated with this range of TSS concentrations is 0.0037 km^2 (5 mg/L at 24 hours).

If it is assumed that the worst-case scenario impacts will occur, the overall sub-lethal impacts to phytoplankton at the population level in both IAA would be highly localised, temporary, and undetectable at the population level.

Given that both lethal and sub-lethal impacts of drill cutting sediment plumes on phytoplankton will be undetectable at the population level in both IAA the overall consequence is considered to be *negligible*.

Likelihood – Given the worst-case assumptions that have been built into the predictions on the impacts on phytoplankton the likelihood that phytoplankton would be impacted at the worst-case levels presented here is considered to be *unlikely*.

Given that the consequence of the impacts of drill cutting sediment plumes on phytoplankton will be *negligible* and that the scale of the effects described here is *unlikely* to occur the overall environmental magnitude of the environmental impact is assessed as being ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Discharge and deposition of drill cuttings – effects on primary productivity from increased turbidity	0 – Negligible *Increases in turbidity will be highly localised (<1 km²)*	3 – Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

Fish, Fish Larvae, and Zooplankton

Consequence – Potential impacts on fish, fish larvae and zooplankton that could arise from sediment plumes produced by drill cuttings would be varied in that they could be lethal or sub-lethal, acute or chronic, behavioural (in the case of mature fish), or physiological - or a combination.

With respect to the potential for lethal impacts on fish, fish larvae, and zooplankton it is estimated that TSS plume concentrations would need to be greater than or equal to 25 mg/L for at least 24 hours continuously. If any individuals are to be lethally impacted it is likely to be fish larvae and zooplankton as they cannot use avoidance behaviours (Anderson *et al*., 1998) and therefore their breathing apparatus may become blocked causing suffocation among other impacts (e.g. histological). Adult fish species can use avoidance behaviours and therefore will be able to move out of areas of the water column that pose lethal risks. However, it is possible that some individuals could be lethally impacted if they are present in the immediate vicinity of the discharge source and become inundated by sediment.

In terms of the scale of the potential lethal impacts to fish, fish larvae, and zooplankton via prolonged exposure to a sediment plume, based on the predicted area of impact associated with 25 mg/L TSS concentration at 24 hours, the worst-case scenario is that lethal impacts could occur an area of up to 0.0037 km^2.

Hydrodynamic conditions in the IAA are high energy and therefore it is unlikely that any fish, fish larvae, or zooplankton would be present in any portion of the water column for long enough (24 hours) to be lethally impacted by a sediment plume. Some fish larvae or zooplankton could be lethally impacted but impacts to populations of any impacted species of fish or zooplankton would be *negligible* given the very small area of potential impact.

Other potential impacts on fish, fish larvae, and zooplankton would be sub-lethal and could temporarily influence fish behaviour and physiology, and larval and zooplankton physiology. This level of impact could be detrimental for the impacted individuals as it would be energetically, and physiologically costly for them. These sub-lethal impacts could be acute (≤ 24 hours) or chronic (> 24 hours) and could arise at TSS concentrations in excess of 2 – 5 mg/L. The worst-case scenario sub-lethal impact area 0.015 km^2 which is associated with a TSS concentration of 2 mg/L at 7 days.

If it is assumed that the worst-case scenario impacts will occur, the overall sub-lethal impacts to fish, fish larvae, and zooplankton at the population level in the IAA would be highly localised, temporary, and undetectable. Given this, the overall consequence is considered to be *negligible*.

Likelihood – Given the worst-case assumptions that have been built into the predictions on the impacts on fish, fish larvae, and zooplankton the likelihood that these would be impacted at the worst-case levels predicted here is considered to be *unlikely*.

Given that the consequence of the impacts of drill cutting sediment plumes on fish, fish larvae, and zooplankton will be *negligible* and that the scale of the impacts described here is *unlikely* to occur, the overall environmental magnitude of the environmental impact is assessed as being ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Discharge and deposition of drill cuttings – effects on fish, fish larvae and zooplankton from increased turbidity	0 – Negligible *Increases in turbidity will be highly localised (<1 km^2)*	3 – Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

Marine Mammals

The seabed is important habitat for those marine mammal species that rely directly on benthic organisms as a primary source of food. For these species, disturbance to the seabed from cuttings deposition has the potential to affect the quality and availability of benthic prey which ultimately can affect the health of individuals and resilience of the populations that they belong to.

Of the marine mammal species that could possibly be present in the vicinity of the Kupe IAA, common dolphins, killer whales, long-finned pilot whales, Māui's/Hector's dolphins, and New Zealand fur seals are known to exploit benthic prey in offshore waters (see **Table 27**); however, none of these species rely solely on benthic prey nor the Kupe IAA for their food. Target prey species for marine mammals on the seabed are most likely to be large mobile epifauna (for example larger species of crabs and bivalves) that will be relatively tolerant of low levels of disturbance (Lohrer *et al.* 2004) or demersal fish that would most likely move out of the cuttings deposition area. In addition, marine mammals are highly mobile and can readily avoid the small, affected areas in favour of alternative benthic foraging habitat.

Table 27 Foraging ecology of marine mammals that could occur in PML 38146

	Species	Foraging Ecology	Benthic Prey?
Certain	New Zealand fur seal	New Zealand fur seals forage on a range of species, with the relative importance of each prey item varying by season. Arrow squid are important prey items in summer and autumn, lanternfish are taken year-round, barracouta and jack mackerel are major contributors to the summer diet, while red cod, ahuru, and octopus are important winter prey species (Harcourt *et al.*, 2002). Diet does include benthic prey.	Yes
Likely	Common dolphins	Diverse diet of fish and cephalopod species. The primary prey species in New Zealand are pelagic, including arrow squid, jack mackerel and anchovy, but the overall diet does include some benthic prey (Meynier *et al.*, 2008). Diet changes with body size, sex and season (Peters *et al.*, 2020).	Yes
	Killer whales	Orca present around the North Island are generalist foragers that opportunistically take advantage of prey (Visser, 2007) Benthic foraging for rays is common around New Zealand's coast (Visser, 1999). Diet does include some benthic prey.	Yes
Possible	Blue whales	Feed on krill and other zooplankton by lunge feeding in mid- or surface waters (Acevedo-Gutierrez *et al.*, 2002). Diet does not include benthic prey.	No

	Species	Foraging Ecology	Benthic Prey?
	Fin whale	Diet is dominated by krill in the southern hemisphere (Miyashita *et al.*, 1995; Shirihai & Jarrett, 2006). Lunge feed in mid- or surface waters. Diet does not include benthic prey.	No
	Minke whale	Feed on krill and a variety of other small schooling fish by lunge feeding in mid- or surface waters (Cooke *et al.*, 2018). Diet does not include benthic prey.	No
	Long-finned pilot whales	Diet information is limited for this species in New Zealand, but stomach content analysis of five stranded individuals suggests a cephalopod diet of both pelagic squid and benthic octopus (Beatson *et al.*, 2007). Diet does include some benthic prey.	Yes
	Humpback whale	Feed on krill and small pelagic schooling fish by lunge feeding in mid- or surface waters (Murase *et al.*, 2002). Diet does not include benthic prey.	No
	Māui's/Hector's dolphins	Diet consists of a variety of fish species, with red cod, ahuru, arrow squid, sprat, sole, and stargazer contributing the majority (77%) of the total diet (Miller *et al.*, 2013). Diet does include some benthic prey.	Yes
	Pygmy right whale	Diet thought to consist of meso-zooplankton, particularly calanoid copepods (Cooke *et al.*, 2018). Diet does not include benthic prey.	No
	Southern right whale	Utilise offshore summer feeding grounds in Antarctic waters to feed on krill by lunge feeding in mid- or surface waters. Do not typically feed during coastal winter presence in New Zealand (Carroll *et al.*, 2011). Diet does not include benthic prey.	No

There is the potential that the benthic prey of marine mammals could bioaccumulate metals and hydrocarbons; with metals typically bioaccumulating in molluscs and crustaceans (Zeng *et al.* 2013) and hydrocarbons bioaccumulating in bivalves (Hoffman *et al.*, 2003). Benthic foraging marine mammals could therefore be subject to some secondary contamination through the consumption of invertebrate prey that has become contaminated by drilling waste deposited on the seabed. However, this is unlikely to cause significant health effects because: 1) marine mammals are capable of metabolising and excreting hydrocarbons (Eisler, 1987); 2) contaminated areas would represent a very small proportion of total foraging habitat for marine predators; 3) only WBMs will be discharged; 4) based on post-drill environmental monitoring undertaken in the STB, no chemicals have been found above default guideline values in accordance with ANZECC; and 5) no marine mammal species predicted to be present are entirely dependent on benthic prey.

An increase in turbidity (suspended sediment in the water column) will occur in association with drilling discharges. Although turbidity has the potential to reduce light penetration through the water column, this is anticipated to have little effect on the ability of marine mammals to navigate through the water and/or detect and capture prey as they are well adapted to forage and navigate at depth where natural light is limited or in turbid coastal waters where visibility is restricted. Instead of vision, toothed whales and dolphins use echolocation to navigate and detect prey and baleen whales and pinnipeds feel for prey with their sensitive whiskers (Peyensen *et al.*, 2012; Dehnhardt *et al.*, 1998).

While cuttings deposition and turbidity have the potential to cause small changes to prey availability, prey quality and foraging success of some marine mammals, it is noteworthy that subsurface infrastructure can provide predictable foraging opportunities to marine mammals (Todd *et al.*, 2020a). The existing infrastructure at the Kupe WHP may therefore be targeted by some individual marine mammals as a feeding location. While quantitative knowledge of the role of oil and gas infrastructure for New Zealand fur seals is lacking, it is known that seals have a consistent presence around oil and gas platforms in Taranaki, including the Kupe WHP, and take advantage of haul-out opportunities that some types of infrastructure (e.g. jackets of platform legs) present (McConnell, 2015). In addition, Arnould *et al.* (2015) reported that of 36 tagged Australian fur seals 25% exhibited foraging behaviour near subsurface infrastructure, with evidence suggesting that individual seals targeted oil and gas pipelines and undersea cables. Therefore, while the Kupe Phase 2 Development Drilling Programme could have some negative effects on foraging, the Kupe WHP may well have substantially benefitted some individual marine mammals through its lifetime.

Despite some small potential changes to prey availability, prey quality, and foraging success of marine mammals from cuttings deposition or turbidity, these effects are unlikely to be of ecological relevance to marine mammals because:

- The area of turbidity and deposition caused by cuttings discharge from the Kupe Phase 2 Development Drilling Programme will be discrete and spatially restricted;
- Marine mammals are highly mobile and have ample opportunity to avoid discrete areas of turbidity or deposition;
- Marine mammals are well adapted to forage and navigate at depth where natural light is limited or in turbid coastal waters where visibility is restricted;
- Marine mammals tend not to rely on vision for detecting their prey; and
- While some marine mammals do have a benthic component to their diets and this could be impacted by deposition, none are solely reliant on benthic prey (consuming a mixture of benthic and pelagic prey species).

Consequence – Any potential effects of released drill cuttings on marine mammals would be localised and would only occur for a relatively short period of time and as soon as the programme concludes, any potential impacts will cease. Alternative habitat is plentiful outside the discrete area of impact and no population effects are predicted. Therefore, the consequence will be *minor*.

Likelihood – Adverse effects on marine mammals are *unlikely* from the release of drill cuttings as no marine mammal species is entirely reliant on the Kupe IAA for benthic foraging habitat and turbidity effects are not predicted to change foraging success.

As the consequence of effects from the drilling operations on marine mammals is *minor*, and it is considered *unlikely* to occur, the environmental risk of adverse effects occurring is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Release of drill cuttings – effects on marine mammals	1 – Minor *Localised, short-term effect.*	3 – Unlikely *Not likely to occur in normal circumstances*	3 - Low	Less than minor

7.2.6.2.2 Benthic Environs

Benthic Communities

Consequence – Once drilling is completed the sediment composition will reflect the grain size distribution of the released drill cuttings and drilling fluids, rather than the original sediments (Ellis *et al.*, 2012). Alterations to benthic infaunal communities within 300 m of a drill location have been observed by Ellis *et al.* (2012), with effects including a reduction in species diversity and increased abundances of some opportunistic taxa. Ellis *et al.* (2012) also noted functional changes to infaunal communities, including the loss of suspension feeders and the increased prevalence of deposit feeders. The observed changes were attributed to physical alteration in sediment texture and organic enrichment (Ellis *et al.*, 2012).

As discussed in **Section 2.2.4.1** and **Section 7.2.6.1.2**, the deposition modelling undertaken specifically for the Kupe WHP location suggests the maximum distance from the well that 6.3 mm of deposition is predicted to occur is 0.3 km (300 m) for the initial well and re-spud scenario. The predicted worst-case depositional footprint covers an area of 0.12 km^2 based on this modelling scenario.

Monitoring of biological communities from pre- and post-drill surveys have been undertaken within the offshore Taranaki Basin for many years. The Taranaki monitoring has found measurable effects on biological communities rarely extend beyond 1 km from the well location. For example, monitoring results from the Whio-1 exploration well site, which included a batch discharge of WBM at the end of drilling programme, showed there were significant decreases in the abundance and diversity of the benthic macrofauna (compared to pre-drill levels) following the completion of drilling that extended out as far as 500 – 1,000 m from the well location. However, there were also significant decreases in the abundance and diversity of the benthic macrofauna over the same period at the control sites, making it difficult to ascribe the measured changes in biological communities around the well to solely the drilling activities. By the end of three years' post-drill monitoring, the majority of the Whio-1 sample stations showed that macrofauna community diversity and abundance had returned to levels that were at or above what was observed in the pre-drill surveys, and these results were also comparable to what was found at the control sites, which were by then also showing increases compared to pre-drill.

Ellis *et al.*, (2012) suggested that benthic communities around single wells return to baseline conditions one year after the cessation of drilling.

Drill cuttings piles deposited during drilling will be initially colonised by a different community assemblage to the surrounding area; although, this community will 'age' over time, being subject to continuing natural deposition, bioturbation, and dispersal by bed-loading mechanisms (Sneddon, 2009). However, because the rate of recovery from physical disturbances in benthic communities in the marine environment varies significantly, with deeper habitats generally taking longer to recover (Harris, 2014), it is expected that recolonisation of areas impacted by drill cutting deposition could take in the order of months. The rate of recovery to natural conditions will be strongly linked to the rate of recolonisation and the resulting bioturbation of the sediment (Johnson, 1971, 1972; Nilsson & Rosenberg, 2000) and cutting piles around each well after the initial disturbance effects of drilling activities (Trannum *et al*., 2010, 2011). Benthic communities will recover from the impacts of drill cutting deposition, but the recovery time is difficult to predict and could potentially be in the order of months to years. For this reason, the consequence of the impacts of drill cutting deposition arising from the drilling of the two proposed wells is considered as *moderate*.

Likelihood – Whether effects on benthic organisms occur depends on reactions to drill cutting deposition and can include organisms avoiding the area (for mobile organisms) but can also include direct mortality of sessile or immobile organisms (Buchanan *et al.*, 2003). Based on monitoring undertaken elsewhere within the Taranaki Basin, it is considered *likely* that benthic infauna and epifauna communities will be impacted by the deposition of drill cuttings around the Kupe WHP.

As the consequence of effects from drill cutting deposition on benthic communities is *moderate*, and it is considered *likely* to occur, the environmental risk of adverse effects occurring is assessed as ***moderate***, and the resultant magnitude of the environmental impact is predicted to be ***minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Discharge and deposition of drill cuttings – effects on benthic communities	2 – Moderate *Localised change in habitat and ecosystem function affecting an area of up to 3 km² and recovery timeframe in the order of months to years*	5 – Likely *Effects have generally found to have occurred in similar projects*	10 – Moderate	Minor

7.2.6.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from the deposition of drill cuttings will be in place during the Kupe Phase 2 Development Drilling Programme:

- Pre-drill benthic surveys will be undertaken prior to the commencement of drilling operations. Post-drill monitoring programme will be undertaken and will be repeated annually for a period of up to three years. This monitoring programme will monitor the initial impact of drilling and subsequent recovery and recolonisation over time. This will ideally be undertaken in the same season as the pre-drill monitoring to exclude any seasonality effects;
- All personnel using the equipment will have the appropriate training and qualifications (where appropriate); and
- All equipment used for the Kupe Phase 2 Development Drilling Programme will be inspected, tested and maintained as per the MODU planned maintenance system requirements and in accordance with applicable industry standards to ensure its integrity.

7.2.7 ROV Works

As discussed in **Section 2.2.5**, ROVs will be used for observational purposes to support the activities associated with the Kupe Phase 2 Development Drilling Programme. ROVs have the potential to affect the pelagic environs (i.e. water quality) and the benthic environs (i.e. benthic invertebrates).

7.2.7.1 Area of Potential Impact

Under normal operations, no seabed disturbance from the ROV is anticipated. However, if the ROV is required to land on the seabed (for some unforeseen reason), a small depression on the seabed may result, leaving a footprint of up to 6 m^2 (depending on the type of ROV).

While the ROV is operating in close proximity to the seabed, the propulsion jets from the ROV thrusters may disturb the surficial sediment layers, causing localised degradation in the water quality. However, the planned ROV work is observational, meaning that the ROV will be operated at least 3 m above the seabed. Therefore, the exact area of potential impact to the water column is difficult to quantify.

7.2.7.2 Potential Effects

7.2.7.2.1 Pelagic Environs

The degradation of the water quality in and around any disturbance from the ROV thrusters will be highly localised. This activity will result in a very short-term increase in the turbidity levels around the disturbance area which, in this case, will likely be from sediments associated with the cutting pile near the well location. Any potential effect from this increased turbidity would revert as soon as the activity ceased, and normal function would return to the marine environment.

The use of the ROV, particularly the lighting associated with it, may attract some species of fish (e.g. Rountree *et al*., 2002). However, this effect would be highly localised and short-term in duration.

Consequence – Given this short-term duration, and highly localised effects, the consequence of the ROV activities on the pelagic environment are assessed as *negligible*.

Likelihood – The likelihood of any effect occurring from the ROV works on the pelagic environment is considered to be *possible* as it could occur at some time.

As the consequence of effects from the ROV works on the pelagic environment is *negligible*, despite a *possible* likelihood, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
ROV works – effects on pelagic environs	0 – Negligible *Highly localised effect*	4 – Possible *Could occur at some time*	0 – Negligible	Negligible

7.2.7.2.2 Benthic Environs

Physical disturbance of the seabed from the ROV works may or may not occur depending on whether the ROV is required to land on the seabed. If a landing is required, the resultant physical disturbance will be extremely limited in spatial scale (up to 6 m^2) and will be temporary in nature to the extent that any minor depression in the seabed will likely recover quickly.

Any associated effects on benthic species from the disturbance associated with this activity will be equally limited in spatial scale. It is worth noting that the deposition of drill cuttings is the main driver of effects on benthic species (see **Section 7.2.6**), with any effects from the ROV works occurring within this already modified environment.

Consequence – Given the localised and short-term nature of the potential effects on benthic communities, and that there would be no predicted adverse effects to populations from this activity, the consequence is *negligible*.

Likelihood – The likelihood of any benthic effect occurring from the ROV use is considered to be *unlikely*, as ROV landing is not likely under normal circumstances.

As the consequence of effects from the ROV works on the benthic environment is *negligible*, and effects are *unlikely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
ROV works– effects on benthic environs	0 – Negligible *Highly localised effect*	3 - Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

7.2.7.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measure to avoid, remedy, or mitigate adverse effects from the ROV works will be in place during the Kupe Phase 2 Development Drilling Programme:

- All ROV works will be undertaken by appropriately trained and experienced ROV operators.

7.2.8 Formation Evaluation

As discussed in **Section 2.2.6**, formation evaluation will be undertaken during drilling and once the drilling of each well is complete.

The majority of the evaluation techniques that may be used during the Kupe Phase 2 Development Drilling Programme do not require either marine consent or marine discharge consent as they are regulated under the Permitted Activities Regulations; therefore, the potential effects of those activities are not considered here. The exception to this is the potential for Sidewall Coring, WFT and well test operations to be undertaken as part of the formation evaluation. Of these techniques, no effects on the receiving environment are anticipated from Side Wall Coring (the removal of small rock samples from the well bore). During well testing, flaring will occur, which is discussed below.

7.2.8.1 Area of Potential Impact

Although it is difficult to predict the area of potential impact from heat radiation associated with flaring operations, given the height of the flare-boom above the water (~35-50 m), and the variable wind conditions that are anticipated, it is considered that this area is likely to be well within 1 km^2 of the flare boom.

7.2.8.2 Potential Effects

7.2.8.2.1 Pelagic Environs

Seabirds

Seabirds have been included in the pelagic environ section as this is considered the most appropriate location for their assessment due to their close ties with the pelagic environment in offshore areas for both foraging areas and migratory pathways.

During the Kupe Phase 2 Development Drilling Programme a well test could occur for both development wells. Each test may result in the flaring of hydrocarbons for up to several days. No long-term flaring is proposed as part of this consent application.

Flaring of the hydrocarbons produced during well test operations is of primary concern for seabirds as flaring attracts seabirds to offshore structures (Day *et al*., 2015) and can result in death or injury by impact or burning (Hope-Jones, 1980). Annual rates of mortality in flares have been estimated to be “a few hundred birds per platform per year” in parts of the northern hemisphere where gas flaring is common and continuous (Bourne *et al.*, 1979; as cited in Ronconi *et al.*, 2015).

MODUs are strong attractants to seabirds on account of light emissions, including flaring and platform lighting. During seabird surveys around oil production platforms in Arctic Alaska, Day *et al.* (2015) reported higher numbers of bird flocks during flaring nights and that flight behaviour was more erratic on these nights. In addition to the direct effects of flaring, these factors can also contribute to birds colliding with offshore structures and sustaining traumatic injuries.

Observations for interactions between seabirds and flaring were carried out continuously for five weeks at the Brent Field, 200 km northeast of Shetland. Seabirds were reported to circle the flaring tower, eventually landing exhausted on the platform or sea surface; however, the authors note that overcast conditions may have been the main cause of mortality by precluding the birds' ability to navigate (Hope-Jones, 1980). While the seabirds were attracted in large numbers to the flare, Hope-Jones (1980) concluded that significant mortality was unlikely.

This is further emphasised by Ronconi *et al*. (2015) who states that risk of incineration is likely to be restricted to smaller species attracted to lights, and some larger species disorientated by adverse weather conditions (e.g. fog). Storm petrels and shearwaters are particularly vulnerable and can be attracted in large numbers to the light that is emitted from flares at night (Wiese *et al*., 2001). Eight species of shearwater and three species of storm petrel could occur in the IAA (**Appendix E**), with the IAA being within the known foraging grounds for sooty shearwaters, with this area also used for foraging and passage by a number of globally threatened seabird species (e.g. northern royal albatross).

Consequence – The potential effects from formation evaluation (specifically well test operations) are highly localised (< 1 km^2) and short-term in nature. Potential impacts are largely limited to the effects of flaring on seabirds (protected under the Wildlife Act 1953), where it is possible that individuals could suffer injuries or mortality. Therefore, as some individuals of protected species may be impacted, the consequence is considered to be *minor*.

Likelihood – Collision with structures and incineration in flares are not uncommon at offshore installations and mortality rates of seabirds around platforms and MODUs tend to be higher in low visibility weather conditions (e.g. fog, low cloud, drizzle) (Weir, 1976; as cited in Wiese *et al*., 2001). Therefore, the likelihood is assessed as *possible*.

As the consequence of effects from the formation evaluation on seabirds is *minor*, and it is considered a *possible* occurrence, the environmental risk of adverse effects is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Formation evaluation – effects on seabirds	1 – Minor *Some individuals of protected species may be impacted*	4 – Possible *Collision and incineration in flares could occur at some time*	4 – Low	Less than minor

7.2.8.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from the formation evaluation will be in place during the Kupe Phase 2 Development Drilling Programme:

- All equipment used for the Kupe Phase 2 Development Drilling Programme will be inspected, tested and maintained as per the MODU planned maintenance system requirements and in accordance with applicable industry standards to ensure its integrity;
- All formation evaluations will be undertaken in accordance with the Crown Minerals (Petroleum) Regulations 2007;
- Beach will procure flare technology which will limit the smoke and fallout from flaring as much as practicable for the Kupe Phase 2 Development Drilling Programme; and

- Flaring will be intermittent, its duration will be minimised where possible.

7.2.9 Supporting Activities

Section 2.2.8 details two activities (the use of support vessels and helicopters) that will support the MODU throughout the Kupe Phase 2 Development Drilling Programme. These activities have the potential to affect the pelagic environment, i.e. marine mammals and seabirds. Coastal receptors that may be affected by supporting activities include pinnipeds and seabirds; these receptors have been included in the discussions below.

7.2.9.1 Area of Potential Impact

The area of potential impact from the supporting activities (i.e. the area surrounding the vessels and helicopters) is difficult to determine as they operate in different mediums (i.e. air and the sea). However, as discussed in **Section 2.2.8,** these supporting activities do not require marine consent – their inclusion within this ERA is for the sake of completeness. Accordingly, it is considered that the exact area of potential impact is not required. Instead, the following assessment has been made on best judgement and knowledge of the activities, and the potential impacts of those activities on the receptors that may interact with them.

7.2.9.2 Potential Effects

7.2.9.2.1 Pelagic Environs

Marine Mammals

Ship strike

The term 'ship strike' refers to the collision of a marine mammal with a vessel, and as ship strike events can result in death or life-threatening injuries to whales and dolphins, they are of global conservation concern (IWC, 2014). A number of factors influence the likelihood of collisions, these are:

- Vessel size – larger vessels (> 80 m) are more frequently involved in collisions with marine mammals than smaller vessels (Laist *et al.*, 2001; Jensen & Silber, 2003). Large vessels usually have deeper drafts, hence a larger strike area (Schoemann *et al.*, 2020);
- Vessel speed – most lethal marine mammal collisions involve vessels travelling at faster speeds (> 12 knots; Laist *et al.*, 2001; Vanderlaan & Taggart, 2007) because higher speeds increase the risk of blunt force trauma (Wang *et al.*, 2007);
- Species – large whales are the most common victims of collisions (e.g. fin whales, right whales, humpback whales, minke whales and sperm whales) (Laist *et al.*, 2001; Jensen & Silber, 2003; Van Waerebeek *et al.*, 2007). However, a recent global review of ship strike incidents by Schoemann *et al.* (2020) found a total of 61 marine mammal species are affected by vessel collisions and incidents involving smaller species often go unreported; and
- Behaviour - species that remain at or near the sea surface for extended periods are particularly vulnerable to collisions (Laist *et al.*, 2001; Constantine *et al.*, 2012); as are species that are attracted to vessels (Bejder *et al.*, 1999; Wursig *et al.*, 1998).

All marine mammal species potentially present in the vicinity of the Kupe IAA are potentially at risk of collision with operational vessels. However, data indicate that large whales are at greater risk than smaller marine mammal species (Laist *et al.*, 2001; Jensen & Silber, 2003); where the size and agility of dolphins and seals means that these groups are more successful at avoiding potential collisions (Schoemann *et al.*, 2020). Evidence suggests that blue whales, in particular, are limited in their ability to avoid collisions, particularly with fast ships, as they tend to respond to a ships approach by a slow descent without lateral movement out of the path of the vessel (McKenna *et al.*, 2015).

Jensen and Silber (2003) reported that fin whales, humpback whales, minke whales, southern right whales, and sperm whales were the most likely to be involved in ship-strike incidents. With the exception of sperm whales, these species have all been identified as having a possible presence in and around PML 38146 (see **Section 4.3.6.3**).

One of the primary factors affecting the severity of each ship-strike incident is vessel speed (Jensen & Silber, 2003) where the likelihood of mortality increases with increasing speed. The mean vessel speed that results in mortality following a ship strike is 18.6 knots (Jensen & Silber, 2003) and Laist *et al.* (2001) found that most lethal ship-strike incidents involved vessels travelling at 14 knots or faster. Vanderlaan and Taggart (2007) reported that the probability of a lethal injury drops below 0.5 at speeds of 11.8 knots or less. The normal transit speed for support vessels associated with the Kupe Phase 2 Development Drilling Programme will be between 8 and 12 knots, albeit much further reduced when in close proximity to the MODU and Kupe WHP (in the order of 0.5 knots when approaching the Kupe WHP), reducing the probability of lethal ship-strike events.

The MMPR stipulate the requirements for operating vessels around marine mammals including:

- Avoid sudden or repeated changes in speed and direction near marine mammals;
- There should be no more than three vessels within 300 m of any marine mammal;
- Vessels should travel no faster than idle or ‘no wake’ speed within 300 m of any marine mammal;
- Do not circle whales and dolphins, and do not obstruct their path or cut through any group; and
- Keep at least 50 m from whales (or 200 m from any large whale mother and calf/calves).

Compliance with these regulations during the Kupe Phase 2 Development Drilling Programme will serve to reduce the likelihood of marine mammal ship strike, as will the slow operation speed of vessels and the short-term duration of the programme. In addition, the master and crews of all support vessels will be required to stay vigilant for marine mammals and to record any observations on the DOC Marine Mammal Sighting form. The masters of the support vessels will also be briefed on the potential migratory seasons of marine mammals in the region.

Support Vessel Noise

Whilst shipping noise has been associated with a number of detrimental effects on marine mammals (e.g. masking (Erbe, 2002), physiological stress (Wright *et al*., 2007), changes in behaviour (Nowacek *et al*., 2007), and changes in vocalisations (Parks *et al*., 2007)), in the most part, the movement of support vessels to and from Kupe WHP constitutes no greater threat than fishing vessels or commercial shipping that might also use the region. The noise outputs from the passage of support vessels will be transient at any one location en-route to and from the MODU and will only persist for the duration of the project. The exception to this is the use of DP thrusters which support vessels may use to hold their location during the installation and removal of the MODU and intermittently at other times around the MODU and Kupe WHP during the Kupe Phase 2 Development Drilling Programme.

Underwater noise generated by DP thrusters is non-impulsive, low frequency broadband sound, with some tonal components ranging from 30 Hz to 3 kHz and with source levels ranging from 177 dB to 196.7 dB re 1 µPa at 1 m (Blackwell & Green, 2003; Hannay *et al.*, 2004; Tetra Tech, 2013; McPherson *et al.*, 2016; Zykov 2016); where Tetra Tech (2013) reported a source level of 177 dB re 1 µPa for a cable laying vessel using DP and Zykov (2016) reported source levels of 196.7 dB re 1 µPa for a drillship and a semi-submersible platform (both using DP).

Todd *et al.* (2020b) measured the near-field sound pressure levels associated with a jack-up MODU in the North Sea and concluded that noise levels measured during the operation of support vessels onsite were higher than any MODU operations in the 25 Hz to 1 kHz frequency band. At these frequencies' vessel noise was generally 20 dB greater than MODU operations (even when the MODU was drilling). In keeping with this finding, Merchant *et al.* (2014) quantified the underwater noise of vessels using DP to tow and position rigs in the Moray Firth in northeast Scotland. These vessels produced sustained, high-amplitude broadband noise concentrated below ~1 kHz, and the authors concluded that DP use produces sound levels significantly higher than generic shipping noise (Merchant *et al.*, 2014), where peak frequencies of commercial shipping are typically <100 Hz (e.g. Arveson and Vendittis, 2000; McKenna *et al.*, 2012) and source levels are typically less than 188 dB re 1 µPa @ 1 m (McKenna *et al.*, 2012).

Based on this information, it is reasonable to assume that DP use during the Kupe Phase 2 Development Drilling Programme will be a significant component of underwater noise associated with the programme and warrants further discussion. Without specific knowledge of the sound levels of the actual vessels that will be used and further sound transmission loss modelling it is not possible to specifically predict the range over which this noise will be audible to marine mammals. However, by using onset thresholds developed by the US-based National Marine Fisheries Service (NMFS, **Table 28**), estimates of TTS and PTS onset distance can be generated for the different marine mammal functional hearing groups and these are presented in **Table 29** and **Table 30**, respectively. These onset distance estimates assume that the exposed animal remains stationary relative to a non-impulsive, stationary, and continuous noise with a source level of 180 dB re 1 µPa at 1 m (which represents a support vessel under DP (e.g. tugboat) pulling a jack-up rig, following Hannay et al., 2004; Blackwell & Green, 2003). Weighting factor adjustments for a broadband source spectrum were used to provide the most realistic scenario, and a propagation loss coefficient was also included to account for the shallow water depth of the Kupe IAA. In practice, noise emissions with DP are variable with both animals and vessels being mobile, meaning that while TTS and PTS exposure for cetaceans over extended periods (1 to 24 hours) is hypothetically possible, it is highly improbable in reality.

Table 28 Thresholds for marine mammal hearing impacts from cumulative exposure to non-impulsive noise event

Marine mammal hearing group	TTS onset threshold Weighted SEL (dB re 1µPa^2·s)	PTS onset threshold Weighted SEL (dB re 1µPa^2·s)
Low-frequency (LF) cetaceans	179	199
Mid-frequency (MF) cetaceans	178	198
High-frequency (HF) cetaceans	153	173
Otariid pinnipeds (underwater)	199	219

Source: NMFS, 2018

Table 29 Estimated TTS isopleths for marine mammals from DP use (180 dB SL)

Common name	Marine mammal hearing group	Likelihood of presence	TTS Isopleth to threshold (m)			
			1 Hour	4 Hours	8 Hours	24 hours
Blue whale	LF	Possible	80	201	319	663
Humpback whale	LF	Possible	80	201	319	663
Fin whale	LF	Possible	80	201	319	663
Minke whale	LF	Possible	80	201	319	663
Southern right whale	LF	Possible	80	201	319	663
Pygmy right whale	LF	Possible	80	201	319	663
Common dolphin	MF	Likely	2	6	9	19
Killer whales	MF	Likely	2	6	9	19
Long-finned pilot whale	MF	Possible	2	6	9	19
Māui/Hector's dolphin	HF	Possible	44	110	174	362
New Zealand fur seal	OW	Certain	1	3	4	9

New Zealand fur seals will have a certain presence around the MODU and the Kupe WHP, however in order to suffer TTS they would need to remain submerged and very close to the DP thrusters for extended periods. As this species is highly mobile and surfaces to breathe frequently, no TTS is anticipated. Common dolphins and killer whales are the cetacean species most likely to be present around the Kupe WHP during drilling and the TTS onset distance for these species is 2 to 19 m meaning that they would have to remain within these distances of the noise source for extended periods to experience TTS. Given the open water nature of these species, it is highly unlikely that this would happen. For other species that could possibly be present around the Kupe WHP during drilling, the predicted onset distances are larger (80 m to 663 m for baleen whales, and 44 m to 362 m for Māui/Hector's dolphins), and while unlikely, it is not impossible that individuals could remain close enough to the support vessel(s) for long enough to experience TTS; however there is no evidence to suggest that the affected area is of particular relevance to cetaceans for important ecological functions (feeding, breeding etc) which would provide them with high levels of motivation for site fidelity.

Table 30 Estimated PTS isopleths for marine mammals from DP use (180 dB SL)

Common name	Marine mammal hearing group	Likelihood of presence	PTS Isopleth to threshold (m)			
			1 Hour	4 Hours	8 Hours	24 hours
Blue whale	LF	Possible	1	9	15	31
Humpback whale	LF	Possible	1	9	15	31
Fin whale	LF	Possible	1	9	15	31
Minke whale	LF	Possible	1	9	15	31
Southern right whale	LF	Possible	1	9	15	31
Pygmy right whale	LF	Possible	1	9	15	31
Common dolphin	MF	Likely	0	0	0	1
Killer whales	MF	Likely	0	0	0	1
Long-finned pilot whale	MF	Possible	0	0	0	1
Māui/Hector's dolphin	HF	Possible	2	5	8	17
New Zealand fur seal	OW	Certain	0	0	0	0

With regard to the potential for PTS, the onset distances are presented in **Table 30**. These threshold distances indicate that it is highly unlikely that marine mammals will suffer permanent hearing damage as a result of the DP noise, because for this to occur the animals would need to remain closer than 50 m from the noise source for extended periods of time. Given the most common reaction of marine mammals to loud noises is avoidance, this is highly unlikely. In particular, the potential for PTS, while theoretically possible for Maui's/Hector's dolphins (which are of greatest conservation concern), it is considered to be highly unlikely to occur in reality as:

- Extremely low density of Māui's dolphins in this area (Currey *et al.*, 2012; Roberts *et al.*, 2019), hence, the likelihood of an individual being present at the drilling site is very low;
- The likelihood of any individual being remaining in close proximity to the DP thrusters for long enough to suffer PTS is virtually nil; and
- Despite records being collected since 2007 from the Kupe platform, no Māui's or Hector's dolphins have been seen.

While hearing damage to marine mammals is not anticipated during the Kupe Phase 2 Development Drilling Programme, it is possible that some marine mammals that occur nearby the support vessels may be subject to masking, and minor behavioural changes (e.g. temporary displacement) as a result of underwater noise from DP use. While these effects would extend beyond the onset distances for hearing damage, no population effects are predicted, and any potential individual effects are unlikely to be of ecological relevance as:

- DP thrusters will only be used intermittently throughout the Kupe Phase 2 Development Drilling Programme, i.e. this will not represent a constant noise source for the duration of the programme;
- Marine mammals are highly mobile and have ample opportunity to move away from the noise source into alternative habitat in the wider Taranaki region (on account of the open water nature of the platform);

- Most species that could potentially be present utilise open water habitat and have large home ranges (as described in **Section 4.3.6**);
- The area associated with the Kupe Phase 2 Development Drilling Programme does not represent marine mammal habitat that is of particular importance relative to other habitat in the wider Taranaki region (see **Section 4.3.6**); and
- The short-term/temporary nature of the drilling activities (up to 95 days total per well); hence any effects will be short-term in nature.

Helicopter Disturbance

The reaction of marine mammals to helicopter operations was reviewed by Richardson *et al.* (1995) who reported that, in general, reactions vary with species, time of year, and helicopter altitude, type and behaviour. For New Zealand fur seals, helicopters flying over haul-out sites at altitudes greater than 305 m elicited few responses, but below this altitude responses were noted (i.e. increased alertness, rapid water entry) and increased in magnitude as flight altitude decreased; however, habituation to frequent helicopter activity tended to decrease the level of response for some species through time. Whale response to helicopter presence varied from no response to avoidance dives and abrupt changes in direction (Richardson *et al.,* 1995). The reasons for these observed behavioural changes are unclear with both noise and the shadow of the aircraft passing over the whale likely to contribute to eliciting the avoidance behaviour (Patenaude *et al.,* 2002). Low altitude passes by aircraft can cause some toothed and baleen whales to dive or turn away, with sensitivity depending on animal activity. For cetaceans, effects seem transient and occasional overflights have no identified long-term consequences.

The closest terrestrial breeding colony of New Zealand fur seals to the Kupe IAA occurs within the group of islands collectively referred to as the Sugar Loaf Islands (Ngā Motu). Pupping occurs on the islands in December/January (Baird, 2011). Specific breeding locations include Waikaranga (Seal Rock), Moturoa, and Whareumu (Lion Rock), and non-breeding fur seal haul-outs occur along most coastlines of the Sugar Loaf Islands (pers. comm. C. Lilley, Nga Motu Office, DOC). When departing and arriving to New Plymouth helicopter operations are sometimes directed to fly over the Sugar Loaf Islands airspace by air traffic control. However, flight altitude here is typically well above the altitude at which a disturbance response would be expected from New Zealand fur seals. Based on this, the helicopter operations that will support the Kupe Phase 2 Development Drilling Programme are not anticipated to cause any disturbance to New Zealand fur seals at the Sugar Loaf Islands.

In New Zealand, the MMPR stipulate the requirements for helicopter use around marine mammals, including restrictions on altitude and lateral approach distances. With regard to helicopter use around marine mammals, Section 18 of the MMPR stipulates that:

a) When flying around marine mammals no aircraft shall be flown below 150 m unless taking off or landing; and

b) When flying at altitudes lower than 600 m, no aircraft shall be closer than 150 m horizontally from a point directly above any marine mammal.

Restrictions on altitude and lateral approach distances are thought to decrease the likelihood of whales reacting and being displaced from important habitat (Patenaude *et al.*, 2002). The above MMPR restrictions will be implemented during the Kupe Phase 2 Development Drilling Programme and are considered appropriate to mitigate against disturbance to marine mammals from helicopter use during decommissioning activities.

Consequence – Disturbance from the operation of the support vessels and helicopters will be localised and temporary. Hearing damage from underwater noise associated with support vessels has been thoroughly assessed and, while theoretically possible, is improbable in reality given the mobile nature of marine mammals and the fact that DP thrusters will only be used intermittently during the drilling programme. Despite this, some protected marine mammal species could be subject to short-term behavioural and perceptual impacts (e.g. avoidance and masking). Predicted effects would be temporary and no population level effects are anticipated. As a result, the consequence has been assessed as *minor*.

Likelihood – Vessel and helicopter disturbance is a known impact on marine mammals in New Zealand waters, therefore minor effects on marine mammals from supporting activities are *likely* to occur while the vessel or helicopter is in close proximity to marine mammals.

As the consequence of effects from supporting activities on marine mammals is *minor*, but such effects are *likely* to occur, the environmental risk of adverse effects occurring is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Supporting activities – effects on marine mammals	1 – Minor *Localised, short-term effect.*	5 – Likely *Will probably occur in normal circumstances*	5 - Low	Less than minor

Seabirds

There is the potential for vessels and seabirds to collide, particularly when vessels travel at night (as seabirds may be attracted to vessel lighting), or when vessels are transiting close to aggregation areas such as breeding colonies. However, as discussed within **Section 4.3.7.2**, the closest large seabird breeding colonies to the Kupe IAA are located at the Ngā Motu/Sugar Loaf Islands, and support vessels transiting through coastal waters, will not construe any greater risk to seabirds than other vessels (e.g. cargo ships and fishing vessels) in the area.

As discussed in **Section 7.2.5.2.1**, underwater noise could cause some disruption to seabird foraging behaviours. For vessels using DP, vessel noise was generally 20 dB greater than the noise from a drilling MODU (Todd *et al.*, 2020b); hence, DP noise during the Kupe Phase 2 Development Drilling Programme has been identified as the loudest underwater noise (see subsection above regarding marine mammals).

While no onset distances for PTS or TTS can be calculated for seabirds, the effects of DP use on seabirds are reduced somewhat as seabirds on the sea surface are afforded some protection from underwater noise as noise levels at the surface are lower than those in the water column; a phenomenon known as the “Lloyd Mirror Effect” (Carey, 2009). In addition, penguins are expected to avoid exposure to dangerous underwater noise levels through avoidance of affected foraging areas (Pichegru *et al.*, 2017).

Hearing sensitivities are typically lower in birds than mammals (Dooling *et al.*, 2000), on account of this it is predicted that the zone of impact from underwater noise on seabirds will be smaller than the areas of relevance to marine mammals calculated in the subsection above. On this basis, underwater noise levels of concern to seabirds are expected to be highly localised (probably well less than < 1 km from the source) and given the wide-ranging nature of seabirds through the STB this will only ever represent a very minor part of any species available habitat. In addition, DP use will only be intermittent during the Kupe Phase 2 Development Drilling Programme.

Noise is also generated by helicopters and therefore has the potential to disturb seabirds, particularly during breeding season when birds are nesting and courting (e.g. Wilson *et al*., 1991). However, there are no seabird colonies within the IAA, and although helicopters may be directed by air traffic control to take a flight path over the Sugar Loaf Islands, they will not carry out low-altitude flights/take-offs or landing over these sensitive onshore colonies.

Consequence – Based on the above, disturbance of seabirds from the use of support vessels and helicopters will be highly localised and temporary. However, as some protected seabird species could be subject to short-term disturbance impacts, the resulting consequence has been assessed as *minor*.

Likelihood – As disturbance from vessels and helicopters is a known impact on seabirds in New Zealand waters, the likelihood of there being minor disturbance related effects on seabirds from supporting activities is considered to be *likely*.

As the consequence of effects from the supporting activities on seabirds is *minor*, and it is considered *likely* to occur, the environmental risk of adverse effects occurring on seabirds from supporting activities is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Supporting activities – effects on seabirds	1 – Minor *Short-term impacts that may affect some protected species*	5 – Likely *Will probably occur in normal circumstances*	5 – Low	Less than minor

7.2.9.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from the supporting activities will be in place during the Kupe Phase 2 Development Drilling Programme:

- Support vessel operations will comply with the MMPR, including:
  - Avoid sudden or repeated changes in speed and direction near marine mammals;
  - There should be no more than three vessels within 300 m of any marine mammal;
  - Vessels should travel no faster than idle or 'no wake' speed within 300 m of any marine mammal;
  - Do not circle whales and dolphins, and do not obstruct their path or cut through any group;
  - Keep at least 50 m from whales (or 200 m from any large whale mother and calf/calves);
- Helicopter operations will comply with the MMPR, including:
  - When flying around marine mammals no aircraft shall be flown below 150 m unless taking off of landing;
  - When flying at altitudes lower than 600 m, no aircraft shall be closer than 150 m horizontally from a point directly above any marine mammal;
- The use of DP thrusters will be minimised as far as is practicable;
- Helicopters will use flight paths that minimise impacts of any sensitive coastal seabird and seal haul-out areas, particularly during roosting and breeding seasons;

- Support vessel masters and crew will be briefed on the requirement to record any marine mammal observations and record them on the DOC Marine Mammal Observation forms; and
- Support vessel masters and crew will record any seabird vessel collisions or interactions.

7.2.10 Environmental Monitoring

Post-drill benthic monitoring will be undertaken for the wells drilled as part of the Kupe Phase 2 Development Drilling Programme to monitor the effects from the drilling activity on the benthic marine environment and the subsequent recovery.

This monitoring methodology will result in a disturbance of the seabed and removal of non-living material through the use of benthic survey equipment. No sampling equipment will be permanently deployed on the seabed. Either a TIA or a ROV will be utilised to obtain seafloor imagery as part of the monitoring programme. While benthic disturbance is not predicted through ROV use, the TIA’s runners are expected to leave shallow indentations in the soft mud sediments along the video transects.

The methodologies used to conduct the environmental monitoring programme (detailed in **Section 2.2.9**) have the potential to affect the pelagic environment (i.e. water quality) and the benthic environment (i.e. benthic macrofauna). No large fish, marine mammals, pelagic species, squid, or seabirds are anticipated to be directly affected in any way from the environmental monitoring programme and are therefore not considered within this assessment.

7.2.10.1 Area of Potential Impact

As outlined in **Section 2.2.9**, each deployment of the grab sampler disturbs an area of seabed of approximately 0.21 m^2 (0.32 m x 0.64 m) and removes approximately 0.026 m^3 of sediment. Hence, the collection of triplicate samples during a ‘typical’ monitoring programme (e.g. 21 sample stations) will disturb approximately 13.23 m^2 of seabed and remove approximately 1.62 m^3 of sediment. Following subsampling and sieving, approximately 90% of the sediment is deposited back over the side of the survey vessel close to where it was collected.

Based on the deployment of six benthic TIA tows, it is predicted that up to 96 m^2 will be disturbed during the collection of benthic imagery. This calculation is based on a total runner width of 80 mm and indentations of up to 10 mm deep along the length of each 200 m transect (assuming worst-case scenario of full contact throughout all tows).

On this basis, the total area of seabed disturbance from post-drill monitoring would be up to 109.23 m^2.

7.2.10.2 Potential Effects

7.2.10.2.1 Pelagic Environs

Undertaking the environmental monitoring associated with the Kupe Phase 2 Development Drilling Programme will result in the slight reduction in water quality from disturbing seabed sediments with the monitoring equipment. Upon contact with the seabed, the sampling equipment will disturb finer-particle sediments, ultimately resulting in the creation of a small sediment plume.

To reduce the effects from the reduction of water quality, and to avoid false activations of the sampling equipment, a controlled descent (through the use of winches onboard the surveying vessel) is used to lower the equipment to the seabed, with the descent slowing nearing the seabed before impact is made.

As the monitoring equipment is retrieved back to the vessel a plume of fine sediments will come off the equipment as water flows past it. However, this plume will only occur in the lower part of the water column when it first leaves the seabed, with any sediments settling back to the seabed quickly.

Once the equipment is at the surface, the samples are processed onboard the survey vessel for future analysis. Any excess sediments that are not required for retention are washed back overboard, creating a small, localised increase in turbidity.

Consequence – The increased suspension of sediments and slight reduction in water quality from the deployment of environmental monitoring equipment will be highly localised (< 1 km^2). The volume of sediment released from the equipment will not be large, and due to current flows near the Kupe WHP, this fine sediment will rapidly disperse; therefore, the small amount of suspended sediment arising will not have any effect on pelagic organisms or communities with the significant mixing and dilution that would occur. Based on this, the consequence of environmental monitoring on the pelagic environment is assessed as *negligible*.

Likelihood – The likelihood of effects on pelagic environs is assessed as being *unlikely* due to the small volumes of sediment that will be released back overboard from each sampling event at each sampling station, along with the dispersion and settling out of the water column that is expected.

As the consequence of effects from the environmental monitoring on the pelagic environment is *negligible*, and it is considered *unlikely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Environmental monitoring – effects on pelagic environs	0 – Negligible *Highly localised and short-term*	3 – Unlikely *Effects are unlikely to occur*	0 – Negligible	Negligible

7.2.10.2.2 Benthic Environs

Each deployment of the grab sampler will create a depression (0.32 m x 0.64 m x 0.16 m) in the seabed where sediment is removed. While the depressions from the sampling equipment will initially be noticeable, they will be in-filled over time through sedimentation and active bed transport generated by near-seabed currents and bioturbation from macrofauna.

The macrofauna living within or on the substrate collected during the environmental monitoring will be retained and preserved for taxonomic analysis in the laboratory. Therefore, any macrofauna living within the approximately 0.026 m^3 of collected sediment will be removed. There is potential that some benthic macrofauna on the surface of the seabed that are not collected within the cores may be crushed as the equipment lands.

Consequence – The physical disturbance from the deployment of environmental monitoring equipment will be highly localised, and the 0.026 m^3 of sediment collected for sub-sampling is a miniscule proportion of the overall IAA. As such the consequences of undertaken the environmental monitoring programme are *negligible*.

Likelihood – The likelihood of impacts on the benthic environment is assessed as being *likely*.

As the consequence of effects from the environmental monitoring on the benthic environment is *negligible*, and it is considered *likely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Environmental monitoring – effects on the benthic environs	0 – Negligible *Highly localised and short-term*	5 – Likely *Will probably occur in normal circumstances*	0 – Negligible	Negligible

7.2.10.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from the environmental monitoring will be in place during the Kupe Phase 2 Development Drilling Programme:

- Deployment of the sampling equipment will be undertaken in a controlled manner to avoid any deployment wakes and to allow more mobile species time to get out of the way of the descending sampling equipment;
- Experienced personnel will be carrying out the environmental monitoring programme;
- All equipment utilised for the environmental monitoring programme will be appropriately inspected, tested, and maintained to ensure its integrity; and
- Seabed imaging equipment will be deployed in a manner that avoids contact with the seabed wherever possible.

7.2.11 Contingent Activities

Beach may be required to implement certain activities under exceptional circumstances during the Kupe Phase 2 Development Drilling Programme. These contingent activities include side-track drilling, re-spudding, the contingent use of explosives, and excess cement disposal.

Unplanned side-track drilling (**Section 2.2.10.1**) may occur by drilling from a kick-off point some distance above the top of the zone of interest (i.e. hydrocarbon bearing zone downhole, or stuck equipment). The result of this contingency activity is a potential increase in the deposition of drill cuttings. However, any increase in the deposition of drill cuttings has effectively been modelled through the worst-case scenario in which a re-spud is required (see paragraphs below, and **Section 7.2.6** for further information).

In the event that any of the wells have to be abandoned before they reach their target, then the well may need to be re-spudded as outlined within **Section 2.2.10.2**. In this event, there will be an increase of drill cuttings deposited, resulting in an overlap of drill cutting deposition between the initial and re-spudded well. The drill cutting deposition and dispersal modelling (**Appendix B**) took this contingent activity into account, modelling both the initial well and a re-spud for a worst-case scenario (Calypso Science, 2022a). This worst-case scenario is what has been used throughout this IA for determining the potential effects from the release of drill cuttings on the receiving environment (see **Section 7.2.6**).

7.2.11.1 Explosives

Other than the planned use of explosives for the development well tie-in (see **Section 2.2.3.2**), explosives will only be used in exceptional circumstances as a contingency as a response to unavoidable complications that may occur during drilling activities. If explosives are used, their use would be planned for and implemented by a specialist to ensure the appropriate technology and charge is used. The use of explosives would result in vibrations in the seabed and lower water column. As such, there is potential for the sound waves from the charge to emanate up the well bore and into the surrounding strata and water column.

Given that explosives are the only contingent activity that has not yet been assessed within this IA, the potential effects of explosives on pelagic and benthic environs are discussed below.

7.2.11.1.1 Area of Potential Impact

If explosives are required as a contingent activity during the Kupe Phase 2 Development Drilling Programme, they would be detonated down the wellbore, i.e. below the seabed. Depending on detonation depth, noise effects for some marine fauna could potentially still occur as sound waves from any explosion will travel back up the wellbore and/or through the surrounding substrate into the water column. However, the actual area of potential impact will depend on the weight of the charge and the depth of detonation, both of which cannot be predicted.

7.2.11.1.2 Potential Effects

Pelagic Environs

The detonation of explosives results in the release of intense impulsive sound pressures that are typically short-lived and characterised by rapid rise times (Simmonds *et al*., 2004). Explosions generally have high source levels, with the exact characteristics of sound varying with the weight of the charge and depth of the detonation (Hildebrand, 2009). The resulting noise and vibrations from the detonation of explosives have the potential for several effects on marine fauna, including mortality, temporary hearing impairment, injury, and behavioural changes (e.g. displacement, changes in vocalisations). Effects on fish and marine mammals are of primary relevance to the Kupe Phase 2 Development Drilling Programme; however, the effects of underwater noise on these taxa have been discussed at length in **Sections 7.2.5** and **7.2.9** and are not repeated here.

Underwater noise from in-water blasting can include components across a wide frequency range, with the fundamental cause of the peak noise pressure pulse being the shock wave generated by the rapid expansion of gas upon detonation underwater. It is expected that by placing the charges below the seabed, the magnitude of the peak noise pressure pulse would be considerably reduced, since there would be no rapid expansion of gas underwater on detonation. Instead, the effect of the charges would be to excite vibration of the wellbore casing which would transmit into the surrounding substrate which will act to muffle any sound waves before they reach the water column.

Baker (2008) undertook a series of calculations to predict the 'danger zone' for fish and dolphins for which serious injury can result from an explosive charge during blasting activities for a hypothetical demolition project. For fish and dolphins, the danger zone was out to 668 m and 555 m respectively. These impact distances were based on open-water detonation, whereas confined blasts (i.e. explosive use within a wellbore) will substantially decrease the amount of pressure released into the water column (Baker, 2008), meaning that the impact zone for any wellbore detonations would be substantially smaller. On this basis, underwater noise from the detonation of explosives during the Kupe Phase 2 Development Drilling Programme is unlikely to result in physiological injury or hearing damage to pelagic marine species, but behavioural responses from individuals near the Kupe WHP are expected.

Consequence – Any impact zone from underwater noise caused by explosive use is predicted to be localised (1-5 km) and although individual fish and marine mammals may exhibit a behavioural response to any detonation, the resulting disturbance is expected to be temporary. Furthermore, the detonation of explosives during the Kupe Phase 2 Development Drilling Programme will only occur in exceptional circumstances and the immediate vicinity of the Kupe WHP does not represent specifically important breeding or feeding habitat for pelagic species. As such the consequences are considered to be *minor*.

Likelihood – If the use of explosives is required, it is *likely* that some impacts would occur on fishes that are exposed to higher sound levels

As the consequence of effects from the contingent activities on the pelagic environs is *minor*, and it is considered *likely* to occur, the environmental risk of adverse effects occurring on the pelagic environs from contingent activities is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Contingent activities – effects of explosives on pelagic environs	1 – Minor *Localised effect, short-term disruption whilst activity occurs then stops once ceases*	5 – Likely *Will probably occur in normal circumstances.*	5 – Low	Less than Minor

Benthic Environs

Any explosives required will be used down-hole using explosive charges specifically designed for the task at hand by a suitably qualified explosive specialist. It is considered that most of the noise generated from the explosive charge would emanate out through the walls of the well into the surrounding strata. The sediments at each well location will likely absorb and muffle any sound waves before they reach the seabed.

Consequence – Invertebrates on the seabed and within the substrate are generally not expected be affected by the detonation of explosives, although minor behavioural changes may occur such as retraction of feeding structures or retraction of bodies into shells in response to vibrations. Consequently, if explosives are required, there should be no widespread effect on the benthic fauna. The use of explosives on benthic fauna would be localised (1-5 km^2) depending where in the wellbore the explosives were detonated, but any potential effects would stop as soon as the explosives detonated. Therefore, the consequence is assessed as *minor*.

Likelihood – The likelihood of effects on benthic fauna, given invertebrates do not have sensory organs like fish or mammals, is assessed as *rare*.

As the consequence of effects from the contingent activities on the benthic environs is *minor*, and it is considered to be a *rare* occurrence, the environmental risk of adverse effects occurring on the benthic environs from contingent activities is assessed as ***very low***, and resultant magnitude of the environmental impact is predicted to be ***almost negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Contingent activities – effects of explosives on benthic environment	1 – Minor *Localised effect, short-term disruption whilst activity occurs then stops once ceases*	2 – Rare *May occur, but only in exceptional circumstances*	2 – Very Low	Almost Negligible

7.2.11.1.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measure to avoid, remedy, or mitigate adverse effects from the contingent activities will be in place during the Kupe Phase 2 Development Drilling Programme:

- The size of any explosive charge required will be designed by a specialist to ensure it is appropriate for the required task.

7.2.11.2 Excess Cement Disposal

As discussed in **Section 2.2.10.4**, on very rare occasions cement batches may be prepared onboard the MODU but are ultimately deemed unsuitable for use or are an excess at the required point in the well (e.g. the cement is not weighted or setting correctly) and the batch of approximately 15 m^3 of cement may need to be discarded.

7.2.11.2.1 Area of Potential Impact

The cement would be discharged in slurry form will have a relatively high density compared to the surrounding seawater, so upon discharge it will form a convective descent plume that will pull the vast majority of the substance downwards and deposit in a spatially limited area on the seabed. During descent the cement will mix with surrounding seawater and become more dilute than its original state, meaning it is possible that the discharged cement could form a shallow pile on the seabed. The effects on marine organisms are likely to be restricted to a relatively spatially limited area close to and slightly down-current of the Kupe WHP, it is unlikely to result in a large cement structure on the seafloor as the cement will get further mixed in the water column as it sinks. Over time the cement would slowly be covered over following the deposition of natural sediments through resuspension and sediment transport pathways influenced by local currents present in the general offshore Taranaki region.

There could be a potential increase in pH within the water column around the discharged cement as it sinks from the surface to the seabed; however, it is considered that this would have no effect on the marine communities present in the offshore Taranaki waters due to the well-mixed water column and high dilution that will result, should such a discharge occur.

7.2.11.2.2 Potential Effects

Pelagic Environs

Consequence – Finer particles within the cement that become dispersed during the descent to seafloor would likely create highly localised increases in turbidity, which would be very temporary in nature as the dispersed particles are transported and mixed by waves and currents in the open ocean environment. Due to the highly mobile nature of pelagic fauna, any fauna present are likely to move away from the turbid plume. However, planktonic fauna directly within the highest concentrations of the discharge plume may become smothered by small cement particles.

Any potential effects from this discharge will be intermittent and will stop once sufficient mixing has occurred, which is expected to occur rapidly through dilution and dispersion. Planktonic fauna within the discharge plume may be affected by physical smothering; however, the discharge plume will rapidly disperse, and any effects will be highly localised, and population level effects will not occur. Therefore, the consequence of cementing operations on the pelagic environment is considered to be *negligible*.

Likelihood – The likelihood of any effects occurring is assessed as being *remote* due to the very small worst-case area of potential impact from the discharge of the cement mixture, along with the rapid dilution and dispersion anticipated in the high-energy offshore marine environment within the IAA.

As the consequence of effects from the cementing operations on the pelagic environment is *negligible*, and it is considered a *remote* likelihood, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Cementing operations – effects on pelagic environs	0 – Negligible *Highly localised effect and there are no predicted adverse effects to populations*	1 – Remote *Effects extremely unlikely but theoretically possible*	0 – Negligible	Negligible

Benthic Environs

Consequence – As discussed above in relation to the pelagic environs, a batch discharge of cement will have a relatively high density relative to the surrounding seawater, and upon discharge will form a convective descent plume that will pull the vast majority of the cement downwards. If the batch discharge reaches the seabed, albeit in a reduced volume, it could have a smothering effect on the seabed and any benthic communities living on or within the substrate would be smothered.

The resulting effects from the physical disturbance associated with the cement discharge will be over a small spatial scale (less than 1,000 m^2) and not result in detectable impacts to benthic species at a population level, with the ecosystem remaining intact. Therefore, the consequences of such a discharge are *negligible*.

Likelihood – The likelihood of effects within the immediate vicinity of the well location from the deposition of cement is considered to be *possible*.

As the consequence of effects from the discharge of a batch of excess cement on the benthic environment is *negligible*, and it is considered a *possible* likelihood, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Cementing operations – effects on benthic environs	0 – Negligible *Highly localised with no predicted adverse effects to populations*	4 – Possible *Could occur at some time*	0 – Negligible	Negligible

7.2.11.2.3 Measures to Avoid, Remedy or Mitigate Adverse Effects

The following measures to avoid, remedy, or mitigate adverse effects from cementing operations will be in place during the Kupe Phase 2 Development Drilling Programme:

- Cement volumes will be specifically calculated to minimise excess cement remaining; and
- Cement make-up is completed by competent personnel to minimise likelihood of excess batches being prepared.

7.3 Potential Adverse Effects from Deck Drainage

As outlined within **Section 2.3**, Beach cannot guarantee the absolute absence of harmful substances in water that runs off hazard areas into the deck drains of the MODU and is subsequently discharged into the surrounding marine environment. Therefore, the following assessment of this potential discharge has been based on an example MODU, which has been used to provide an indication of the potential volumes of discharge that may occur from its deck drains and the potential concentration of harmful substances contained within such discharges. If any other MODU is used for the Kupe Phase 2 Development Drilling Programme that differs to the example MODU used here, then the only difference relevant to this consent application is the potential volume of discharge, which is dependent on the size of the decks which in turn dictates runoff (discharge) volumes. The assumptions made in this consent application reflect a worst-case discharge scenario.

7.3.1 Discharge Volumes

The discharge volumes from deck drains of the MODU that will be located at the Kupe WHP are dependent on the volume of water entering the deck drain system. Water discharged from the deck drains includes rainwater, wash-down water, sea spray, and any potential water from deluge operations should it be required.

Given there is no rainfall data available at the Kupe WHP, rainfall data from onshore weather stations located nearby were utilised and assessed to represent indicative rainfall values for the drilling location. Three stations were investigated, the Hawera Aerodrome, Ohawe, and Tawhiti Stream (at Duffys Road, Whareroa) which indicated mean daily rainfall values of 3.11, 3.28, and 2.92 mm per day, respectively, for the data periods available (ranging between 2000 to 2021). All of these rainfall stations are located within 34 km of the Kupe WHP.

The Tawhiti Stream data have been used for the concentration calculations as it had the lowest daily mean and lowest daily 90th percentile rainfall statistics. The lower rainfall values represent a worst-case scenario because the lower the rainfall, the lower the rate of dilution of any harmful substances prior to discharge to the sea and therefore the highest concentration of the harmful substances in the discharge. Using rainfall statistics from weather stations with a higher daily rainfall value (i.e. Ohawe) would result in higher dilution rates and therefore lower concentrations of harmful substances in the discharge than would otherwise be made using the Tawhiti Stream rainfall data (**Table 31**).

Table 31 Rainfall data summary statistics for Tawhiti Stream at Duffys Road

Determinand	Statistic
Dataset Date Range	9 September 2000 to 9 September 2021
Minimum daily rainfall	0 mm
Maximum daily rainfall	99 mm
Annual daily mean rainfall	3.02 mm
Median daily rainfall	0 mm
% of days that rainfall occurs	46%

The volume of rainwater run-off from the MODU is dictated by the surface area of its decks. A deck surface area of 4,300 m^2 has been used in the dilution calculations in the following sections as a reasonable representation of a standard MODU. This deck size is based on the length and width of the triangular shaped Valaris Gorilla VII jack-up MODU which is being utilised by another operator in the Taranaki region and is considered suitable to undertake the Kupe Phase 2 Development Drilling Programme.

The calculations presented in the following sections assume that all rain falls evenly across all of the deck area of the MODU during any rainfall event and that all water is collected and routed through the deck drains. This assumption represents a worst-case scenario as rainfall is unlikely to be completely even across the entire footprint of the MODU given the variable height, shape, and type of surfaces on the MODU which create sheltered areas, causing rainwater to potentially deflect off some areas and go directly overboard, or causing rainwater to accumulate more in other areas.

For the purpose of this assessment, it has been assumed, based on the information presented in **Table 31**, that the annual daily mean rainfall (3.02 mm) falls on 46% of the days that the MODU is in position at the Kupe WHP. In reality, the amount of rain that falls on any 'rain day' would be ~6.57 mm; however, 3.02 mm has been used for the purposes of this assessment as it results in significantly less dilution and therefore represents a worst-case scenario. Based on these assumptions, the average hourly rate at which runoff from the decks of the MODU entering the hazardous deck drain settlement tank is 541 L/hr – this input rate has been used in the dilution calculations presented in **Section 7.3.2**.

7.3.2 Harmful Substance Dilution Calculations

7.3.2.1 Overview

As outlined in **Section 2.3.3.2**, a harmful substance that is typically used on MODUs has been utilised for these calculations. Sodium hypochlorite is likely the most ecotoxic substance that is harmful to the aquatic environment which could be stored and used on board the MODU and therefore could potentially be discharged from the deck drains. This substance was chosen as it is very likely to be onboard the MODU irrespective of who the chemical supplier is for the drilling activities as it is typically required for the treatment of potable water supplies. Sodium hypochlorite is stored as a neat product (i.e. 100% active ingredient).

Table 32 presents the available information on the ecotoxicity of sodium hypochlorite from the product SDS (updated as of 8/8/2017), a copy of which is included in **Appendix I**. This ecotoxicity information has been used to determine potential effects on the environment and existing interests.

Although sodium hypochlorite may not be included in the final list of substances associated with the Kupe Phase 2 Development Drilling Programme (although it is very likely), the results of this assessment will be directly applicable to any harmful substance with similar ecotoxicity characteristics. Any harmful substances that are discharged which have lower ecotoxicity will result in lesser effects than has been assessed in the following sections.

Table 32 Ecotoxicity data for sodium hypochlorite[28]

Product Name and *HSNO Approval Code*	Intended Use	Form	Harmful Classification	Algae	Fish	Invertebrate
SODIUM HYPOCHLORITE POTABLE GRADE *HSR003698*	Water treatment chemical for potable water supplies	Liquid. Miscible in seawater and sinks.	GHS 7 Acute Category 1 (previously 9.1A)	EC_{50} (72 hr) 0.018 mg/L (no species provided in SDS) NOEC (72 hr) 0.005 mg/L (no species provided in SDS)	LC_{50} (96 hr) 0.032 mg/L) (no species provided in SDS)	EC_{50} (48 hr) 0.026 mg/L (crustacea) (no species provided in SDS)

The lethal concentration (**LC_{50}**) and effects concentration (**EC_{50}**) values in **Table 32** are based on 48- or 96-hour exposure times at the listed concentrations, meaning the test organism was subjected to the stated concentration of sodium hypochlorite over the time period defined (i.e. 48 or 96 hr).

LC_{50} is the statistically derived dose/concentration at which 50% of the test organisms would be expected to die following exposure to the harmful substance for the stated duration (i.e. 48 or 96 hours).

EC_{50} is the dose/concentration which results in a 50% reduction in algal growth rate or invertebrate mobilisation (e.g. the concentration of the substance at which 50% of the test organisms stop moving) following exposure to the harmful substance for the stated duration (i.e. 48 or 96 hours).

The No Observable Effects Concentration (**NOEC**) is the highest tested dose/concentration where there were no statistically significantly different effects to test organisms compared to the control group.

7.3.2.2 Calculations

The following assumptions have been made in the calculations of likely discharge concentrations of sodium hypochlorite from the deck drains:

- 250 mL of sodium hypochlorite remains on the deck following clean-up of any spill and the entire volume enters the deck drainage treatment system prior to being discharged to the sea.

  The actual volume of residual substance remaining on the deck following clean-up of any spill would likely be much less than this volume; however, a 250 mL residual volume has been used in the following calculations to represent a worst-case scenario.

  Beach notes that a 250 mL residual volume formed the basis of three recent IAs prepared in support of marine discharge consent applications considered by the EPA (EEZ100017 for OMV Taranaki Limited, EEZ100018 for OMV GSB Limited, and EEZ100019 for Beach Energy Resources NZ (Holdings) Limited). For all three applications, the respective decision-making committees accepted this to be an appropriate volume of residual harmful substance left on the deck following clean-up of any spill to assess potential effects;

[28] The ecotoxicity data from the SDS are based on exposure to sodium hypochlorite 12% active chlorine solution, being the same as the proprietary product SODIUM HYPOCHLORITE POTABLE GRADE.

- All runoff from the decks drains into a settlement tank with a capacity of 5 m^3 which is half full (i.e. 2.5 m^3) before water discharges from its outlet. The volume of the settlement tank used in the calculations (5 m^3) is a relatively small tank compared to the tanks on many modern MODUs (e.g. the Valaris Gorilla VII is understood to have a tank capacity of 178 m^3); however, Beach is aware that some jack-up MODUs have small settlement tanks with capacities in the order of ~5 m^3 (e.g. the jack-up MODU 'ENSCO-107'). Beach will contract a jack-up MODU for the Kupe Phase 2 Development Drilling Programme which will have a settlement tank which is at least 5 m^3. It should be noted that the larger the settlement tank, the more dilution is available within the tank before the harmful substance is discharged. Using a 5 m^3 settlement tank size in the following calculations is therefore considered to represent a worst-case scenario for the concentration at the point that discharge begins to occur; and
- None of the sodium hypochlorite is removed through the treatment system. While the deck drainage water will flow through settlement tanks and then through the OWS before being discharged, harmful substances are not necessarily removed through this system if they are in a dissolved state. However, any such substances that are adhered to particles may be collected within the settlement tanks and any that are floatable may be removed through the OWS. Assuming no removal of sodium hypochlorite through the treatment system in the following calculations therefore represents a worst-case scenario.

The 250 mL volume of spilled sodium hypochlorite first needs to be converted to a mass using the specific gravity of the product, being 1.26 (obtained from the SDS), resulting in a mass of 315 g (315,000 mg). Therefore, 315,000 mg of sodium hypochlorite would enter the 2,500 L settlement tank (half full), resulting in a concentration of 126 mg/L within the settlement tank.

7.3.2.3 Comparison to Predicted No Effects Concentration

Directly comparing the concentration of sodium hypochlorite within the settlement tank to ecotoxicity EC_{50} and LC_{50} concentrations is not appropriate because these end-points constitute significant effects on the test organisms (e.g. death or immobility). A more appropriate approach is to compare the concentration of sodium hypochlorite within the discharge to a Predicted No Effects Concentration (**PNEC**), which is an estimate of the lowest concentration of a chemical in a particular environmental compartment (i.e. water or sediment) at which no adverse effects on the receiving environment would be expected.

The EPA typically uses the Chemical Hazard and Risk Management (**CHARM**) model to assess the potential environmental effects associated with the discharge of certain harmful substances in the waters of the EEZ. For the purposes of this consent application, the CHARM approach to calculating a PNEC has been followed; however, a full CHARM assessment is not carried out as the CHARM model is not designed to deal with the discharge of harmful substances from deck drains.

The CHARM user manual sets out the process for calculating the PNEC for a harmful substance[29]. The calculation of PNEC values varies depending on whether the substance being assessed is to be discharged in a 'batchwise' or 'continuous' manner. Discharges from deck drains will only occur during or after a rainfall or deluge event and are therefore analogous to a batchwise discharge under the CHARM model assumptions.

[29] https://eosca.eu/wp-content/uploads/2018/08/CHARM-User-Guide-Version-1-5.pdf

The PNEC value is calculated by dividing the lowest L/EC_{50} value by 10, this being referred to as an 'extrapolation factor'. This accounts for the uncertainty around the applicability of the L/EC_{50} value (which has been derived from a lab experiment) to field conditions. Under the CHARM model, if EC_{50} values are available for only two of the three trophic groups (i.e. algae, crustacea, or fish), which is the case for sodium hypochlorite (refer **Table 32**), then the lowest EC_{50} value is divided by a further extrapolation factor of 10. Following this approach, the PNEC value for sodium hypochlorite is calculated to be 0.00018 mg/L on the basis of:

- The discharge from the deck drains being batchwise;
- An extrapolation factor of 10 must be applied to account for the potential difference between lab test results to the ecotoxic outcomes in the field;
- EC_{50} values are only provided for two of the three trophic groups and a further extrapolation factor of 10 has therefore been applied to the lowest EC_{50} value;
- 0.018 mg/L is the lowest EC_{50} value (for an unspecified species of algae); and
- 0.018 mg/L divided by 100 (i.e. two extrapolation factors of 10 equals 100) results in a calculated PNEC of 0.00018 mg/L.

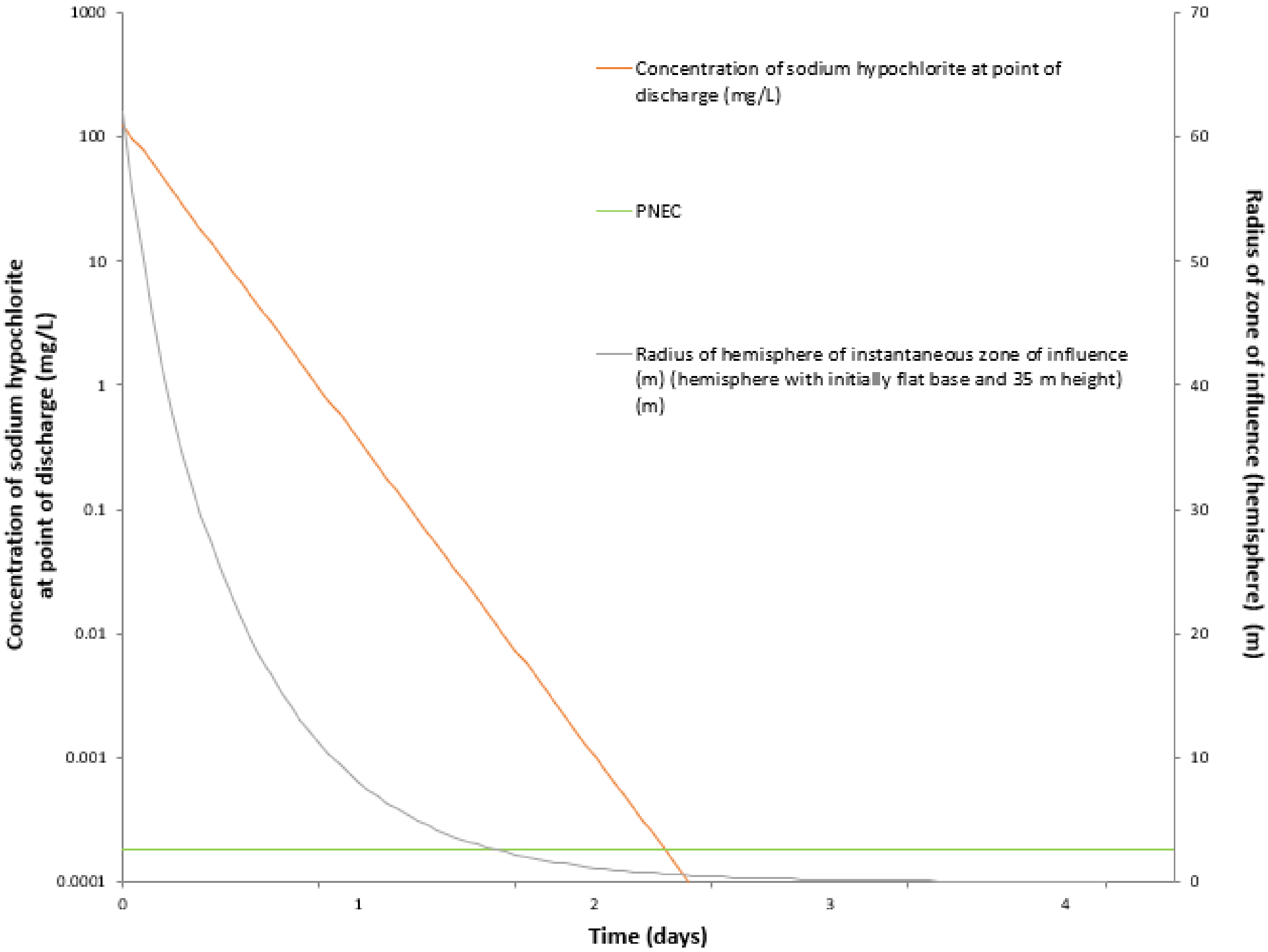
The calculated PNEC is significantly lower than the concentration of sodium hypochlorite in the settlement tank (0.00018 mg/L compared to 126 mg/L) but once it begins being discharged to the sea, it will be rapidly diluted within the high energy receiving waters. The rate of discharge to the sea is assumed to be equal to the rate at which runoff from the deck enters the settlement tank (i.e. water in equals water out), which was calculated as being 541 L/hr (**Section 7.3.1**). The volume of water required to reduce the concentration of sodium hypochlorite in the discharge to the PNEC can be calculated and a 'zone of influence' can be determined, this being the area/zone within the receiving water where the concentration of sodium hypochlorite exceeds the PNEC.

For the purposes of this assessment a hemisphere shaped zone of influence, initially with a flat base due to the seabed when its radius was greater than 35 m, has been used and an assumption made that dilution would occur uniformly within the hemisphere. It should be noted that the actual shape and extent of the zone of influence (i.e. the discharge plume) would probably be patchily distributed in time and space and governed by the intensity of intermittent rainfall events, ambient wind, current, and tidal conditions at the time of any such discharge. However, using a simple hemispherical zone of influence is considered appropriate to provide an indication of the likely scale of effects.

The largest zone of influence would occur when the discharge first commences because it would contain the highest concentration of sodium hypochlorite – the radius of the hemispherical zone of influence when the discharge first commences is calculated to be 62 m. This represents the largest extent of potential effects because the concentration of sodium hypochlorite within the settlement tank would decrease over time as 'clean' rainfall runoff from the decks continues to enter the tank, resulting in the concentration in the discharge going to the sea continually decreasing over time. This, in turn, would reduce (shrink) the radius of the hemispherical zone of influence over time as the discharge continues.

How the concentration of sodium hypochlorite decreases over time and corresponding reduction in the zone of influence is shown in **Figure 53** (also shown is the PNEC). The zone of influence reduces from an initial radius of 62 m to approximately 8 m in one day and down to almost zero in approximately three days. Note, this timing is based around the small tank size of 5 m^3 and the uniform rate of water entering (and then exiting) the settlement tank of 541 L/hr. A larger tank, with the same rate of input/output would result in a lower initial concentration at the start of discharge but a slower rate of decreasing concentration over time (i.e. longer period required to reach zero). While a higher rate of input/output with the same sized tank would result in a greater proportion of the substance being discharged at each time point, the concentrations within the tank would decrease faster (i.e. shorter time to reach zero).

Figure 53 Concentration of sodium hypochlorite at the point of deck drainage discharge, and the radius of the hemisphere of potentially affected area over time



7.3.3 Uncertainty Associated with the Discharge of Harmful Substances

Section 61(2) of the EEZ Act states that, if the information available is uncertain or inadequate, the marine consent authority must "favour caution and environmental protection". Section 61(1)(b) also states that a decision maker must base decisions on the "best available information", being the best information that, in the particular circumstances, is available without unreasonable cost, effort, or time.

The two uncertainties relating to this marine discharge consent application are not knowing the:

- Specific details of the MODU(s) and associated deck drainage system(s); and
- Precise list of harmful substances that may be used during the Kupe Phase 2 Development Drilling Programme, and consequently the harmful substances which may be discharged from the deck drains.

Notwithstanding the above uncertainties, the ERA is based on the best available information. In addition, these uncertainties do not mean that the assessments and conclusions within this marine consent application are uncertain or inadequate. In fact, the approach taken in the preparation of this marine consent application has enabled the appropriate assessments of potential effects on the environment and existing interests to be made so that the requirement to favour caution does not arise. This approach has involved using worst-case scenario assumptions to account for any possible uncertainty, including:

- The IAA has been defined to ensure that the drilling of the wells will occur within this IAA and the existing environment (**Section 4**) and ERA (**Section 5**) reflects the overall extent of the IAA;
- The assumed volume of the MODU's settling tanks is small (5 m^3), with a further assumption being that these tanks are only half full (2.5 m^3) prior to a rainfall event occurring (**Section 7.3.1**). This provides for the highest concentration of harmful substance (i.e. the strongest concentration) prior to discharge to the receiving environment; and
- An example harmful substance from the most ecotoxic substance category under GHS 7 (i.e. Acute Category 1) has been used in the calculations (**Section 7.3.2**).

These worst-case scenario assumptions have been applied to the likelihood and consequence approach within the ERA to assess the potential effects on the environment to ensure that the assessments fully account for any uncertainty associated with this marine consent application. To further address any potential uncertainty, Beach has proffered a condition requiring minimum design requirements for the deck drainage of the MODU selected to undertake the drilling for the Kupe Phase 2 Development Drilling Programme (Condition 9 within the marine discharge consent conditions contained in **Appendix A**).

In addition to the matters discussed above, an integral measure in dealing with the specifics of the harmful substances associated with the Kupe Phase 2 Development Drilling Programme is the implementation of an ESRP in accordance with regulation 24 of the D&D Regulations. Beach will comply with this regulation prior to undertaking the Kupe Phase 2 Development Drilling Programme. The ESRP will contain the emergency spill response procedures for all harmful substances held on-board the MODU, and will include:

- Guidance to ensure the safety of personnel;
- Measures to prevent the occurrence of a spill; and
- Information to help personnel on the MODU deal with a spill by detailing the actions necessary to stop, minimise, or mitigate the effects of a spill.

In summary, the uncertainties relating to this marine consent application have been accounted for by using worst-case scenario assumptions in the ERA and the proffered conditions that have been included within **Appendix A**. These measures ensure that the assessments and conclusions within this marine consent application are adequate and appropriate to inform a decision.

7.3.4 Potential Effects on the Environment from Discharges of Harmful Substances via Deck Drains

7.3.4.1 Introduction

This section presents an assessment of the potential effects of the discharge of harmful substances from the deck drains of the MODU on the following receiving environments:

- Biological environment (plankton, benthic invertebrates, pelagic species, and seabirds); and
- Socio-economic environment (recreational and commercial fishing).

7.3.4.2 Biological Environs

7.3.4.2.1 Plankton and Primary Productivity

Plankton are a group of marine species whose distributions are predominantly determined by ocean currents. Although the IAA is at the eastern edge of the STB, spatially isolated phytoplankton blooms can form in eddies thrown off from the Kahurangi Upwelling that may travel into the STB and possibly reach the IAA. The calculations in **Section 7.3.2** show that the maximum radius of the potentially affected area (a hemisphere which initially has a flat base when the radius is greater than 35 m) would lie within 62 m of the point of discharge. These calculations assume equal mixing occurring within the receiving waters; however, under field conditions, the actual shape of the mixing zone would be dictated by the predominant current at the time of any discharge (the most common being the tidal M2 current which is tidally reversing NW-SE) and wave actions/directions within the receiving waters at the time of discharge – the actual shape is likely to be variable (e.g. hemispherical, conical, patches, ribbon-like). Nevertheless, the same volume of water (as calculated) would be needed to reduce the harmful substance concentrations to below the PNEC (for any given input concentration and discharge rate). Given the variability of potential shape of the discharge plume, it is considered that using a hemisphere in the calculations provides a reasonable indication of the scale of potential spatial/volumetric effects.

Consequence – Plankton species are likely to be in the immediate vicinity around the point of discharge. Any individuals that come into contact with a discharge plume containing ecotoxic concentrations of a harmful substance have the potential to be adversely affected – this may include acute or chronic effects. The dilution calculations provided in **Section 7.3.2** indicate any adverse effects would be highly localised (<1 km^2), temporary in nature, and result in no effects to plankton populations within the IAA or the wider STB. Therefore, the consequence on plankton is assessed as being *negligible*.

Likelihood – To be significantly affected, an individual must be exposed to ecotoxic concentrations of a harmful substance for an extended period. The lowest EC_{50} used in the dilution calculations in **Section 7.3.2.3** was for algae, being 0.018 mg/L (72 hour), which means that for the growth rate of a given number of individuals to be reduced by 50%, those individuals must be exposed to 0.018 mg/L for a minimum of 72 hours. In the worst-case discharge scenario assessed in **Section 7.3.2.3** and outlined in **Figure 53**, this level of exposure is theoretically possible, but would require a zero rate of water flushing in the immediate vicinity of the point of discharge for this entire period. The hydrodynamic regime in this area could be so modified that it allows individuals of plankton to come into extended periods of contact with ecotoxic concentrations of harmful substances discharged from deck drains – for example in the eddies formed behind the Kupe WHP legs, or the MODU legs. Based on the above, it is *certain* that individuals of plankton species would be adversely affected by the discharge of harmful substance from the deck drains, if a discharge does in fact occur.

As the consequence of the discharge of harmful substances from deck drains on plankton is *negligible,* and there is a *certain* likelihood that this could occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Deck drainage – effects on plankton and primary productivity	0 – Negligible *Highly localised, <1 km², temporary duration and no predicted adverse effects to populations*	6 – Certain *Is expected to occur in most circumstances and has a history of occurrence.*	0 – Negligible	Negligible

7.3.4.2.2 Benthic Invertebrates

Any discharges of harmful substances from the deck drains of the MODU would occur near the sea surface water, being ~35 m above the seabed. The high energy nature of the environment in the IAA means that any harmful substances that are discharged would receive significant mixing and dilution within the top portion of the water column before reaching the seabed – if at all.

Consequence – The dilution calculations provided in **Section 7.3.2** indicate that if harmful substances are discharged from the deck drains, any adverse effects would be highly localised (<1 km^2) and likely undetectable beyond a short distance of the point of discharge. However, given that the assumed equal mixing in all directions does assume downwards mixing occurring within the hemispherical zone of effects there is a possibility that concentrations of harmful substances could still be above PNEC at the seabed under this scenario and therefore theoretically have an effect on benthic invertebrates. Therefore, given the likely short duration (days), small area (62 m radius), and lack of sensitive benthic invertebrates within the IAA, the consequence of any effects on benthic invertebrates falls under the *negligible* category.

Likelihood – Benthic invertebrates could be adversely affected if the harmful substance discharged from the deck drains were insoluble, denser than water and sank to the seabed upon discharge, noting that any such substance would need to pass through the treatment system unaltered. However, substances that are insoluble and denser than water are likely to be collected within the settlement tank of the deck drainage system, thereby reducing the likelihood of such substances being discharged. There is a low likelihood that harmful substances discharged from the deck drains would reach the seabed at high enough concentrations have any detectable effect on benthic invertebrates, and thus, given that it is theoretically possible for such an effect to occur, a *remote* likelihood has been allocated.

As the consequence of the discharge of harmful substances from deck drains on benthic invertebrates is *negligible,* and it is *remote* likelihood to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Deck drainage – effects on benthic invertebrates	0 – Negligible *Highly localised, <1 km², temporary duration and lack of sensitive benthic invertebrates affected*	1 - Remote *Highly unlikely but theoretically possible*	0- Negligible	Negligible

7.3.4.2.3 Pelagic species

This receptor group includes pelagic species that can move independently of ambient hydrodynamic conditions: fish (including demersal fish species), cephalopods, cetaceans, and pinnipeds. Pelagic species have varying levels of sensitivity to harmful substances, but, given the localised scale of the potential effects of the discharges of harmful substances from the deck drains following the clean-up of a loss of containment, it is considered that grouping these species together is appropriate and would not underrepresent the level of effect on even the most sensitive or highly protected species in this group.

Section 4.3 outlines the pelagic species that could be in in the IAA during drilling, and which could come into direct contact with the discharge plume. Some pinnipeds and fish species may temporarily aggregate in the vicinity of the MODU and Kupe WHP to rest or to forage. This behaviour increases the likelihood of such individuals of these species being exposed to harmful substances that could be present within the deck drain discharges following the clean-up of a loss of containment. While the majority of pelagic species are likely to be passing transiently through the IAA and are therefore unlikely to use the MODU as foraging or resting areas, the physical structures of the Kupe WHP and the legs of the MODU represent somewhat of an artificial reef in an area of relatively mobile seabed sediments and likely provide an aggregation point for some pelagic species. This increases their exposure time to any harmful substances that may be discharged from deck drains and could therefore increase the likelihood of them being adversely affected by the discharges.

Consequence – The endpoint values for the harmful substances used in the calculations within **Section 7.3.2** represent the ecotoxicity to small aquatic organisms after extended periods of exposure (minimum 48 hours) to the most ecotoxic substance likely to be stored on the MODU. In terms of the pelagic species, these endpoint values would be most representative of the potential sensitivity of very small fish species to the harmful substance used in the calculations. Any larger pelagic species, such as commercially important fish species, or species that are protected or that have an elevated conservation status, will be significantly less sensitive than any test organisms and inherently more tolerant to the worst-case concentrations of harmful substances considered in **Section 7.3.2**.

The consequence of the discharge of harmful substances from deck drains on pelagic species is assessed to be *negligible* because:

- The discharges would occur intermittently (if at all), be of short duration, and given the strong currents and high energy receiving environment, would most likely only affect small volume of water in the upper layers of the water column in the immediate vicinity of the point of discharge;
- Only a small number of individuals could be affected;
- No pelagic species are predicted to be adversely affected at the population level; and
- While some individuals of protected species (such as fish and marine mammals) may be exposed to harmful substances within the discharges from the deck drains, these species are relatively large and tend to be highly mobile and able to move away from a source of discomfort and thus are not expected to be adversely impacted.

Likelihood – For pelagic species to be adversely affected by the discharged harmful substances, they must firstly be present around the MODU at the specific time of a discharge from deck drainage that contained a harmful substance, and then must be exposed to ecotoxic concentrations of that substance(s) for periods of time long enough for acute or chronic effects to occur. Pelagic species can move independently of hydrodynamic conditions which means that it is unlikely that an individual would remain within 62 m of the point of discharge for an entire period of 48 hours or more, thus replicating the conditions required to produce the level of ecotoxic response considered in **Section 7.3.2** (minimum of 48 hours of exposure to PNEC). Further, the discharged harmful substance would need to remain present at a concentration above the PNEC throughout this period which, given the dynamic offshore environment and the currents that flow through the area, is unlikely. Therefore, it is *unlikely* that any pelagic species would be adversely affected by the proposed discharge.

As the consequence of the discharge of harmful substances from deck drains on pelagic species is *negligible,* and it is *unlikely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible****.*

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Deck drainage – effects on pelagic species	0 – Negligible *Highly localised, <1 km^2, temporary duration and almost no protected species impacted*	3 – Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

7.3.4.2.4 Seabirds

MODUs in general are known to be used by seabirds for perching opportunities to rest during long flights or during adverse weather conditions, and seabirds have been observed perching on the Kupe WHP. Aggregations of small fish around the MODU offer a foraging opportunity for diving seabirds, although this is likely already the case with the existing Kupe WHP. Therefore, it is theoretically possible for individual seabirds to be diving in proximity to the point of discharge while harmful substances are being discharged. However, the small scale of the potentially affected area and intermittent nature of any harmful substance discharge (if at all) reduces any potential for spatial and temporal overlap with diving seabirds.

Consequence - Any overlap that may occur between seabirds contacting the ocean following a discharge and ecotoxic concentrations of harmful substances discharged from deck drains would be very short in duration as any discharges will be intermittent. If any adverse effects occur, they would do so in a highly localised area around the point of discharge and very few, if any, protected species are expected to be impacted. On this basis, the consequence to seabirds is assessed to be *negligible*.

Likelihood – For seabirds to be adversely affected by the discharged harmful substances, they must firstly be present around the MODU at the time of a discharge and then must be exposed to ecotoxic concentrations of that substance(s) for prolonged periods of time. It is considered that there is a low likelihood of an individual seabird being exposed to ecotoxic concentrations of a harmful substance for the length of time required for it to be adversely affected. Accordingly, the likelihood of any individuals to be adversely affected by the discharge of harmful substances from deck drains is assessed as *unlikely*.

As the consequence of the discharge of harmful substances from deck drains on seabirds is *negligible,* and it is *unlikely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible****.*

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Deck drainage – effects on seabirds	0 – Negligible *Highly localised, <1 km^2, temporary duration and no predicted adverse effects to populations*	3 – Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

7.3.4.3 Socio-Economic Environs

An overview of the socio-economic environment relevant to the IAA is provided in **Section 4.5** which reflects the users of the marine environment within and surrounding the IAA. In this instance, these users are restricted to recreational and commercial fishers.

7.3.4.3.1 Recreational Fishing

As outlined in **Section 4.5.1.2** the majority of the recreational fishing effort in the vicinity of Kupe IAA tends to be further inshore, closer to the coastline. A Safety Zone exists around the Kupe WHP, and a Protected Area is in place over the Kupe pipeline which restricts fishing activities, removing the legal ability for recreational fishers to be in close proximity to the Kupe WHP (or in fact the MODU) or to any discharge of any harmful substance that might occur from the deck drains.

Consequence – As any ecotoxic effects that could occur from the discharge of harmful substances from the deck drains would occur well within the 500 m Safety Zone around the Kupe WHP, the consequence on recreational fishing is assessed to be *negligible*, which aligns with the potential effects on the pelagic fish species that recreational fishers are likely to target.

Likelihood – Given that recreational fishers are rarely likely to be fishing near the Kupe WHP due to the existing 500 m Safety Zone around the Kupe WHP restricting recreational fisherman from targeting this area, it is considered *remote* that any recreational fishing will be affected by the discharge of harmful substances from the deck drains.

As the consequence of the discharge of harmful substances from deck drains on recreational fishing is *negligible,* and it is *remote* likelihood to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible.***

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Deck drainage – effects on recreational fishing.	0 – Negligible *Highly localised, <1 km^2, temporary duration and no disruptions to normal activities*	1 – Remote *Extremely unlikely but theoretically possible*	0 – Negligible	Negligible

7.3.4.3.2 Commercial Fishing

Commercial fishing activities are known to take place within and in reasonably close proximity to the Kupe IAA (as discussed in **Section 4.5.1.1**), utilising bottom long lining, bottom trawling, hand-lining and set-netting to target predominantly snapper, gurnard, school shark, trevally, blue cod and rig. However, given that commercial fishing activities are currently excluded from around the Kupe WHP (due to the Safety Zone), no commercial fishers will be in close proximity to the MODU or any discharge that may potentially occur.

Consequence - As discussed in **Section 7.3.4.2.3** the predicted magnitude of environmental impact on pelagic species, which includes many of the commercially important fish species, would be negligible. Some of the targeted species are less pelagic (e.g. blue cod and gurnard) but the predicted magnitude of impact to these species is expected to similarly be negligible. Consequently, the effects on commercial fishing are also assessed to be *negligible***.**

Likelihood – As set out in **Section 7.3.4.2.3** it is *unlikely* that pelagic species would be affected by the proposed discharge as it is unlikely that an individual would remain within 62 m of the point of discharge for the entire 48 hours or more which would be needed to replicate the conditions required to produce the level of ecotoxic response considered in **Section 7.3.2** (minimum of 48 hours of exposure to PNEC). However, the presence of the Kupe WHP and its action as somewhat of an artificial reef may have resulted in there being some commercially fished species becoming somewhat more resident to this area. But as also detailed in **Section 7.3.4.2.3** if any commercially important pelagic species, or more benthic species as detailed above, are affected, this would only be a small number of individuals relative to the size of their populations will be affected. Therefore, it is *unlikely* that commercial fishing will be adversely affected by the potential discharge of harmful substances from the deck drains.

As the consequence of the discharge of harmful substances from deck drains on commercial fishing is *negligible,* and it is *unlikely* to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Deck drainage – effects on commercial fishing.	0 – Negligible *Highly localised, <1 km^2, temporary duration and no disruptions to normal activities*	3 – Unlikely *Not likely to occur in normal circumstances*	0 – Negligible	Negligible

7.3.5 Measures to Avoid, Remedy or Mitigate Adverse Effects

The measures to avoid, remedy, or mitigate adverse effects of the discharges of harmful substances are outlined in **Section 2.3** and are not repeated here. They relate to systems that will be employed by Beach to minimise the likelihood of any harmful substances being spilled on the decks of the MODU and the procedures/equipment that will be used to clean up any such spills in the unlikely event of any such spill.

7.4 Potential Adverse Effects on Persons with Existing Interests

7.4.1 Ngāti Ruanui and Ngāruahine Cultural Interests

The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine (included as **Appendix F**) assesses the cultural impacts of the proposed activities. The reader is referred to the CIA for a detailed assessment of these cultural impacts.

Both Ngāti Ruanui and Ngāruahine state they oppose the application on the basis of the nature and significant scale of cultural impacts on the moana and people of the iwi.

The collaborative CIA concludes the IAA and surrounds have high cultural significance to Ngāti Ruanui and are habitats of taonga species including indigenous flora and fauna. The CIA concludes there are cultural impacts on whakapapa, tikanga, mātauranga, and kaitiakitanga that are 'significant' and cannot be avoided or remedied.

The previous sections of this IA have determined the environmental risk and resultant magnitude of environmental impact on the basis of the 'consequence' and 'likelihood' approach. The collaborative CIA prepared by prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the activities on cultural values and associations as 'significant', however this overall assessment did not apply the 'consequence' and 'likelihood' methodology used in other parts of this IA. As such, no descriptors or scores are provided for these two attributes. According to **Table 22,** a 'significant' impact equates to a 'high' environmental risk and this risk is therefore used in the table below.

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Impact
Cultural values and associations of Ngāti Ruanui and Ngāruahine	N/A	N/A	High	Significant

7.4.2 Ngāti Manuhiakai Cultural Interests

In terms of effects on Ngāti Manuhiakai hapū cultural values and associations, the Ngāti Manuhiakai CIA (also contained in **Appendix F**) includes a 'modified criteria' table which has determined the 'residual impacts'[30] on mauri. This table is based on **Table 34** of this IA and assesses the residual impacts of the proposed activities on the current state of mauri of the various receptors.

The CIA states that the current state of the environment does not exist in a vacuum and is a direct result of the Kupe field over time and the CIA assesses the current state of mauri using descriptors ranging from 'minor degradation' through to 'severe degradation'. The CIA then applies the magnitude of environmental impact from **Table 34** to the state of existing mauri to produce a residual impact on mauri assessment for the proposed activities.

Usefully, the methodology used in the CIA aligns with the 'consequence' and 'likelihood' method used in this IA and the residual impact/risk[31] on mauri range from 'very low' to 'high'. Those activities which have been assessed as having a 'high' residual impact on mauri are the deposition of drill cuttings on benthic environments, the discharge of harmful substances via deck drainage on seabirds, and the loss of well control (condensate spill) effects on marine mammals and seabirds. A 'high' residual impact/risk[31] equates to a 'significant' magnitude of impact according to **Table 23** and this descriptor has therefore been used in the table below.

Receptor	Consequence	Likelihood	Risk	Predicted Magnitude of Impact
Cultural values and associations of Ngāti Manuhiakai	N/A	N/A	High	Significant

[30] The CIA notes that the residual impact assessment is on the basis that the conditions recommended in the CIA are confirmed.

[31] While the CIA refers to the result as being a residual 'impact', using a consequence and likelihood methodology results is a 'risk' being determined rather than an impact. The descriptors of residual impact presented in the CIA align with the 'risk' rankings presented in **Table 22** and **Table 23** of this IA.

7.5 Effects on Human Health from Planned Activities

The main pathway for potential effects on human health is associated with the discharge of harmful substances that may be discharged via the deck drains. The pathways for effects on human health from the discharge of any such harmful substances relate to either direct exposure to the discharge or from the consumption of fish caught (either commercially or recreationally) that have been exposed and contaminated by the discharge. Due to the extremely small volumes of harmful substances that may be discharged via the deck drains, combined with the high-energy and exposed marine environment within the IAA, the potential effects on human health will be extremely small.

Consequence – Any pelagic fish species entering the discharge plume would only experience low-level temporary exposure to a harmful substance within the discharge due to the rapid dilution and dispersion of the harmful substances upon entering the marine environment. The only potential for some form of impact would be if the fish species were located right next to the point of discharge for extended periods of time. The PNEC that has been determined for the example harmful substance assessed in **Section 7.3** has been based on ecotoxic data which required subjecting the test species to the contaminant for long periods of time (from 48 hours up to 21 days); given the offshore location of the Kupe WHP, any fish that did show up would be highly mobile, so this constant period of exposure would not occur. Therefore, the risk of bioaccumulation of any harmful substances to offshore fish species around the MODU is extremely low.

No commercial fishing will take place in close proximity to the MODU due to the 500 m Safety Zone that exists around the Kupe WHP.

Under normal working conditions, the only exposure to any risks associated with the activities undertaken as part of the Kupe Phase 2 Development Drilling Programme would be direct exposure to those personnel engaged to work on the MODU and support vessels. These personnel will all be suitably trained and qualified and will complete inductions prior to commencing work so that they are aware of all potential hazards and dangers working in the environment they do. Daily toolbox meetings will be undertaken to ensure safety of personnel is paramount for all activities performed and everyone is aware of the potential dangers.

Any potential effects from a harmful substance discharge would be intermittent. Any environmental effects would reduce and/or stop once sufficient dilution and dispersion has occurred, which is expected to occur rapidly in the high-energy offshore Taranaki marine environment. Any discharge of harmful substances is not anticipated to impact any commercial fish species. As a result, the consequences from the drilling activities and discharge of harmful substances via deck drains on human health would be *negligible*.

Likelihood – The 500 m Safety Zone that exists around the Kupe WHP will ensure that no human contact will be made with any discharged harmful substances. With this 500 m Safety Zone in place it is considered that the potential for direct exposure of the users of the marine environment to a discharge of harmful substances is remote – that is, the likelihood of any effects on human health from the drilling activities and associated discharge of harmful substances via deck drains is assessed as being *remote* due to the distance offshore, the 500 m Safety Zone, combined with the rapid dilution and dispersion anticipated in the high-energy offshore Taranaki marine environment.

As the consequence of effects on human health being *negligible*, and it is considered a *remote* chance to occur, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activities	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Effects on human health	0 – Negligible *Effects will be highly localised*	1 – Remote *Extremely unlikely but theoretically possible*	0 – Negligible	Negligible

7.6 Effects outside the EEZ from Planned Activities

The activities involved in the Kupe Phase 2 Development Drilling Programme will be confined around the Kupe WHP, with the maximum extent of effects being related with the seabed disturbance from the deposition of drill cuttings (**Section 7.2.6**). Although the CMA boundary is relatively close to the Kupe WHP (i.e. approximately 5.7 km), the maximum spatial extent of the deposition of drill cuttings extend approximately 1.2 km from the MODU (discussed in **Section 2.2.4**) meaning any potential impacts will not occur within the CMA.

Consequence – The potential effects from the Kupe Phase 2 Development Drilling Programme are highly localised and do not extend beyond the boundaries of the EEZ, meaning there will be no adverse effects to the marine environment (including existing interests) within the CMA.

Similarly, the planned activities associated with the Kupe Phase 2 Development Drilling Programme will have no adverse effects beyond the waters of the EEZ and Continental Shelf.

As a result, the consequence of effects outside the EEZ from the planned activities has been assessed as *negligible*.

Likelihood – It is considered that the likelihood of any effects occurring outside of the EEZ from the planned activities is *remote* due to the separation distance between the planned activities and the boundary of the EEZ.

As the consequence of effects from the planned activities outside of the EEZ is *negligible*, and it is considered a *remote* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Planned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Planned activities – effects outside the EEZ	0 – Negligible *Effects are highly localised very far removed from the EEZ boundary*	1 – Remote *Extremely unlikely but theoretically possible*	0 – Negligible	Negligible

7.7 Cumulative Effects

The potential for cumulative effects is considered with regards to three groups of activities, which are listed as follows, and addressed in the following sections:

1. The various planned activities which are the subject of this consent application;
2. Other activities associated with the Kupe Phase 2 Development Drilling Programme; and
3. Other activities occurring within (e.g. marine traffic) and outside the IAA (e.g. land use, coastal discharges, marine farming).

7.7.1 Potential Cumulative Effects from Planned Activities

There are a number of different activities which, together, can result in cumulative effects during the drilling of the initial development well. In addition, cumulative effects can occur as a result of drilling the second development well as it would be drilled at the same location as the initial well, albeit with a ~12-month gap in between drilling. The greatest cumulative effect associated with drilling the second development well relates to the deposition of drill cuttings and these effects are discussed in **Section 7.7.1.1**, whereas the cumulative effects associated with all the activities associated with drilling each well being discussed in **Section 7.7.1.2**.

7.7.1.1 Cumulative Impact of the Drill Cutting Deposition Footprints

The second development well (if drilled) would be drilled not less than 6 months after the first well and would result in essentially the same depositional footprint as that for the initial development well. However, some of the drill cuttings deposited on the seabed during the drilling of the initial development well would be removed through currents transporting the seabed sediments away from the footprint site. The mobile nature of the seabed sediments in and around the Kupe WHP is evidenced by the fact that three development wells were drilled there around 12 years ago, with deposition of cuttings onto the seabed, however there has been a marked drop in the level of the seabed since that time.

Calypso Science (2022a) states that, due to the receiving environment having a high sediment transport potential, only the coarser fractions (>1 mm diameter) would remain near the initial deposition position. Calypso Science (2022a) modelled the cumulative effects of drilling the second development well 6 months after the initial development well, the results of which are discussed below.

Table 33 shows both the cumulative effect of drilling the second development well in terms of the maximum distance at which the seabed receives drill cuttings above the respective deposition threshold, and also the spatial area that is covered by the drill cuttings above the respective depositional thresholds (1 mm and 6.3 mm).

Table 33 Cumulate maximum distance and area of drill cutting deposition second development well scenario

Deposition Thresholds		Initial Well & Second Well Scenario	
		Distance (km)	Area (km^2)
1.0 mm	Maximum	0.509	0.298
	Most probable *	0.353	0.147
6.3 mm	Maximum	0.270	0.081
	Most probable *	0.154	0.019

* The most probable statistic within this table is presented as ‘P50’ within Calypso Science, 2022a (**Appendix B**) which equates to the median value for the 100 stochastic runs. For the purposes of this consent application, this has been termed the most probably for ease of understanding.

The cumulative effect of depositing cuttings from the second development well does not increase the maximum area of the depositional footprint (for the 6.3 mm depositional thickness), that being 0.081 km^2 for drilling the initial development (refer **Table 6**). However, deposition of drill cuttings from the second development well would result in an increased thickness of deposited cuttings below the point of discharge because the coarser fraction of the initial well’s cuttings would still remain on the seabed. The additional depths are shown in **Figure 54** and **Figure 56**, these representing the major and minor axis of the depositional footprint. The green dashed line shows the thickness of cuttings of drilling the initial well and the solid green line shows the thickness following the drilling of the second development well (labelled ‘revisit’ in the plots). The most probable (median) thickness (**Figure 54**) for the initial well scenario is ~10 mm whereas for the second development well scenario this increases to ~20 mm. The worst-case (maximum) thickness (**Figure 56**) for the initial well scenario is 80 mm, whereas for the second development well scenario this increases to 117 mm. It is important to note that these increases in thickness only occur close (within 300 m) of the Kupe WHP.

Figure 54 Median cumulative depth of drill cuttings after drilling of second development well within 300 m of the Kupe WHP

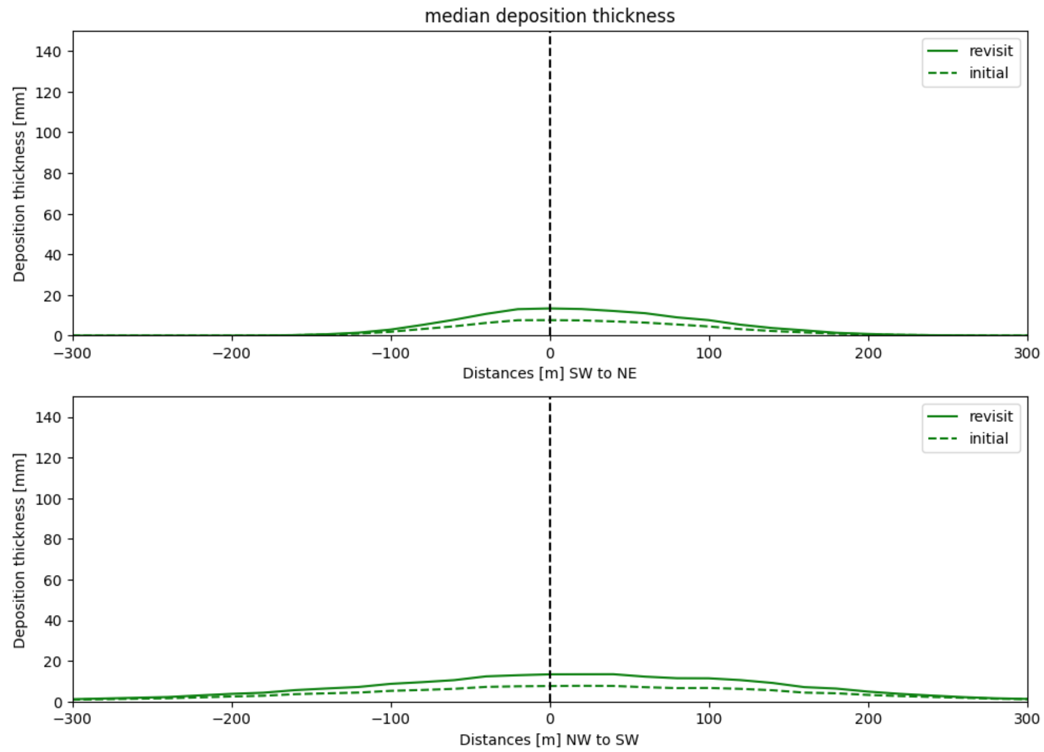
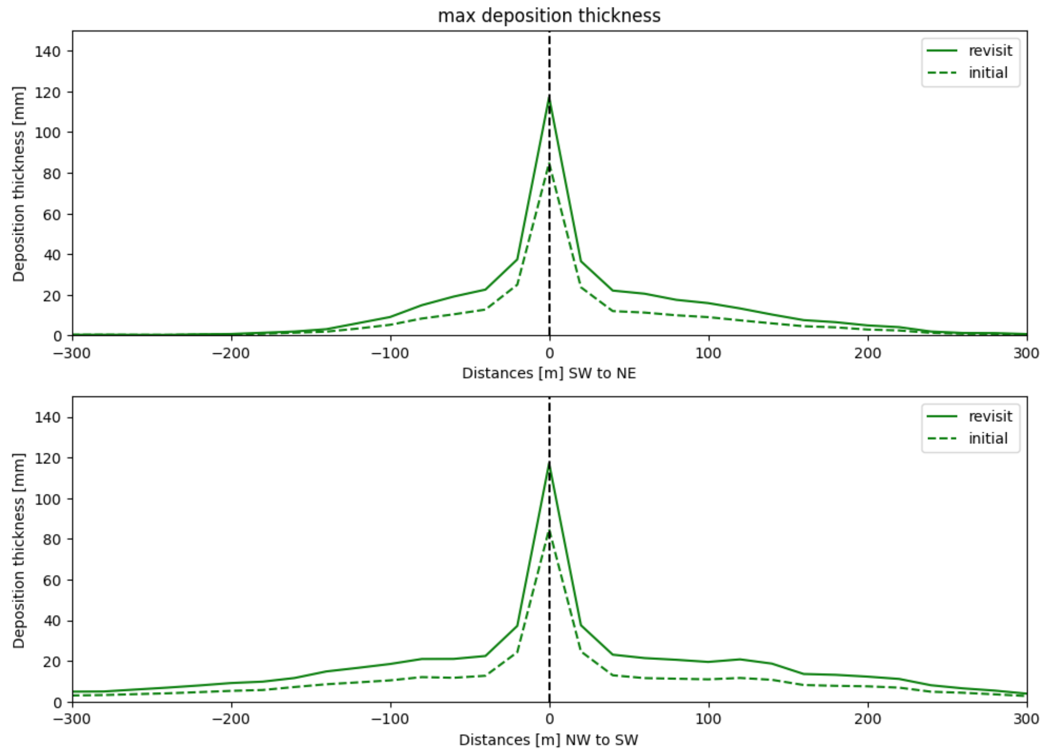


Figure 55 Maximum cumulative depth of drill cuttings after drilling of second development well within 300 m of the Kupe WHP



Consequence – The drilling of the second development well would not result in any greater area of seabed receiving 6.3 mm of drill cuttings than occurs from drilling the initial well, and the cuttings 'mound' would be restricted to a small area around the Kupe WHP. As such, the level of consequence would be the same as that assessed in **Section 7.2.6.2.2** for drilling the initial development well, that being *moderate*.

Likelihood – As discussed in **Section 7.2.6.2.2**, monitoring undertaken elsewhere within the Taranaki Basin has shown that it is considered *likely* that benthic infauna and epifauna communities would be impacted by the deposition of drill cuttings around each well that is drilled.

Accordingly, the environmental risk of adverse effects occurring is assessed as ***moderate***, and the resultant magnitude of the environmental impact of cumulative effects of depositing drill cuttings from the second development well is predicted to be ***minor***.

7.7.1.2 Cumulative Effects from Other Planned Activities

Section 7.2 assesses the actual and potential impacts of each of the various planned activities on different environmental receptors. The majority of the effects of individual activities are assessed as 'negligible'; however, some of the planned activities are predicted to result in 'less than minor' or 'minor' effects. There would be additive (cumulative) effects of the various individual planned activities on each environmental receptor; however, the additive effect of several activities with negligible effects on any particular receptor would not increase the likelihood or consequence levels of the 'worst-case' activities (i.e. those activities with effects that are greater than 'negligible') to any meaningful degree – that is, any additive effects from planned activities that are negligible would not result in a higher/greater overall risk or magnitude of effects category. It is those proposed activities that result in the greatest potential effects on each environmental receptor which ultimately 'drive' the overall cumulative effect.

The planned activity driving the impacts with the largest spatial scale and longest duration associated with the Kupe Phase 2 Development Drilling Programme is the deposition of drill cuttings on the seabed. Impacts on the benthic environment could persist for up to and possibly beyond two to three years. The other activities do not result in effects with the same level of complexity, scale, or duration, but they could interact cumulatively to increase the overall level of effect. However, only the activities that could result in effects greater than negligible, and which are therefore capable of, or potentially capable of interacting additively with other activities are considered in this assessment of cumulative effects.

For this consent application, the activities for both marine consent and marine discharge consent are included, so the potential for cumulative effects that may arise from the marine consent activities (**Section 7.2**) and the marine discharge consent activities (**Section 7.3**) are assessed below. For the purposes of this assessment four environmental receptors are considered:

- Benthic communities;
- Marine mammals;
- Seabirds; and
- Pelagic environs (includes primary production, fish and cephalopods).

The cumulative effects on the various environmental receptors associated with the planned activities only are as follows:

Environmental Receptor	'Driver' Activity of Environmental Risk/Effect (i.e. activity with most significant effect on receptor)	Cumulative Effects of Planned Activities			
		Consequence	Likelihood	Cumulative Risk	Predicted Magnitude of Cumulative Environmental Impact
Benthic communities	Effects associated with discharge and deposition of drill cuttings	2 – Moderate	5 – Likely	10 – Moderate	Minor
Marine mammals	Effects associated with supporting activities and drilling operations – noise and vibrations	1 – Minor	5 – Likely	5 – Low	Less than minor
Seabirds	Effects associated with supporting activities and– noise and vibrations	1 – Minor	5 – Likely	5 – Low	Less than minor
Pelagic environs	Effects associated with contingent activities – effects of explosives	1 – Minor	5 – Likely	5 – Low	Less than Minor

7.7.2 Potential Cumulative Effects from Other Activities Associated with the Kupe Phase 2 Development Drilling Programme

As discussed in **Section 3.1.3,** the Kupe Phase 2 Development Drilling Programme will involve the discharge of harmful substances from a structure that are restricted by section 20B of the EEZ Act, however as discussed in **Section 2.2.3.5**, the preferred supplier of the substances (including those that are potentially harmful) has not been finalised at the time of lodging this consent application. Therefore, Beach will be applying for a separate marine discharge consent for the discharge of these harmful substances once they are known to avoid potential uncertainty with the fluids involved.

The environmental effects of the discharges of these harmful substances would result in cumulative effects on various receptors and these cumulative effects will be assessed in the IA that will be prepared for the application for marine discharge consent to authorise the discharge of those harmful substances.

7.7.3 Potential Cumulative Effects from Other Activities within and outside the IAA

Cumulative effects may occur between activities associated with the Kupe Phase 2 Development Drilling Programme and other marine activities that occur outside of the IAA, including outside the EEZ (i.e within the CMA). Other activities include commercial fishing, recreational fishing, marine farming, maritime shipping and tourism. Some of these activities may take place within the IAA (i.e. marine traffic), while others are located beyond (i.e. marine farming, tourism).

Terrestrial activities which have the potential to give rise to cumulative effects on the marine environment are those associated with land use such as farming, industrial activities, and the discharge of stormwater and wastewater. However, given the distance the Kupe WHP is offshore (approximately 30 km from the nearest land) and the large body of high-energy coastal water between the Kupe WHP and any terrestrial activities that may introduce harmful substances into the marine environment, any contribution to cumulative effects is very unlikely.

The discharges of harmful substances included as part of this consent application are unlikely to have any cumulative impacts on marine farming, tourism and land use and coastal discharges, due to the extremely limited area of potential impact and the significant distance these activities occur from Kupe WHP. As such, the potential for cumulative effects have only been considered for maritime traffic which is discussed in the following sub-section.

7.7.3.1 Marine Traffic

7.7.3.1.1 Discharge of Harmful Substances

The potential for cumulative effects associated with commercial shipping activities relate to discharges of oily or harmful substances through the bilge water from a commercial ship passing in close proximity to the drilling location, or an accident/collision arising in a loss of harmful substances from the vessel.

Consequence – The potential for cumulative effects to arise is associated with two or more discharges occurring in the same temporal and spatial timeframes. This is not anticipated due to the 500 m Safety Zone restricting vessels passing in close proximity to the Kupe WHP, and the international regulations that govern the design specifications and the discharge and monitoring requirements for international vessels. The MODU will only be at the Kupe WHP temporarily (i.e. up to 95-days per well) and maritime traffic that would be passing the MODU is transient, so no long-term cumulative effects could arise from any discharges. Therefore, the consequences are *negligible*.

Likelihood – The likelihood of cumulative effects from harmful substance discharges has been assessed as *remote* due to the high-energy offshore environment within the STB will assist with the rapid mixing and dispersion of any harmful substance discharged from the MODU and minimise their persistence at concentrations which will be harmful to the marine ecosystem. In addition to this, the temporal overlap between the drilling operations (i.e. the time the MODU is in place) and the likelihood of encountering marine traffic a significant distance offshores is remote. This is due to the fact that in general, the highest proportion of shipping activity occurs in close proximity to the coast, but ships occasionally venture through the IAA.

As the consequence associated with the effects of maritime traffic and harmful substance discharges having a cumulative effect is *negligible*, and it is considered a *remote* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Cumulative Effect	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Maritime Traffic - Harmful substance discharges	0 – Negligible *Highly localised and temporary in nature*	1 – Remote *Extremely unlikely but theoretically possible*	0 – Negligible	Negligible

7.7.3.1.2 Noise and Vibrations

Consequence – The 'background' noise levels associated with busy shipping areas is known to affect the communication calls between marine mammals due to 'masking', whereby calls are not as easily heard above the noisy background. Masking is a complex phenomenon and masking levels are difficult to predict for any particular combination of sender, environment, and receiver characteristics (Erbe *et al*., 2016). In the presence of constant noise, marine mammals sometimes adapt their vocalisations in order to overcome the effects of masking (e.g. McGregor *et al*., 2013) (also see **Section 7.2.4.2**).

The cumulative effects of exposure to multiple sound sources may be more relevant at the population level on a chronic basis than at the individual level on an acute basis (Ellison *et al*., 2016), and therefore introducing short-term (acute) vessel noise to an area that has existing background noise from operational activities is unlikely to impact marine species at the population level.

Marine environments differ in their resilience to anthropogenic stressors (Ban *et al*., 2010), and the potential for cumulative effects is likely to be related to physical features such as water depth, seabed characteristics and coastline shape. A higher risk from noise is evident in shallow waters and enclosed bays where the attenuation potential is lower, whereas open-water areas, as in the IAA, allow sound to dissipate more rapidly and therefore the risk is lower.

Potential for cumulative effects is associated with noise and vibration from activities within the Kupe Phase 2 Development Drilling Programme and commercial shipping would be short-term in nature and would cease as the vessel moves past. Any such overlap in noise is not expected to have any adverse effects to marine mammal or fish populations in the area. Therefore, the consequence is *negligible*.

Likelihood – The likelihood of any cumulative effect resulting from noise and vibration has been assessed as *remote* as the MODU will only be at any one well location temporarily (up to 95-days per well), marine traffic will be limited throughout the IAA (due to the presence of the Safety Zone and the offshore precautionary area that exists within the Taranaki Basin), and if it does occur, it will be transient and only within the noise and vibration envelope of the MODU for a short period of time.

As the consequence associated with the effects of maritime traffic and noise and vibration having a cumulative effect is *negligible*, and it is considered a *remote* occurrence, the environmental risk and resultant magnitude of the environmental impact is predicted to be ***negligible***.

Cumulative Effect	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Maritime Traffic - Noise and Vibration	0 – Negligible *Highly localised and temporary in nature*	1 – Remote *Extremely unlikely but theoretically possible*	0 – Negligible	Negligible

7.7.4 Summary of Potential Cumulative Effects on Environmental Receptors from Planned Activities and Other Activities

Section 7.7.3 identifies the cumulative effects of other activities occurring within and outside the IAA not associated with the Kupe Phase 2 Development Drilling Programme. However, these additional effects are negligible and do not increase the overall magnitude of effect determined for the proposed activities – that is, they do not result in the overall magnitude of effects to increase to a higher category.

The following table presents the overall cumulative effects assessment on the various environmental receptors, this being the combined effects of the proposed activities plus other activities not associated with the Kupe Phase 2 Development Drilling Programme.

Environmental Receptor (including 'Driver' of effect of proposed activities)	Cumulative Effect of the Planned Activities on Receptor	Cumulative Effects of Other Activities		Overall Cumulative Effect on Receptor
		Maritime Traffic - discharges	Maritime Traffic - noise and vibration	
Benthic communities (effects associated with discharge and deposition of drill cuttings)	Minor	Negligible	Negligible	Minor
Marine mammals (effects associated with supporting activities and drilling operations – noise and vibrations)	Less than minor	Negligible	Negligible	Less than minor
Seabirds (effects associated with supporting activities and– noise and vibrations)	Less than minor	Negligible	Negligible	Less than minor
Pelagic environs (effects associated with contingent activities – effects of explosives)	Less than Minor	Negligible	Negligible	Less than Minor

7.8 Unplanned Activities

Unplanned activities are those that are non-routine and do not constitute activities for which this consent is sought, and include:

- Loss of well control (**Section 7.8.1**);
- Fuel spill from refuelling operations (**Section 7.8.2**);
- Vessel collision (**Section 7.8.3**);
- Biosecurity incursions (**Section 7.8.4**); and
- Dropped objects (**Section 7.8.5**).

As discussed in **Section 7.1** the ERA methodology for the unplanned activities differs slightly from that of the planned activities. When assessing 'likelihood' for unplanned activities, the likelihood of the unplanned ***activity*** occurring is assessed, rather than the likelihood of an ***effect*** occurring which was the approach used for planned activities.

7.8.1 Oil Spill from Loss of Well Control

A well blowout or loss of well control and the subsequent uncontrolled release of hydrocarbons into the marine environment and the discharge of gas into the atmosphere would potentially result in adverse effect that could extend to areas well away from the Kupe WHP.

Hydrocarbon spills from offshore petroleum facilities are extremely rare in comparison with spills from nearshore fishing and shipping activities which are much more frequent. To put the likelihood of such an event occurring into perspective, over 200 offshore wells have been drilled in New Zealand to date there have been no blowouts or loss of well control during the drilling of any of these wells. All practicable steps would be taken during the Kupe Phase 2 Development Drilling Programme to ensure that this clean record continues, and that the risk of a hydrocarbon spill is reduced to ALARP.

In the event of a hydrocarbon spill, coastal ecosystems, marine mammals and seabirds are most at risk; however, benthic ecosystems and cultural and socio-economic values are also vulnerable. Potential effects on the pelagic environs (i.e. marine mammals, fish, plankton/primary producers (**Section 7.8.1.2.1**)), and benthic environs (i.e. benthic macrofauna (**Section 7.8.1.2.2**)) are discussed below. Potential impacts on existing interests are dealt with in a more holistic manner within **Section 7.4.1** and within the CIAs (**Appendix F**).

Importantly, Part 131 of the Maritime Protection Rules requires that all MODUs operating in New Zealand waters are required to develop an OSCP. The requirements of an OSCP are outlined in **Section 3.4.4** and an application for the OSCP must be made at least two months before the date on which the Kupe Phase 2 Development Drilling Programme activities are due to begin and be approved by MNZ before drilling operations can commence.

7.8.1.1 Oil Spill Trajectory Modelling

An oil spill trajectory model was commissioned (Calypso Science, 2022b) to assess the potential oceanic dispersal and beaching of an accidental spill of oil condensate from the KS-9 Development Well (**Appendix J**). Oil condensate properties used in the model were based on the properties of the oil condensate produced from Kupe KS-7. Calypso Science (2022b) adopted a stochastic approach to define the statistical probabilities related to oil trajectory, dispersion, weathering, and beaching patterns. A total of 100 spill events were simulated and randomly distributed over a ten-year period; the results of which were collated and used to generate statistics and probabilities for the purposes of this IA.

Each spill event was based on a blowout situation occurring for a period of 132 days, with a release position at 2 m above the seabed and a variable release rate decreasing over time from 1,099 m^3/day to 427 m^3/day. The total volume of oil released to the sea for the spill event was modelled to be 100,747 m^3. These rates represent a worst-case scenario and Beach will have controls in place to mitigate such an event happening.

Each of the 100 spill events were simulated at random times of the 10-year period 2008 – 2017 and stratified by season (i.e. 25 spills per season). This approach recognises that an accidental spill event can occur at any time of the year and be subject to a combination of atmospheric and oceanographic forces which must be accounted for in the model. Hindcast data for winds, waves and currents were used to support this approach.

Each simulation was run for 200 days and tracked 18,912 discrete oil particles in space and time over this duration. As oil condensate in the marine environment would be subject to weathering due to ambient oceanic and atmospheric conditions the key processes of evaporation, emulsification, and dispersion are simulated within the model. There is no dissolution simulated within the model. Kupe KS-7 condensate is reported to contain 23% aromatics, which would therefore have a degree of solubility that is not represented in the modelled oil budgets. However, as evaporation typically affects the mass budget much more than dissolution, the modelled results represent an overestimate, particularly during the ascendant plume phase and during the first few days on the surface.

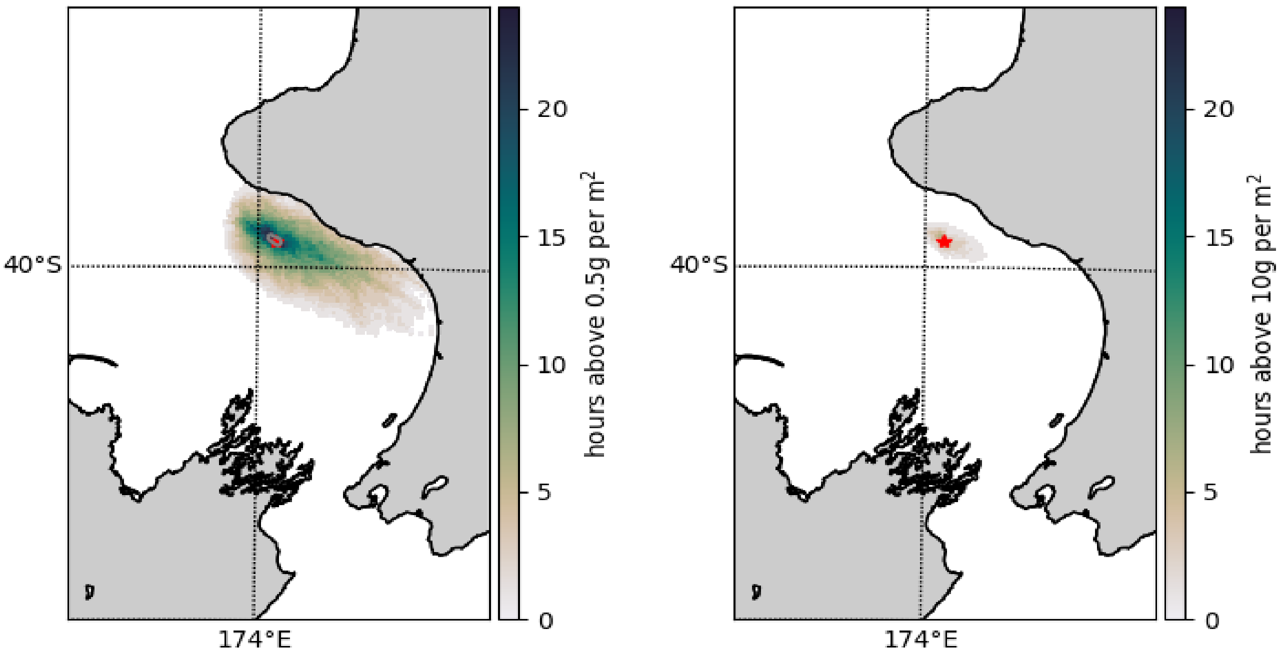
The following key statistics were calculated by the model:

- Persistence of plume - for each run the number of days the surface concentration is above 0.5 g/m^2 and 10 g/m^2 was calculated and the 50th and 99th percentile value derived;
- Surface time - for each run the number of days of condensate presence exceeding 0.5 g/m^2 and 10 g/m^2 was calculated, and the overall minimum and median time defined;
- Beaching risk – defined as the probability for one particle to land within that cell, irrespective of mass;
- Time to beaching - presented as the overall minimum and median time it takes for one particle to beach, irrespective of mass; and
- Total condensate on the beach - for each run the mass of oil entering a cell is summed, and then presented as the median and 99th percentile.

The characteristics of the condensate, with a relatively high percentage of volatiles, means that within days at sea more than half of the spilled volume would be evaporated, dissolved, or dispersed. On the sea surface, strong winds would increase the rate of evaporation, while the wave conditions associated with these winds would also act to mix and disperse the oil into the upper layers of the ocean. Consequently, the day-to-day weather conditions would strongly influence the mass budget of condensate throughout the simulations.

The dominant trajectory for spilled condensate is to the east and southeast in response to the prevailing winds and surface currents. The plots in **Figure 56** demonstrate these main trajectory modes and show the median (most probable) number of hours when the surface concentration would exceed 0.5 and 10 g/m^2, respectively. These concentrations are based on the practical limit of observing hydrocarbons in the marine environment (0.5 g/m^2 AMSA, 2015a), and the surface concentration threshold for ecological impact (10 g/m^2 French-McCay, 2009).

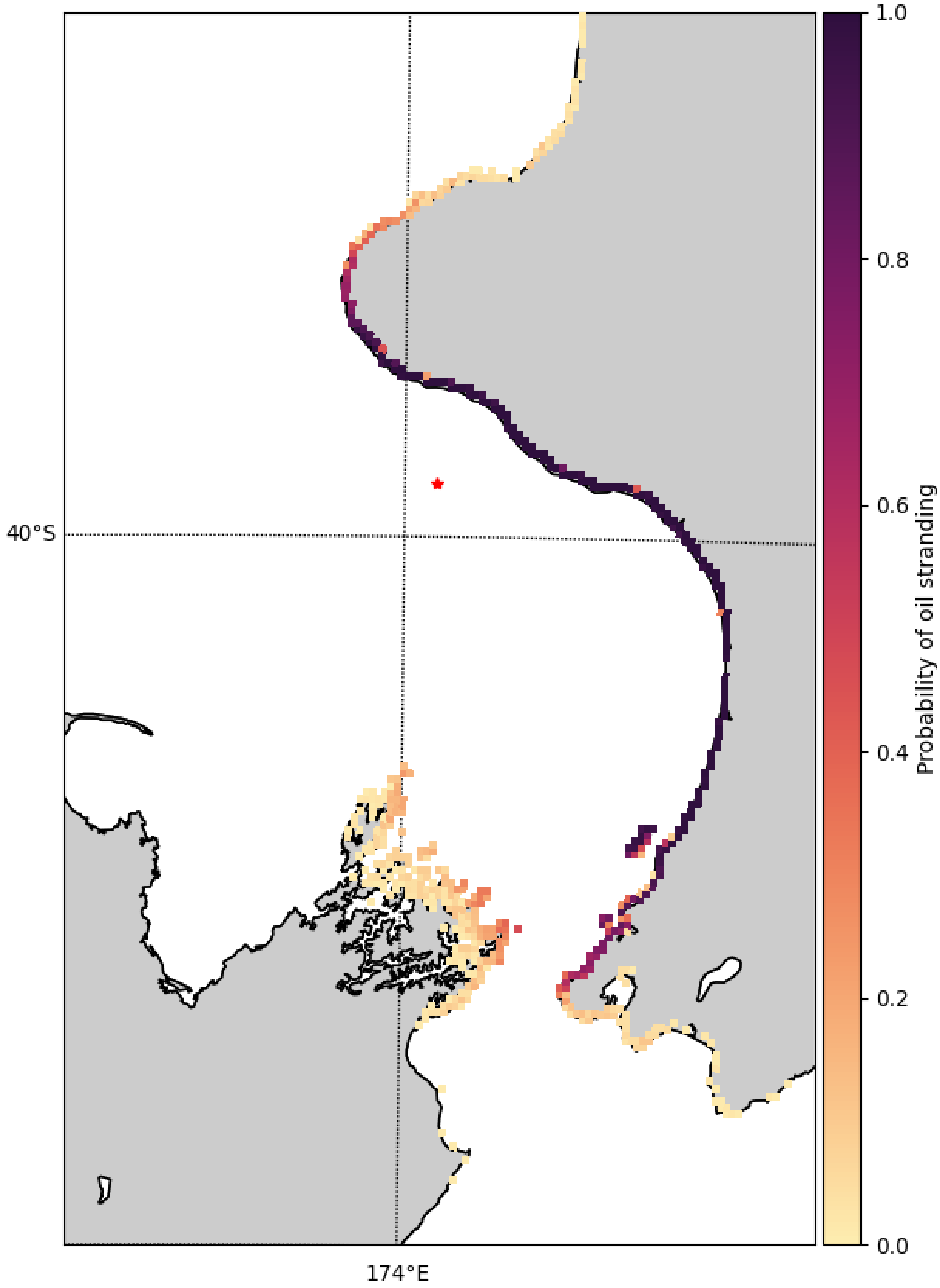
Figure 56 The median amount of time (in hours) that the surface concentration exceeds 0.5 g/m^2 (left) and 10 g/m^2 (right)



Source: Calypso Science, 2022b

Figure 57 shows that, in the extremely unlikely event of a loss of well control, the locations where condensate beaching is predicted to occur over the 100 spill event simulations and assigned a probability of occurrence that is independent of volume. The model predicts that the highest chance of condensate stranding occurs between Cape Egmont and Cape Terawhiti. However, the model predicts the coastline between Opunake (in the north) to Kapiti (in south) could receive a stranding concentration of ≥1 T/km, this being a proxy for a threshold of ecological impact.

Figure 57 Probability for oil being stranded on the coast from any of the 100 simulated spills

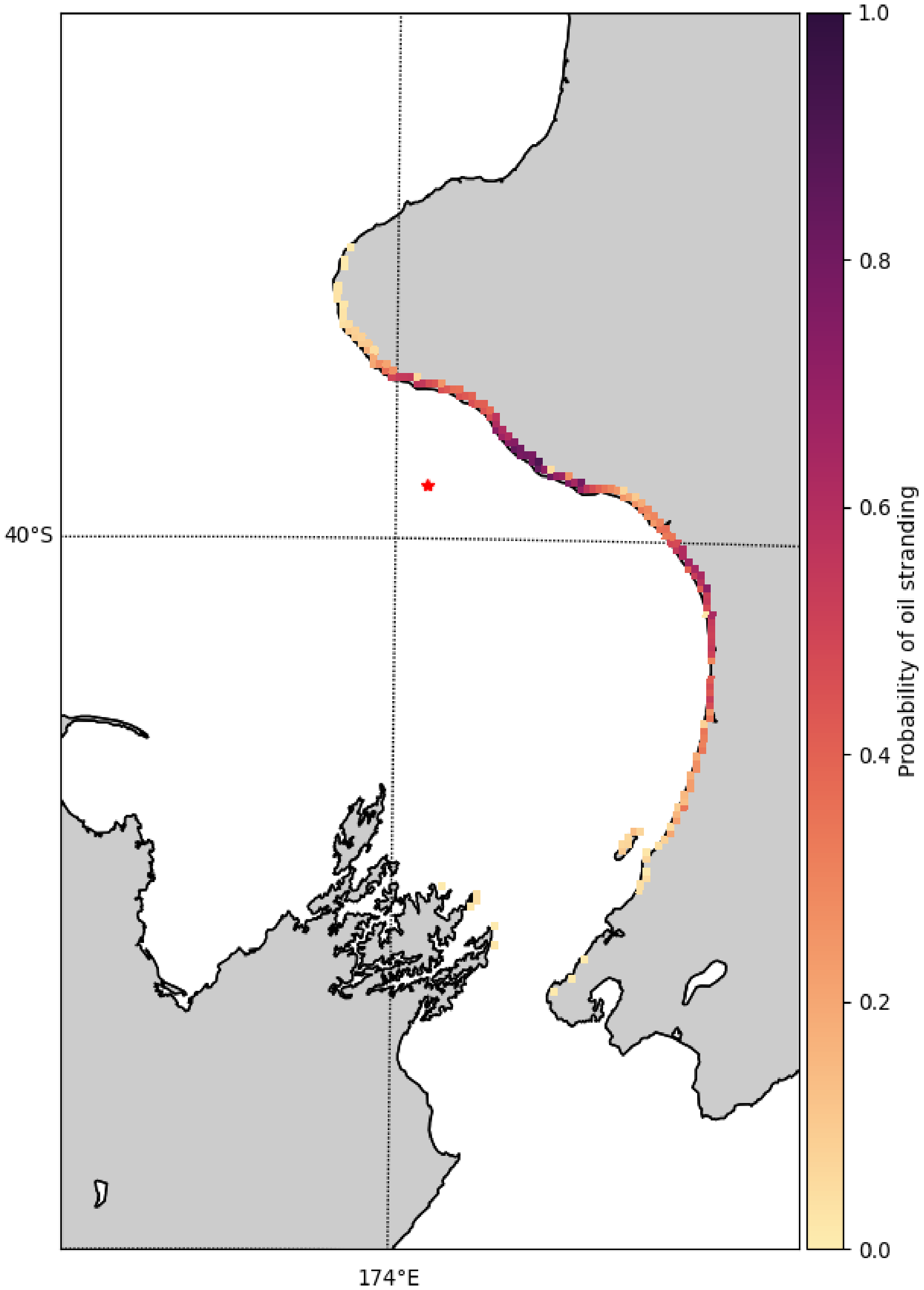


Source: Calypso Science, 2022b

Note: A probability of 1 Represents 100 % Chance of Oil Stranding.

To consider these amounts in the context of impacts, AMSA (2015b) apply a value of 100 g/m^2 as the threshold below which recovery is best achieved by natural processes alone. Deposition of 1 T/km, assuming a 10 m wide stranding zone, would equate to 100 g/m^2. On an annual basis, the probability that this threshold could be exceeded is presented in **Figure 58**.

Figure 58 Probability for condensate stranding volumes >1 tonne per km of coast from the 100 simulated spills



Source: Calypso Science, 2022b

Note: A probability of 1 represents 100% chance of stranding

The most probable (median) amount of condensate predicted to stand (beach) on an annual basis was predicted to be 1% of the spilled condensate, however seasonal differences were also predicted with summer scenarios resulting in higher stranding rates. The single worst-case scenario resulted in 3.3% of the spilled condensate stranding, with the 'hotspot' being located on the shoreline near Hawera, however it should be noted that the chances of this occurring is exceedingly low (1%).

7.8.1.2 Potential Effects

The main trajectory for any spilled hydrocarbon would be to the east and southeast, in response to the prevailing winds and ocean currents.

The water quality surrounding any spill would reduce as the spill drifts with tidal and wind-driven currents, as mixing, dilution and weathering processes increase the concentrations of hydrocarbon constituents in the marine environment. However, the weathering process would occur much more slowly within the water column than at the surface where the additional wave action and solar radiation would accelerate hydrocarbon breakdown.

The severity of potential effects on marine organisms following a hydrocarbon spill would be influenced by the type of hydrocarbon spilt, exposure concentration, duration, susceptibility and health of the exposed individual, and the season in which a spill could occur. However, in general, the effects of hydrocarbons on marine organisms fall into four categories (ITOPF, 2021):

- Physical smothering with an impact on physiological functions;
- Chemical toxicity giving rise to lethal or sublethal effects or causing impairment of cellular functions);
- Ecological changes, primarily the loss of key organisms from a community and the takeover of habitats by opportunistic species; and
- Indirect effects such as the loss of habitat or shelter and the consequent elimination of ecologically important species.

Compared with crude oil, gas condensates are much more volatile and seldom last more than a few days on sea surface. A gas condensate is typically a mixture of hydrocarbon liquids of low-molecular weights compared to crude oils which typically consist of hydrocarbons of higher molecular weights.

The potential environmental effects that could arise from an extremely unlikely loss of well control and subsequent spill of condensate to the marine environment are discussed in the following sub-sections.

7.8.1.2.1 Pelagic Environs

Marine Mammals

Wildlife can potentially suffer from both external and internal effects during an oil spill from the extremely unlikely event of loss of well control. External effects are caused by the contamination of the exterior surface of an animal (fur, skin etc.) and internal effects relate to the physiological changes that occur in response to the absorption of toxic hydrocarbon constituents. Both external and internal effects could be serious and could compromise the immediate survival or long-term health of the affected individual. Internal and external effects could occur concurrently in most spill circumstances.

Whales and dolphins have smooth skin that hydrocarbons are less likely to adhere to and a thick blubber layer for insulation, hence have a relatively low sensitivity to external hydrocarbon exposure. Fur seals, on the other hand, rely solely on the integrity and health of their fur for waterproofing and insulation and are therefore highly susceptible to external hydrocarbon contamination and if contaminated, could suffer severe thermoregulatory effects: rapidly becoming waterlogged and hypothermic (Oiled Wildlife Care Network, 2004).

Internal contamination can occur when toxic hydrocarbons enter the blood stream after inhalation or ingestion of oil. Polycyclic aromatic hydrocarbons (**PAH**) are the constituents of hydrocarbons which are largely responsible for toxicological effects. This internal contamination commonly causes effects, including dehydration, anaemia, organ damage, intestinal ulceration, immunosuppression, irritations and burns to mucous membranes, and aspirate pneumonia (Balsiero *et al.*, 2005).

The hydrocarbon spill modelling predicts that Kupe condensate would experience relatively high rates of evaporation, dissolution, and dispersion once on the sea surface and that the dominant spill trajectory would be to the east and southeast with the highest risk of ecological impact along the shoreline extending from Opunake to Kapiti. It is noteworthy that high rates of evaporation, would rapidly reduce the slick volume and would therefore reduce the risk of on-going external contamination of wildlife. However, the high proportion of volatiles in condensate would increase the toxicity potential to wildlife, particularly through inhalation of volatiles associated with exposure to fresh product. In line with these observations, wildlife in the immediate vicinity of the spill (i.e. in contact with the fresh product) would be at the greatest risk of both external and internal effects of an unplanned spill during the Kupe Phase 2 Development Drilling Programme. While several cetacean species are likely to, or could possibly, occur in the STB during the proposed Kupe Phase 2 Development Drilling Programme (**Section 4.3.6**), they would not consistently be present around the drilling site or in the vicinity of the Kupe IAA, but rather are expected to visit from time to time. While blue whales are resident or semi-resident to the STB, their distribution is further offshore and occurs primarily in the opposite direction to the predicted spill trajectory modelling. These factors, and the highly mobile nature of marine mammals, would help to reduce the potential for population level consequences in the event of an oil spill.

However, if any fur seals are in the immediate vicinity of the MODU at the time of a spill, which is a distinct possibility as they are known to be at the Kupe WHP, they would be at particular risk of external contamination and internal effects. In general, wildlife encounter rates with hydrocarbons at sea are likely to be minimised when the flow of hydrocarbons can be quickly stopped and any appropriate clean up actions rapidly instigated.

In addition to the direct effects of a hydrocarbon spill on marine mammals, the following indirect effects are also possible:

- Damage to, or exclusion from habitats and other important areas (e.g. areas used for feeding, resting, migrating and breeding);
- Toxicity of prey species;
- Long-term disruption of food chains and predator/prey interactions; and
- Any adverse effect on marine mammals from loss of well control may compromise the capacity for populations to increase.

Consequence - A spill could have a very large-scale effect, with surface concentrations exceeding 0.5 g/m^2 over a large portion of the STB, and both external and internal effects on marine mammals would be anticipated. Therefore, the consequence is assessed as *major*.

Likelihood – The likelihood that all operational procedures and mitigation measures fail, and a loss of well control occurs resulting in a spill, is considered to be *rare*.

As the consequence of effects from a loss of well control on marine mammals is *major*, and it is considered a *rare* occurrence, the environmental risk of adverse effects occurring on marine mammals from the loss of well control is assessed as ***moderate***, and resultant magnitude of the environmental impact is predicted to be ***minor***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Loss of well control – effects on marine mammals	4 – Major *Very large-scale effect, with capacity for population to be affected, recovery measured in multiple years*	2 – Rare *May occur, but only in exceptional circumstances*	8 – Moderate	Minor

Seabirds

Hydrocarbon spills may affect seabirds in a number of ways including lethal and sub-lethal toxicity, contamination of habitat (including food sources), and contamination of plumage. Seabirds rely on their plumage for flight, insulation and buoyancy (O'Hara & Morandin, 2010), plumage contamination is considered to be the primary cause of mortality in seabirds that have been exposed to hydrocarbon spills (Leighton, 1991) and affected seabirds generally require human intervention in order to survive.

The external contamination of the plumage of seabirds would quickly compromise the fundamental insulation and waterproofing properties required for their survival at sea. Feather health and integrity is fundamental for pelagic seabirds that require a completely waterproof plumage in order to survive in the cold marine environment. The outer contour feathers of seabirds create a complete barrier to water to ensure that the downy layer of insulation feathers (that trap warm air against the skin) stay dry. When contour feathers are contaminated with hydrocarbons this cohesive barrier is compromised and seabirds rapidly become waterlogged and hypothermic (Massey, 2006), which can soon lead to exhaustion and death by drowning. Shorebirds are also at risk of external contamination during a spill event, however, unlike pelagic seabirds these animals are more readily able to take refuge ashore when they begin to suffer thermoregulatory distress; hence are less likely to drown as a result.

Species that feed by diving or swimming on the sea surface (e.g. penguins, diving petrels, shags and gannets) are more vulnerable to contamination than species that pluck prey from the surface during flight (e.g. terns and white-faced storm petrels) (Williams *et al.*, 1995). The foraging strategy of a number of seabirds likely to be present in the IAA means that they would be vulnerable to the effects of a hydrocarbon spill. Albatross and mollymawk species in particular rest on the sea surface between shallow feeding dives. If significant numbers of any threatened species were to become oiled during a spill then the long-term viability of populations may be at risk.

In general, external effects are typically obvious and debilitating for seabirds when spills involve crude oil. However, as discussed in **Section 7.8.1.1**, gas condensate is highly volatile and relatively non-persistent in the marine environment. This volatility provides a key point of difference between most marine oil spills of crude oil and the potential spill products associated with the Kupe field. This volatility means that only wildlife that come into contact with the freshly spilt product are at risk of significant external contamination - as evaporative processes rapidly reduce the volume of the spill once at the sea surface. In the case of condensate, the fresh product is quickly converted to a waxy residue that is less likely to cause a loss of waterproofing to wildlife.

As with marine mammals, PAHs are largely responsible for toxicological effects on wildlife during hydrocarbon spills, which can culminate in dehydration, anaemia, organ damage, intestinal ulceration, immunosuppression, irritations and burns to mucous membranes, and aspirate pneumonia (Balsiero *et al.*, 2005). Sub-lethal toxic effects of hydrocarbons on seabirds have been demonstrated following major oil spills. Alonso-Alvarez *et al.* (2007) documented the effects of PAHs on yellow-tailed gulls (*Larus michahellis*) following the Prestige oil spill off northwest Spain. Contaminated birds had reduced levels of glucose, inorganic phosphorus, total protein and creatinine, and elevated enzyme levels indicative of liver disease (Alonso-Alvarez *et al.*, 2007). The persistence of long-term health implications as a result of hydrocarbon toxicity may also lead to decreased reproductive success (egg mortality, inhibition of ovarian function, embryonic abnormalities) which not only affects individual animals, but can also have indirect consequences for population viability (e.g. Velando *et al*. 2005).

Consequence – A number of protected species of seabird are predicted to occur within the STB. Any adverse effect on seabirds from loss of well control may compromise the capacity for populations to increase. As such the consequence is assessed as *severe*.

All of the seabirds likely to be present in the IAA are highly mobile and far-ranging, which somewhat reduces their vulnerability to a spill. However, if contaminated, this would have implications for oiled wildlife response as oiled birds may move well outside of the impacted area. Coastal birds tend to be less far-ranging than seabirds and could also be impacted when condensate strands.

Likelihood – The likelihood that all operational procedures and mitigation measures fail, and a loss of well control occurs resulting in an oil spill, is considered to be *rare*.

As the consequence of effects from a loss of well control on seabirds is *severe*, and it is considered a *rare* occurrence, the environmental risk of adverse effects occurring on seabirds from the loss of well control is assessed as ***moderate***, and resultant magnitude of the environmental impact is predicted to be ***minor***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Loss of well control – effects on seabirds	3 – Severe *Capacity for population to be affected, recovery measured in multiple years*	2 – Rare *May occur, but only in exceptional circumstances*	6 – Moderate	Minor

Fish

Due to the buoyant nature of hydrocarbons, fish are often either unaffected or only briefly affected by hydrocarbon spills. However, when hydrocarbons enter shallow coastal waters, some fish species may be affected (NOAA, 2020a). Lethal and sub-lethal effects of hydrocarbons on fish following an oil spill have been demonstrated in a number of studies. Examples of observed effects include:

- Mortality through hydrocarbon toxicity (NOAA, 2020a);
- Cardiotoxicity in embryos and juveniles, including heart failure in salmon embryos and irregularities in heart shape of adult fish (Hicken *et al.*, 2011), and changes in heart physiology and morphology in embryos and larvae of tuna, swordfish and other predatory pelagic fish (Incardona *et al.*, 2014);
- Reduced and delayed growth in juveniles (Heintz *et al.*, 2000) and reduced immunity to disease and parasites (Kahn, 1990), potentially leading to reduced survival;

- Reduced swimming performance in adult salmon (Hicken *et al.*, 2011) and Pacific herring (Kennedy & Farrell, 2006);
- Impairment of cognitive function and behaviours necessary for juvenile settlement and survival (Johansen *et al.*, 2017);
- Irritation of gills resulting in heavy secretion and erosion of mucus membranes (Russel & Kotin, 1957);
- Lesions on ovaries, kidneys and gills (Stott *et al.*, 1983); and
- Biochemical changes such as depressed liver glycogen and ascorbic acid, hypoglycaemia, and altered muscle amino acid ratios indicating altered energy metabolism and balance (Neff, 1985).

Fish may accumulate hydrocarbons in their tissues through the transport of contaminants across cell membranes of their skin and gills, or in their diets through ingesting contaminated food (Moe *et al.*, 1994). Contaminants are transported through the blood to body organs where they can accumulate at several thousand times the concentration of surrounding water (Ansari *et al.*, 2012). Although the accumulation of hydrocarbons in fish tissues is temporary due to their ability to metabolise PAHs (Lawrence & Weber 1984), the rate of accumulation and excretion is species-dependent (Neff *et al.*, 1976).

The sensitivity of fish to hydrocarbons has been demonstrated to be species- as well as age-dependent. Relatively sessile or benthic species are likely to suffer higher rates of mortality and experience effects for longer as a result of repeated exposure to contaminated sediments when compared to more mobile pelagic species (Collier *et al.*, 1996; Carls *et al.*, 2001), and younger fish may be more sensitive to hydrocarbon contaminants on account of their less developed metabolic capability (Long & Holdway, 2002).

Consequence – Most fish species predicted to occur in the STB are highly mobile so would be unlikely to come into prolonged contact with any hydrocarbons in the event of a spill. However following NOAA (2020a) those in affected shallow coastal waters could be more at risk. **Figure 58** shows that high loadings of condensate on the shoreline are predicted to only affect a reasonably small portion of coastline from Hawera to Waiinu Beach, and from Whanganui to Foxton. As such, a medium-scale effect could be expected; while there may be some localised population effects on fish within these areas, long-term viability of regional fish populations would not be expected to be threatened. As such the consequence is assessed as *moderate*.

Likelihood – The likelihood that all operational procedures and mitigation measures fail, and a loss of well control occurs resulting in an oil spill, is considered to be *rare*.

As the consequence of effects from a loss of well control on fish is *moderate*, and it is considered a *rare* occurrence, the environmental risk of adverse effects occurring on fish from the loss of well control is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Loss of well control – effects on fish	2 – Moderate *Medium scale effect, recovery in months*	2 – Rare *May occur, but only in exceptional circumstances*	4 –Low	Less than minor

Plankton and Primary Producers

Planktonic communities are particularly susceptible to hydrocarbon spills (Graham *et al.*, 2010). Oil droplets are often in the food-size spectra of zooplankton and may be directly ingested by some species (e.g. as demonstrated in Almeda *et al.*, 2014), while water-soluble hydrocarbons may be acquired directly through cutaneous absorption or the ingestion of affected phytoplankton (Wang & Wang, 2006). Oil slicks inhibit air-sea gas exchange and light penetration; important factors in controlling photosynthesis and phytoplankton growth (Gonzalez *et al.*, 2009). However, the volatility of gas condensates means that as evaporative processes rapidly reduce the volume of the spill, effects are likely to be largely restricted to the vicinity of freshly spilt product.

Lethal toxic effects on plankton resulting from oil spills have been documented in a number of studies; for example, Almeda *et al.* (2013) observed a significant effect of crude oil on mesozooplankton survival, with mortality ranging from 12 – 96% depending on hydrocarbon concentration and sample site. Temperature and UV radiation may significantly increase the toxicity of oil to zooplankton (Jiang *et al.*, 2012, Almeda *et al.*, 2013); therefore, impacts on zooplankton communities may be higher in summer when sea surface temperature and UV radiation are highest (Almeda *et al.*, 2014). Abbriano *et al.* (2011) also suggested that the rate of zooplankton mortality may be more dependent on exposure time than total oil concentration.

Zooplankton exposed to oil may experience an alteration in behaviour, energetics, or biochemical processes (such as those associated with reproduction) (Almeda *et al.*, 2014), leading to a number of sub-lethal effects. Sub-lethal effects of oil on plankton are not as well understood as lethal effects but may have important implications for the wider marine environment. For example: reduced zooplankton egg production may reduce the availability of an important food source (Almeda *et al.*, 2014); reductions in growth rate may reduce nutrition levels influencing higher trophic levels (Saiz *et al.*, 2009); mass mortalities and reduced fecundity (including fish and invertebrate eggs and larvae) could lead to poor recruitment to adult populations (Avila *et al.*, 2010); or chemosensory abilities may be affected leading to behavioural changes (Seuront, 2011). Narcosis has also been observed which may lead to reduced feeding, an increase in predation rate, or ultimately death (Almeda *et al.*, 2013).

Zooplankton can accumulate PAHs through the ingestion and absorption of oil droplets (Almeda *et al.*, 2013). As plankton play a crucial role in the transfer of matter from low to higher trophic levels in marine food webs they may facilitate the bioaccumulation of hydrocarbons in the marine food chain. Phytoplankton blooms may also occur following the release of oil as a result of a reduction in grazing pressure by zooplankton (Abbriano *et al.*, 2011).

Consequence – While there may be some adverse effects to plankton populations in close proximity to any discharged hydrocarbon, detectable effects would not be expected to be widespread throughout the STB; hence no population level effects are predicted for plankton or primary productivity. Currents within the IAA would allow relatively rapid recovery of planktonic communities. Effects would be short-term, and as soon as the spill stopped, recovery would commence. As such the consequence is assessed as *minor*.

Likelihood – The likelihood that all operational procedures and mitigation measures fail, and a loss of well control occurs resulting in an oil spill, is considered to be r*are*.

As the consequence of effects from a loss of well control on planktonic communities is *minor*, and it is considered a *rare* occurrence, the environmental risk of adverse effects occurring on planktonic communities from the loss of well control is assessed as ***very low***, and resultant magnitude of the environmental impact is predicted to be ***almost negligible***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Loss of well control – effects on plankton and primary production	1 – Minor *Localised effect around spill site and no detectable population effects*	2 – Rare *May occur, but only in exceptional circumstances*	2 – Very low	Almost negligible

7.8.1.2.2 Benthic Environs

Benthic Invertebrates

Effects of hydrocarbon spills on benthic invertebrates are similar across all depth zones, with effects including:

- Smothering leading to mortalities or smothering of feeding and respiratory structures. Smothering is only considered significant if the toxic fractions in oil have weathered – if the toxic fractions are still present, the damage done by coating is usually insignificant compared to mortalities from toxic effects;
- The uptake of contaminants from the water column or contaminated sediments leading to lethal and sub-lethal effects. Sub-lethal effects are manifested by physiological, carcinogenic and cytogenic effects, with impacts typically felt at the population level (e.g. changes in abundance, age structure, population genetic structure, reproduction and reduced recruitment potential) (Suchanek, 1993);
- Bioaccumulation of hydrocarbons in tissues and tainting of edible flesh, particularly in species harvested for human consumption; and
- Reduced settlement and recruitment of adults, juveniles and larvae as a result of habitat changes and toxicity of substrate/surfaces.

The ability of invertebrates to metabolise PAHs is generally markedly lower than in vertebrates as invertebrates accumulate a wider range of PAHs due to their lower ability to metabolise xenobiotic compounds (Neff & Burns, 1996). In addition, Armstrong *et al.* (1995) suggested that bioaccumulation of hydrocarbons is particularly significant in bivalves, because they completely lack the ability to metabolise and excrete PAHs (Eisler, 1987).

Consequence – Recovery of benthic communities (including those in the affected intertidal zone) may take several years. There could be moderate changes to ecosystem function particularly surrounding the hydrocarbon release point. As such the consequence has been assessed as *severe*.

Likelihood – The likelihood that all operational procedures and mitigation measures fail, and a loss of well control occurs resulting in an oil spill, is considered to be *rare*.

As the consequence of effects from a loss of well control on benthic invertebrates is *severe*, and it is considered a *rare* occurrence, the environmental risk of adverse effects occurring on benthic invertebrates from the loss of well control is assessed as ***moderate***, and resultant magnitude of the environmental impact is predicted to be ***minor***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Loss of well control – effects on benthic invertebrates	3 – Severe *Long-term recovery period required for some benthic communities*	2 – Rare *May occur, but only in exceptional circumstances*	6 – Moderate	Minor

7.8.1.2.3 Measures to Avoid, Remedy or Mitigate

The following measures will be in place during the Kupe Phase 2 Development Drilling Programme in order to reduce the likelihood of a loss of well control and subsequent condensate spill occurring:

- Extensive planning, peer review, and governance is involved in the design of each well. This includes information on the underlying stratigraphy and anticipated formation pressures used to design and construct a safe and effective petroleum well;
- Beach uses its Well Engineering and Construction Management System, which is a gated project management approach to well design and construction. This system also has a set of technical standards which conform to international standards with a strong management of change and risk based approach to drilling and completions activities;
- Well barrier schematics defining primary and secondary barriers and their verification of Well Acceptance Criteria will be established for each section of the drilling operation;
- The engineered drilling fluid, casing, and cement forms an integral part of the barrier system;
- A pressure-tested BOP attached to the surface wellhead system (at MODU level) will be used by competent personnel to shut in the well in case of any well control situation, following which an engineered method of well control will be implemented; and
- As required by the Maritime Protection Rules Part 131, an approved OSCP and a WCCP will be in place before the commencement of drilling operations;
- As required by Regulation 24 of the D&D Regulations, an approved ESRP will be in place before the commencement of drilling operations;
- All vessels (including the MODU) involved in the Kupe Phase 2 Development Drilling Programme will have an approved and certified Shipboard Marine Pollution Emergency Plan and an International Oil Pollution Prevention Certificate (as per MARPOL and Marine Protection Rules Part 130A and 123A);
- Spill response kits will be located and maintained on-board the MODU in close proximity to hydrocarbon bunkering areas;
- In the event that a spill to sea occurs during refuelling, a spill response will initially be undertaken in accordance with the relevant Shipboard Marine Pollution Emergency Plan, and notifications will be provided to MNZ and the EPA via MNZ's Response Coordination Centre, and relevant regional councils as required;
- Beach has a contract in place with Australian Marine Oil Spill Centre (**AMOSC**) to assist in the response to a large spill. In addition, Beach will also have a contract with Wild Well Control Incorporated (**WWCI**) for the provision of specialist well control and source control personnel and equipment. In the unlikely event of a large spill or loss of well control event, both AMOSC and WWCI personnel and equipment are on standby for mobilisation to New Zealand 24 hours a day, 365 days a year. All these details are included within the OSCP and ESRP;
- Beach has access to MNZ's spill-response equipment and personnel if required; and
- A vessel-specific Safety Case will be prepared by the MODU operator and submitted to WorkSafe for approval prior to the commencement of operations of the MODU.

7.8.2 Fuel Spill from Refuelling Operations

There are three main occurrences in which an unplanned release of fuel hydrocarbons into the marine environment could arise, those being:

- A refuelling incident;
- Leaking equipment or storage containers; or
- Hull/fuel tank failure from a collision or sinking.

Of those occurrences list above, an accidental spill associated with a refuelling incident at sea is the most likely scenario as hydrocarbon spills from leaking equipment or storage containers would generally be contained onboard the vessel or MODU, and a hull/fuel tank failure would only be caused by a highly unlikely collision or sinking event (see **Section 7.8.3**).

Diesel will be utilised by the MODU during the Kupe Phase 2 Development Drilling Programme which will be routinely transferred from support vessels to the MODU, with the main potential cause of a refuelling spill being a hose rupture, coupling failure or tank overflow. Based on these causes, the maximum volume spilt is expected to be the volume of the refuelling hose, plus approximately one minute of pumping before valves can be shut off. A response to a spill during refuelling activities will be included within the OSCP that is required prior to undertaking the Kupe Phase 2 Development Drilling Programme (discussed further in **Section 3.4.4**).

Diesel is a highly volatile substance and would rapidly evaporate in the marine environment and usually remains for no longer than a few days (NOAA, 2020b). Diesel is readily dispersed through wind and wave action, further enhancing evaporation, due to its low viscosity and buoyancy (with diesel being lighter than water). In addition to those weathering processes, hydrocarbons would also be biodegraded by bacteria and microbes (Atlas & Hazen, 2011).

Due to the distance of the drill location from the coastline (i.e. outside the CMA), the potential environmental effects from a spill during refuelling operations are expected to be relatively localised with no effects expected to occur along the coastline. These localised environmental effects would mainly be limited to marine mammals and seabirds due to the properties of diesel in the water column. While seabirds are not generally considered pelagic species, they have been considered pelagic within this ERA due to their use of the water column for feeding, and sea surface for resting. The high energy marine environment with relatively strong surface currents aiding in breaking up of buoyant diesel fuel would minimise the potential for any effects on the benthic environment.

7.8.2.1 Potential Effects

7.8.2.1.1 Biological Environs

It is important to note that diesel is considered to be significantly more toxic to marine organisms than heavy crude oils (NOAA, 2020a). However, given the high rates of evaporation, weathering, dispersion, degradation and dilution, effects are likely to be short-term in nature.

Although invertebrates such as molluscs and echinoderms are considered to be more vulnerable to adverse effects from diesel pollution than vertebrates, given the high energy marine environment, with relatively strong surface currents aiding in breaking up of the diesel (which floats on seawater), these species are highly unlikely to be impacted from a diesel spill.

Fouling or external contamination of fur seals and seabirds is particularly problematic and leads to a loss of insulation and buoyancy (see **Section 7.8.1.2.1**). Affected individuals would groom/preen themselves in an attempt to remove contamination, leading to ingestion and toxicity effects. While cetaceans are less vulnerable to the effects of a diesel spill on account of their smooth skin and insulating blubber, a cetacean surfacing through a diesel spill runs the risk of inhaling/ingesting the spilt substance leading to toxicity effects, or injury/damage to sensitive body parts (i.e. eyes).

Fish and cephalopods are at less of a risk to the effects of a diesel spill as they typically occur within the water column (i.e. below the surface diesel slick); however, should they encounter a spill on the sea surface, they may experience similar toxicity effects to marine mammals and seabirds. Plankton, fish eggs and larvae may experience reduced survival rates; although again, these organisms usually occur within the water column; hence, are unlikely to come into contact with a spill.

Consequence – A diesel spill would quickly spreads out on to top of the water so the coverage in the event of a fuel spill could have a medium-scale effect (5-100 km^2). However, the diesel would quickly break up in the high-energy marine environment with the wave energy, weathering and dissolution. Hence, it is considered that the potential consequence from a fuel spill during refuelling operations on the biological environment is *moderate*.

Likelihood – In order for a spill to occur during refuelling operations, all operational procedures and mitigation measures would need to fail. Therefore, it is considered that although this unplanned activity may occur, it would only be in exceptional circumstances, which equates to a *rare* categorisation.

As the consequence of effects from a fuel spill during refuelling operations is *moderate*, and it is considered a *rare* occurrence, the environmental risk of adverse effects occurring is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Fuel spill from refuelling operations – effects on biological environment	2 – Moderate *Protected species could be impacted if in close proximity to the spill.*	2 – Rare *May occur, but only in exceptional circumstances*	4 – Low	Less than minor

7.8.2.1.2 Socio-Economic Environs

Fisheries

As discussed within **Section 4.5.1**, there are two main commercial fisheries in the vicinity of the IAA; a mixed bottom trawl fishery and a set net fishery for school shark, with approximately 100 fishing events occurring within the IAA over a 5-year period between 2015 and 2021, along with recreational fisheries in the STB (**Section 4.5.1.2**). **Figure 47** and **Figure 48** indicate that commercial fishing effort largely occurs further offshore from the IAA in the central STB. Hence, any temporary displacement from the IAA during a response to a diesel spill is unlikely to have any significant effects on commercial fisheries. Furthermore, due to the presence of the Safety Zone around the Kupe WHP, commercial fishing is already precluded from a 500 m radius around the Kupe WHP.

A diesel spill into the marine environment from refuelling operations may have localised effects on fisheries with interests in the spill location. These potential effects include short-term contamination of sites within the vicinity of the discharge, potential mortality of fish eggs (discussed further in **Section 7.8.2.1.1**), displacement from the affected area during a clean-up response and contamination of fishing equipment if it were to be deployed or retrieved through the spill. In addition, a short-term reduction in air quality surrounding the spill could occur based on the presence of volatile organic compounds being released in the early phases of a spill. Health effects from inhalation of diesel fumes include exacerbation of existing respiratory conditions, nausea and vomiting, dizziness, headaches, and irritation of mucous membranes, while contact with skin may cause skin irritations. However, because diesel is so volatile, its presence at sea would be short-lived on account of the very high rates of evaporation, meaning that diesel spills usually persist for only a few days (NOAA, 2020b).

In order to minimise the potential of a spill occurring various operational constraints are placed on refuelling operations, including the time of day it occurs (i.e. only during daylight hours), ensuring there are appropriate weather conditions to undertake the operations. In addition, the equipment utilised will be routinely checked for integrity and appropriately certified with the relevant 'dry-break' couplings in place. If, in the rare event that a spill does occur, spill response kits are located and maintained onboard the MODU, near hydrocarbon bunkering areas.

Consequence – Although there are potential consequences on commercial fishers during the event of a diesel spill and the subsequent clean-up operations, the IAA does not represent an area of high fishing density, and fishers are likely to have alternative fishing grounds available for the short period of contamination and clean-up. As a result, it is considered that the consequence is *negligible* as no disruptions to normal activities are predicted.

Likelihood – In order for a spill to occur during refuelling operations, all operational procedures and mitigation measures would need to fail. Therefore, it is considered that although this unplanned activity may occur, it would only be in exceptional circumstances, which equates to a *rare* event.

As the consequence of a fuel spill from refuelling operations on commercial fishers is *negligible*, and it is *rare* that this would occur, the environmental risk and the resultant magnitude of the environmental impact is predicted to be ***negligible***.

Unplanned Activity	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Fuel spill from refuelling operations – effects on fisheries	0 – Negligible *No disruptions to normal activities*	2 – Rare *May occur, but only in exceptional circumstances*	0 - Negligible	Negligible

7.8.2.2 Measures to Avoid, Remedy of Mitigate

The following measures to avoid a spill from refuelling operations, and to remedy or mitigate against potential impacts in the event of a spill, will be in place throughout the duration of the Kupe Phase 2 Development Drilling Programme:

- Refuelling will only be undertaken during daylight hours and in appropriate weather conditions (as determined by vessel masters);
- Transfer hoses will be fitted with 'dry-break' couplings (or similar) and only certified hoses will be used. This equipment will be routinely checked for integrity;
- Spill response kits will be located and maintained on-board the MODU in close proximity to hydrocarbon bunkering areas;
- Beach has access to MNZ's spill-response equipment and personnel if required;
- A Safety Zone is in place around the Kupe WHP which provides a 500 m exclusion zone at all times area the Kupe WHP;
- In the event that a spill occurs during refuelling, a spill response will initially be undertaken in accordance with the relevant Shipboard Marine Pollution Emergency Plan, and notifications will be provided to MNZ and the EPA via MNZ's Response Coordination Centre, and relevant regional councils as required;
- Undertaking the Kupe Phase 2 Development Drilling Programme in accordance with the requirements of other MMRs, including:
  - Maritime Protection Rules Part 131 requirement of an approved OSCP and WCCP will be in place before the commencement of drilling operations;
  - MARPOL and Marine Protection Rules Part 130A and 123A requiring all vessels (including the MODU) involved in the Kupe Phase 2 Development Drilling Programme to have an approved and certified Shipboard Marine Pollution Emergency Plan and an International Oil Pollution Prevention Certificate; and
  - HSWPEE Regulations (regulation (72)(3)) requiring the submission of the Beach Emergency Management Plan and the MODU Emergency Response Plan to WorkSafe New Zealand.

7.8.3 Vessel Collision

During the Kupe Phase 2 Development Drilling Programme a vessel collision could occur between vessels at sea, or between a vessel and the MODU. The biggest threats from a vessel collision would be the damage to vessels and/or other structures, the harm to persons on-board those vessels, and the release of either harmful substances (such as diesel or drilling fluids) or debris into the marine environment. The largest risk of a vessel collision is from commercial fisheries and shipping operations that require boat voyages within the offshore marine environment.

To reduce the potential for this to occur the New Zealand Nautical Almanac recommends that vessels keep at least 5 NM away from any MODU, and the implementation of the Offshore Taranaki Precautionary Area (**Section 4.5.4**); therefore, a collision between a vessel and MODU is unlikely. However, support vessels utilised throughout the Kupe Phase 2 Development Drilling Programme are not subject to these same restrictions. Nevertheless, fuel storage systems are compartmentalised (i.e. not one large tank), so if a spill occurred from a tank rupture, if would only release the volume of the ruptured tank. In addition to this, fuel tanks are unlikely to be at maximum capacity when operating. The resulting effects of a diesel spill are the same as for the diesel-fuel spill (**Section 7.8.2**) and have not been repeated in this section; however, should any vessel involved in a collision be carrying crude oil or heavy fuel oil, the environmental effects would be more extensive as discussed within **Section 7.8.1**.

7.8.3.1 Potential Effects

7.8.3.1.1 Pelagic Environs

Adverse effects on marine fauna from marine debris includes the potential for entanglement and ingestion. However, the majority of marine debris released through a vessel collision would not be of the nature that would cause such effects (i.e. entanglement and ingestion is particularly problematic for plastics and discarded fishing gear). Nevertheless, those individuals that become entangled may drown, suffer from injury, or be subject to reduced foraging efficacy and/or predator avoidance, and those that ingest foreign debris could suffer from blocked digestive tracts or internal injury (Laist, 1987). The persistence of marine debris at sea following a collision is of concern as flotsam and jetsam can be carried quickly on currents to areas outside the primary clean-up operations.

While all hydrocarbon spills essentially cause the same kind of environmental effects (as summarised in **Section 7.8.1.2**), those involving crude oil or heavy fuel oil typically cause more obvious and debilitating external effects (i.e. smothering, particularly contamination of the pelage of fur seals and the feathers of seabirds). Although toxicity effects can also occur during crude oil spills, the heavier molecular weights of PAHs associated with heavy fuel/crude oil are less bioavailable to wildlife; however, they can still be associated with chronic toxic effects such as carcinogens (i.e. cancer causing), mutagens (i.e. causing mutations) and teratogens (i.e. causing developmental abnormalities of embryos) (Eisler, 1987).

Consequence – As described above, vessel collisions could cause extensive pelagic debris fields and (depending on the nature and extent of hydrocarbons spilled) could cause large and persistent oil contamination. Based on the large scale of predicted effects and the long-term duration and recovery period, the resultant classification is *severe*.

Likelihood – The likelihood of effects occurring from a vessel collision is considered to be *remote* based on the various operational procedures and mitigation measures that will be implemented during the Kupe Phase 2 Development Drilling Programme.

As the consequence of a vessel collision on the pelagic environment is *severe*, with a *remote* likelihood, the environmental risk of adverse effects occurring is assessed as ***low***, and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Vessel collision – effects on pelagic environs	3 – Severe *Large scale effect.*	1 – Remote *Highly unlikely but theoretically possible*	3 – Low	Less than minor

7.8.3.1.2 Benthic Environs

Localised damage and disturbance to the seabed may occur in the event that debris from a vessel collision makes contact with the seabed, this would in turn impact benthic fauna that may be present, with the persistence of permanent debris on the seabed a possibility.

Any debris that settles on the seabed and is unable to be retrieved would add a hard artificial substrate to the environment which has the potential to create artificial reefs and facilitate the settling and growth of hard-bottomed communities. While this could be considered a positive effect, artificial structures can facilitate the establishment or spread of non-indigenous marine species (which are discussed in detail within **Section 7.8.4**), or potentially affect commercial fishing activities (i.e. damage to ground-based fishing gear) in the future. Nevertheless, this settlement of debris on the seabed would cause measurable changes to substrate type and subsequent changes to ecosystem function.

Consequence – In the most part, submerged debris would be expected to be reasonably localised to the collision location, but some medium scale effects (5-100 km^2) could be expected as submerged debris is moved by currents. Hence, a *moderate* consequence level has been assigned.

Likelihood – The likelihood of effects occurring from a vessel collision on the benthic environs is considered to be *remote* based on the various operational procedures and mitigation measures that will be implemented during the Kupe Phase 2 Development Drilling Programme.

As the consequence of a vessel collision on the benthic environment is *moderate*, with a *remote* likelihood, the environmental risk of adverse effects occurring is assessed as ***very low*** and resultant magnitude of the environmental impact is predicted to be ***almost negligible***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Vessel collision – effects on benthic environs	2 – Moderate *Medium scale effects and habitat changes*	1 – Remote *Highly unlikely but theoretically possible*	2 – Very Low	Almost Negligible

7.8.3.1.3 Socio-Economic Environs

The worst-case effect of a vessel collision on the socio-economic environment would be the potential for injury or casualties. Following this, the potential for released debris to float, either at the surface or partially submerged, creating navigation hazards to users of the marine environment could occur. In addition, large debris that settles on the seabed poses a risk to commercial trawl fisheries through potential entanglement. This could cause long-term disruptions to the fishing industry through exclusion of space associated with permanent debris remaining on the seabed.

Consequence – The resultant consequence category for this potential risk is *severe* as long-term disruption of normal activities could occur.

Likelihood – The likelihood of a vessel collision occurring based on the various operational procedures and mitigation measures that will be implemented during the Kupe Phase 2 Development Drilling Programme is considered to be *remote*.

As the consequence of a vessel collision on the socio-economic environment is *severe*, with a *remote* likelihood, the environmental risk of adverse effects occurring is assessed as ***low*** and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Vessel collision – effects on existing interests	3 – Severe *Severe adverse effect to local communities from casualties or injury*	1 – Remote *Highly unlikely but theoretically possible*	3 – low	Less than minor

7.8.3.2 Measures to Avoid, Remedy or Mitigate

The following measures to avoid a vessel collision, and to remedy or mitigate against potential impacts in the event of a collision, will be in place throughout the duration of the Kupe Phase 2 Development Drilling Programme:

- The drilling operations will be undertaken inside the Kupe Safety Zone, and the Taranaki Precautionary Area, both of which will provide measures to reduce the chance of a vessel collision occurring;
- At all times the support vessel(s) are on location they will be adhering to the International Regulations for the Prevention of Collisions at Sea 1972, maintaining a visual watch and undertaking a full radar scanning watch for the presence of any other vessels in close proximity or any vessel on a course heading towards the MODU;
- The vessel(s) will scan VHF and single sideband radio on the local working channel(s) as well as monitoring emergency Channel 16 and single sideband 2182 for contact with any other vessels in the vicinity;
- Appropriate day shapes (such as 'Restricted in its Ability to Manoeuvre' shapes for vessels carrying out refuelling operations) and lights will be displayed; and
- The MODU and support vessels will have AIS. The AIS will transmit key information from the MODU and support vessels (i.e. vessel position, type, identity, speed, course etc.), as well as receiving from other vessels transmitting AIS.

7.8.4 Biosecurity Incursion

A biosecurity incursion is the introduction and spread of non-indigenous marine species (**NIMS**) outside of their natural range either intentionally or unintentionally by human activities (Hulme, 2009). The main vectors of transport for NIMS include ballast and bilge water discharges, and hull, anchor chain and sea chest fouling (Fletcher *et al.*, 2017).

An introduced species is only considered 'invasive' once it begins to cause negative consequences on its new environment (Bax *et al.*, 2003). Once established, marine pests are difficult to manage or eradicate (Fletcher *et al.*, 2017), with interception or removal of transport pathways often the only effective strategy (Molnar *et al.*, 2008). Established NIMS can have significant biological, economic, and social effects on the marine environment (Bax *et al.*, 2003).

In relation to the Kupe Phase 2 Development Drilling Programme, the effects of a biosecurity incursion mainly relate to the potential effects on the benthic environment and existing interests. As the proposed wells are a significant distance from the coastline (~30 km), coastal habitats in general have not been considered in the following sections. However, possible biosecurity incursions and NIMS reaching coastal habitats could potentially occur due to the movements of support vessels. Support vessels associated with the Kupe Phase 2 Development Drilling Programme would likely travel between the MODU and certain ports around New Zealand's coastline to undertake their support duties, such as providing supplies and for crew transfers. There is a potential risk that, should a NIMS be present on the hull or structures of the MODU, it might be possible for it to reach the support vessel and subsequently transported back to a port. Nevertheless, the actual risk of this occurring is considered to be negligible as outlined in the following discussion.

In order to transfer NIMS between the MODU and the support vessel there would either:

- Be physical interaction between the hulls of the support vessel and the legs of the MODU while at sea; or
- The NIMS would need to have entered the water column near the MODU and then attach to or hide on/in the support vessel as it lay near (for example as a newly spawned larval stage).

In relation to the first possibility, it is highly unlikely that physical interaction between the hull of the support vessel and the legs of the MODU would take place as operations would be occurring within open ocean waters where wind and wave conditions would likely result in the interaction causing damage to one or both vessels. Hence, the intention of all operations will be to keep the support vessel away from the legs of the MODU and Kupe WHP.

While it might theoretically be possible for a NIMS to detach/disperse into the water column from the MODU, the chances of this occurring at the exact time that a support vessel was present near the MODU and in a location where adults/larvae could reach the hull or otherwise be taken onboard the support vessel (e.g. ballast water), are very slim. It would be more likely that the NIMS (if present) would have detached or even spawned during the MODU's transit to the well location rather than at some other time while the MODU sat on the well site. However, if a NIMS did manage to reach the support vessel it would then also have to survive the subsequent passage to port, or at least to waters nearer to shore, where these vessels will transit at between 8 and 12 knots which would induce physical stressors that would detach most taxa.

Vessels (including the MODU itself and support vessels) entering New Zealand's waters are subject to the requirements of the CRMS and required to comply with the Import Health Standard: Ballast Water from All Countries (**IHS**). As outlined in **Section 3.4.1**, the CRMS requires vessels to have 'clean' hull before entering NZ's CMA, and to have recent application of suitable antifoulant coatings. The antifoulant coatings on the MODU would help to prevent the presence of a NIMS in the first instance, and its presence on the hull of the support vessels would further reduce chances that a successful transfer could occur.

7.8.4.1 Potential Effects

7.8.4.1.1 Benthic Environs

Some NIMS have the potential to alter the benthic environment by the accretion of hard substrate, particularly by encrusting bivalves such as oyster and mussel species that can fuse together as they grow to form hard-substrate reefs (termed "oyster-reefs"). However, based on the water depths associated with the Kupe Phase 2 Development Drilling Programme (approximately 35 m), it is unlikely that these oyster-reefs would be created as they typically occur in shallower coastal waters. In addition to the water depth, the conditions within the IAA would need to be similar to the waters in which the NIMS originated from.

Consequence – A biosecurity incursion resulting in the establishment of a NIMS has the potential to have wide-ranging impacts on the surrounding benthic environs, which could result in long-term major changes to ecosystem function. Due to this, it is considered that the consequence of the establishment of NIMS is *major*.

Likelihood – The likelihood of a biosecurity incursion from the Kupe Phase 2 Development Drilling Programme resulting in the establishment of a NIMS has been assessed as *remote* as New Zealand has strict biosecurity regulations (**Section 3.4.1**) (including the MODU and support vessels being subject to the requirements of the CRMS and required to comply with the IHS). In addition, the conditions (such as water depth and temperature) within the IAA are not likely to be conducive to the establishment of any NIMS.

As the consequence of a biosecurity incursion on benthic environments is *major*, with a *remote* likelihood, the environmental risk of adverse effects occurring is assessed as ***low*** and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Biosecurity Incursion – effects on benthic environs	4 – Major *Long-term and continues after activity ceases, with the potential for major changes to ecosystem function.*	1 – Remote *Highly unlikely but theoretically possible*	4 – Low	Less than minor

7.8.4.1.2 Socio-Economic Environs

A biosecurity incursion can result in potential economic and social impacts due to a decrease in production of marine sections such as fisheries, aquaculture, tourism and marine infrastructure (Bax *et al.*, 2003). Globally the economic impact of NIMS has been estimated to range from millions to billions of dollars annually (Pimentel *et al.*, 2000). Due to the offshore nature of the Kupe Phase 2 Development Drilling Programme (i.e. outside the CMA), recreational activities (i.e. fishing and boating) and tourism are unlikely to be affected by any NIMS incursion at the Kupe WHP; however, should any NIMS be transferred by support vessel to the coastal environment then recreational activities could be affected.

New Zealand's aquaculture industry is the most vulnerable to a biosecurity incursion due to the presence of large sedentary structures capable of harbouring NIMS. The closest aquaculture operations to the Kupe Phase 2 Development Drilling Programme occur in Golden Bay. Due to the significant distance between the Kupe WHP and Golden Bay (over 125 km), it is considered that activities occurring in the Kupe IAA are highly unlikely to have any effects on the aquaculture industry in regard to a possible biosecurity incursion, but theoretically an incursion could enter the coastal environment by way of a support vessel and could over time cause major disruption to the industry.

Biofouling on ship hulls increases frictional resistance which can result in an increase in fuel consumption, and potentially decrease top speeds (Schultz, 2007). However, due to the mitigation measures that will be in place during the Kupe Phase 2 Development Drilling Programme (see **Section 7.8.4.2**), it is considered unlikely that any New Zealand vessels will become a host of NIMS.

Collapses of international fisheries by introduced species has been documented in the past; for example, the invasive comb jelly *Mnemiopsis leidyi* has been blamed for the collapse of coastal fisheries in the Black Sea (Shiganova, 1998). However, to date, there have not been any documented effects within New Zealand's offshore commercial fisheries from biosecurity incursions. Nevertheless, if this were to occur, any species detrimental to New Zealand fisheries could have *major* adverse effects to commercial fishing operations.

Consequence – A biosecurity incursion resulting in the establishment of a NIMS has the potential to have wide-ranging impacts on existing interests, which could result in extensive disruptions to normal activities. Due to this, it is considered that the consequence of the establishment of NIMS is *major*.

Likelihood – The likelihood of a biosecurity incursion from the Kupe Phase 2 Development Drilling Programme resulting in the establishment of a NIMS has been assessed as *remote* as New Zealand has strict biosecurity regulations (**Section 3.4.1**) (including the MODU and support vessels being subject to the requirements of the CRMS and required to comply with the IHS). In addition, the conditions (such as water depth and temperature) within the IAA are not likely to be conducive to the establishment of a NIMS.

As the consequence of a biosecurity incursion on socio-economic environment is *major*, with a *remote* likelihood, the environmental risk of adverse effects occurring is assessed as ***low*** and resultant magnitude of the environmental impact is predicted to be ***less than minor***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Biosecurity Incursion – effects on benthic environs	4 – Major *Long-term and continues after activity ceases, with the potential for major changes to ecosystem function.*	1 – Remote *Highly unlikely but theoretically possible*	4 – Low	Less than minor

7.8.4.2 Measures to Avoid, Remedy or Mitigate

The following measures to avoid a biosecurity incursion will be in place throughout the duration of the Kupe Phase 2 Development Drilling Programme:

- All vessels entering New Zealand waters as part of the Kupe Phase 2 Development Drilling Programme (including the MODU) will adhere to CRMS on International Vessels and the IHS;
- All vessels entering New Zealand waters associated with the Kupe Phase 2 Development Drilling Programme (including MODU and any support vessels) will be subjected to a hull inspection and comply with the IHS. If required, a Craft Risk Management Plan will be prepared and submitted to Biosecurity New Zealand for approval prior to the MODU entering New Zealand waters; and
- If transportation of the MODU via a heavy-lift vessel is required, the time in transit to New Zealand and the fact that the MODU will be exposed to air on the back of the heavy lift vessel, will likely result in the removal/killing of any NIMS that might have been present on the hull or structures.

7.8.5 Dropped Objects

There is potential for objects, which can vary in size, to be accidently dropped to the seabed during the Kupe Phase 2 Development Drilling Programme. Hand tools are usually tethered or used in machinery spaces that have steel decking and unlikely to be lost at sea, and larger items are typically covered under manual handling requirements which reduces the likelihood of a drop.

In addition to the work onboard the MODU, any materials utilised during the Kupe Phase 2 Development Drilling Programme will be transported to the MODU by support vessels or helicopters which inherently have a risk that objects could be dropped through transfer operations.

For any larger items that are lost overboard, Beach would attempt to recover them after undertaking a risk assessment of the operation. As soon as practicable, the ROV would assist in identifying the location of the dropped object and if it is technically and safely feasible, the ROV will assist in the recovery of the object if required.

7.8.5.1 Potential Effects

7.8.5.1.1 Pelagic Environs

The potential for environmental effects on the pelagic environment from items that are dropped relate to the potential for those objects to float, and also whether they contain harmful substances which may be released. Such items pose little risk to the pelagic environment if they remain tightly sealed; however, the discharge of harmful substances from damaged floating objects would vary depending on the substance released.

Consequence – If an object is dropped overboard, the potential environmental effects would be highly localised (i.e. < 1 km^2). The potential effects from this unplanned activity would be short-term and temporary. The resulting effects on the pelagic environment are not predicted to be at a population level and ecosystem function would not be affected. As such, the consequences are assessed as being *negligible*.

Likelihood – The highest chance of an item being dropped is through the lifting operations that will occur during the Kupe Phase 2 Development Drilling Programme. However, these operations will be undertaken as safely and carefully as possible, as well as in accordance with the permit to work system to reduce the likelihood of an object being dropped. Therefore, based on the measures put in place to avoid these potential effects, the likelihood is considered to be *remote*.

As the consequence of a dropped object in the pelagic environment is *negligible*, with a *remote* likelihood, the environmental risk and the resultant magnitude of the environmental impact is predicted to be ***negligible***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Dropped objects – effects on pelagic environs	0 – Negligible *No adverse effects to populations, and ecosystem function unaffected*	1 – Remote *Highly unlikely but theoretically possible*	0 – Negligible	Negligible

7.8.5.1.2 Benthic Environs

Dropped objects which reach the seabed may directly affect the benthic environment through the physical impact of the object, or from any disturbance which may occur during retrieval activities.

Fauna present on the seabed may be crushed by the falling object; however, this would only occur directly under the footprint of the object. Over time, these objects may become colonised by fauna if they are not able to be retrieved. Any effects from dropped objects on the benthic environment would be highly localised (restricted to the immediate vicinity of the dropped object) and would not result in adverse effects on populations or ecosystem function.

Should a falling object contain harmful substances there is a potential for release of those harmful substances to the seabed and surrounding environment. However, this would only occur if the containment packaging is broken or ruptured during the fall or impact on the seabed. The potential effects from this release of harmful substance on the benthic environment would be substance dependant, although the substance would likely disperse and dilute with the prevailing currents.

If the fallen object is able to be recovered any resultant depression or disturbance to the seabed would quickly recover through bioturbation and the movement of currents and would not result in an effect on habitat function.

Consequence – Based on the discussion above, it is considered that the likely consequence on the benthic environment from a fallen object would be *negligible*.

Likelihood – The highest chance of an item being dropped is through the lifting operations that will occur during the Kupe Phase 2 Development Drilling Programme. However, these operations will be undertaken as safely and carefully as possible to reduce the likelihood of an object being dropped including being undertaken following Standard Operating Procedures and managed under the MODU Permit to Work System. Therefore, based on the measures put in place to avoid these potential effects, the likelihood is considered to be *remote*.

As the consequence of a dropped object to the benthic environment is *negligible*, with a *remote* likelihood, the environmental risk and the resultant magnitude of the environmental impact is predicted to be ***negligible***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Dropped objects – effects on benthic environs	0 – Negligible *No adverse effects to populations, and ecosystem function unaffected*	1 – Remote *Highly unlikely but theoretically possible*	0 – Negligible	Negligible

7.8.5.1.3 Socio-Economic Environs

Commercial Fisheries and Shipping

Larger objects that fall and rest on the seabed have the potential to cause a snag hazard for the commercial fishing industry. The resultant snag hazard is reduced somewhat as most transfers between the support vessels and the MODU will occur within the Kupe Safety Zone, hence commercial fishing and shipping is already precluded from this area.

In addition, any large floating objects that are lost during the Kupe Phase 2 Development Drilling Programme may present a navigational hazard, with the potential to cause damage to transiting vessels, particularly those that are unable to be retrieved. However, all practicable effects will be made to retrieve large, dropped objects.

Consequence – Based on the discussion above, it is considered that the likely consequence on the benthic environment from a fallen object would be *negligible*.

Likelihood – The highest chance of an item being dropped is through the lifting operations that will occur during the Kupe Phase 2 Development Drilling Programme. However, these operations will likely be undertaken within the Kupe Safety Zone and be undertaken as safely and carefully as possible to reduce the likelihood of an object being dropped, including with certified lifting equipment and being undertaken following Standard Operating Procedures and managed under the MODU Permit to Work System. Therefore, based on the measures put in place to avoid these potential effects, the likelihood is considered to be *remote*.

As the consequence of a dropped object to the socio-economic environment is *negligible*, with a *remote* likelihood, the environmental risk and the resultant magnitude of the environmental impact is predicted to be ***negligible***.

Unplanned Event	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Dropped objects – effects on existing interests	0 – Negligible *Highly localised with no disruptions to normal activities*	1 – Remote *Highly unlikely but theoretically possible*	0 – Negligible	Negligible

7.8.5.2 Measures to Avoid, Remedy or Mitigate

The following measures to avoid a dropped object, and to remedy or mitigate against potential impacts from any dropped objects, will be in place throughout the duration of the Kupe Phase 2 Development Drilling Programme:

- Lifting and bulk transfer operations will be undertaken following Standard Operating Procedures and managed under the MODU Permit to Work System;
- All lifting equipment will be tested and certified, and inspected prior to use, including checking the lifting capabilities of any machinery being use (e.g. cranes) and all loads will be checked for correct size, weight, packaging and item security before any lift commences;
- Lifting/landing areas and routes are clear of personnel, so no one is placed under a suspended load; and
- All objects (where practicable) that are dropped/fall into the sea will be located by the ROV and retrieved if safely feasible. Any significant objects unable to be recovered must be reported to the EPA and if they remain floating other notifications may be needed (e.g. MNZ).

7.9 Summary of Mitigation Measures

Operations associated with the Kupe Phase 2 Development Drilling Programme will be conducted to ensure that all risks to the health and safety of personnel and the potential for harm to the environment are as low as reasonably practicable. This includes undertaking extensive planning, implementation of monitoring systems, safety measures, and reporting procedures prior to the commencement of any drilling activities. In addition, drilling operations will be undertaken continuously, as far as practicable, to ensure that the drilling programme is completed in the shortest possible time.

As outlined throughout **Section 7**, an extensive suite of control measures and operational procedures are proposed to be implemented to avoid, remedy or mitigate the potential effects on the environment and existing interests to ALARP, as summarised within the following list.

MODU Operations

- Undertaking the Kupe Phase 2 Development Drilling Programme in accordance with the requirements of other MMRs, including:
    - Maritime Protection Rules Part 131 requirement of an approved OSCP and WCCP will be in place before the commencement of drilling operations;
    - MARPOL and Marine Protection Rules Part 130A and 123A requiring all vessels (including the MODU) involved in the Kupe Phase 2 Development Drilling Programme to have an approved and certified Shipboard Marine Pollution Emergency Plan and an International Oil Pollution Prevention Certificate;
    - HSWPEE Regulations (regulation (72)(3)) requiring the submission of the Beach Emergency Management Plan and the MODU Emergency Response Plan to WorkSafe New Zealand;
- A vessel-specific Safety Case will be prepared by the MODU operator and submitted to WorkSafe for approval prior to the commencement of operations of the MODU;
- All food waste will be comminuted before being discharged overboard to avoid attracting seabirds;
- Various measures will be implemented to minimise potential adverse effects on seabirds from nocturnal (night-time) lighting utilised on the MODU (and other support vessels), including:
    - Deck light use will be limited to the minimum time and illuminated areas required for safe operations;
    - Deck lights will be directed downwards onto work areas and shielded to reduce peripheral light emissions;
    - Deck lighting will be mounted as low as possible to minimise the illuminated area;
    - Where possible, deck lights will be directed away from reflective surfaces;
    - Search lights will only be used in emergencies;
    - Blinds or curtains will be kept drawn on all portholes and windows at night;
    - Decks shall be kept as free from clutter and/or non-essential items as possible to reduce the entanglement and entrapment potential for seabirds that do become involved in a bird strike incident;
    - Periodic reviews of on-board lighting and behaviour will be undertaken;

- Lifting and bulk transfer operations will be undertaken following Standard Operating Procedures and managed under the MODU Permit to Work System;
- All lifting equipment will be tested and certified, and inspected prior to use, including checking the lifting capabilities of any machinery being use (e.g. cranes) and all loads will be checked for correct size, weight, packaging and item security before any lift commences;
- Lifting/landing areas and routes are clear of personnel, so no one is placed under a suspended load;
- All objects (where practicable) that are dropped/fall into the sea will be located by the ROV and retrieved if safely feasible. Any significant objects unable to be recovered must be reported to the EPA and if they remain floating other notifications may be needed (e.g. MNZ);
- Refuelling will only be undertaken during daylight hours and in appropriate weather conditions (as determined by vessel masters);
- Transfer hoses will be fitted with 'dry-break' couplings (or similar) and only certified hoses will be used. This equipment will be routinely checked for integrity;
- All formation evaluations will be undertaken in accordance with the Crown Minerals (Petroleum) Regulations 2007;
- Beach will procure flare technology which will limit the smoke and fallout from flaring as much as practicable for the Kupe Phase 2 Development Drilling Programme; and
- The size of any explosive charge required will be designed by a specialist to ensure it is appropriate for the required task.

Discharges

- Any MODU selected will have a 'sack store' for the storage of all drilling-related harmful substances. The sack store is not open to the elements;
- Any additional storage space required will be in covered bunded pallets within bunded hazard areas, to ensure the containers of harmful substances are not directly exposed to any rainwater;
- Bunds, coamings, and hard covered bunded pallets for hazardous areas will contain, as a minimum, one full volume of the maximum container size that is stored in that area;
- No ecotoxic substance (i.e. any substance classified as harmful in accordance with the D&D Regulations) will be stored or handled in a non-hazard area which drains directly to the sea;
- Spill response kits will be located and maintained on-board the MODU;
- Systems and procedures will be in place and followed to ensure any harmful substance spilled on the deck of the MODU is cleaned up as soon as practicable;
- Cement volumes will be specifically calculated to minimise excess cement remaining; and
- Cement make-up is completed by competent personnel to minimise likelihood of excess batches being prepared.

Experience and Training of Key Personnel

- All personnel using the equipment will have the appropriate training and qualifications (where appropriate);
- All ROV works will be undertaken by appropriately trained and experienced ROV operators; and

- Experienced personnel will be carrying out the environmental monitoring programme.

Temporary and Localised Activity

- Drilling will occur through existing conductor slots at the Kupe WHP which will limit the spatial extent of disturbance to the seabed to the minimum required in order to complete the operations;
- The number of the pre-drill works will be limited to the minimum required in order to complete the operations such that the spatial extent of the disturbance is limited as far as practicable;
- The MODU will only be on location as a part of the Kupe Phase 2 Development Drilling Programme temporarily;
- Drilling operations will be undertaken in the shortest amount of time possible, whilst taking all practicable steps to minimise the risk of harm to personnel and the environment; and
- Flaring will be intermittent, its duration will be minimised where possible.

Safety Zone

- A Safety Zone is in place around the Kupe WHP which provides a 500 m exclusion zone at all times area the Kupe WHP;
- The drilling operations will be undertaken inside the Kupe Safety Zone, and the Offshore Taranaki Precautionary Area, both of which will provide measures to reduce the chance of a vessel collision occurring;
- At all times the support vessel(s) are on location they will be adhering to the International Regulations for the Prevention of Collisions at Sea 1972, maintaining a visual watch and undertaking a full radar scanning watch for the presence of any other vessels in close proximity or any vessel on a course heading towards the MODU;
- The vessel(s) will scan VHF and single sideband radio on the local working channel(s) as well as monitoring emergency Channel 16 and single sideband 2182 for contact with any other vessels in the vicinity;
- Appropriate day shapes (such as 'Restricted in its Ability to Manoeuvre' shapes for vessels carrying out refuelling operations) and lights will be displayed; and
- The MODU and support vessels will have AIS. The AIS will transmit key information from the MODU and support vessels (i.e. vessel position, type, identity, speed, course etc.), as well as receiving from other vessels transmitting AIS.

Support Vessels and Helicopters

- Support vessel operations will comply with the MMPR, including:
  - Avoid sudden or repeated changes in speed and direction near marine mammals;
  - There should be no more than three vessels within 300 m of any marine mammal;
  - Vessels should travel no faster than idle or 'no wake' speed within 300 m of any marine mammal;
  - Do not circle whales and dolphins, and do not obstruct their path or cut through any group;
  - Keep at least 50 m from whales (or 200 m from any large whale mother and calf/calves);
- Helicopter operations will comply with the MMPR, including:

  - When flying around marine mammals no aircraft shall be flown below 150 m unless taking off of landing;
  - When flying at altitudes lower than 600 m, no aircraft shall be closer than 150 m horizontally from a point directly above any marine mammal;
- The use of DP thrusters will be minimised as far as is practicable;
- Helicopters will use flight paths that minimise impacts of any sensitive coastal seabird and seal haul-out areas, particularly during roosting and breeding seasons;
- Support vessel masters and crew will be briefed on the requirement to record any marine mammal observations and record them on the DOC Marine Mammal Observation forms; and
- Support vessel masters and crew will record any seabird vessel collisions or interactions.

Spill Risk Management and Response Measures

- Extensive planning, peer review, and governance is involved in the design of each well. This includes information on the underlying stratigraphy and anticipated formation pressures used to design and construct a safe and effective petroleum well;
- Beach uses its Well Engineering and Construction Management System, which is a gated project management approach to well design and construction. This system also has a set of technical standards which conform to international standards with a strong management of change and risk based approach to drilling and completions activities;
- Well barrier schematics defining primary and secondary barriers and their verification of Well Acceptance Criteria will be established for each section of the drilling operation;
- The engineered drilling fluid, casing, and cement forms an integral part of the barrier system;
- A pressure-tested BOP attached to the surface wellhead system (at MODU level) will be used by competent personnel to shut in the well in case of any well control situation, following which an engineered method of well control will be implemented; and
- As required by the Maritime Protection Rules Part 131, an approved OSCP and a WCCP will be in place before the commencement of drilling operations;
- As required by Regulation 24 of the D&D Regulations, an approved ESRP will be in place before the commencement of drilling operations;
- Spill response kits will be located and maintained on-board the MODU in close proximity to hydrocarbon bunkering areas;
- In the event that a spill to sea occurs during refuelling, a spill response will initially be undertaken in accordance with the relevant Shipboard Marine Pollution Emergency Plan, and notifications will be provided to MNZ and the EPA via MNZ's Response Coordination Centre, and relevant regional councils as required;
- Beach has a contract in place with AMOSC to assist in the response to a large spill. In addition, Beach will also have a contract with WWCI for the provision of specialist well control and source control personnel and equipment. In the unlikely event of a large spill or loss of well control event, both AMOSC and WWCI personnel and equipment are on standby for mobilisation to New Zealand 24 hours a day, 365 days a year, pending covid restrictions. All these details are included within the OSCP and ESRP;

- Beach has access to MNZ's spill-response equipment and personnel if required.

Biosecurity

- All vessels entering New Zealand waters as part of the Kupe Phase 2 Development Drilling Programme (including the MODU) will adhere to CRMS on International Vessels and the IHS;
- All vessels entering New Zealand waters associated with the Kupe Phase 2 Development Drilling Programme (including MODU and any support vessels) will be subjected to a hull inspection and comply with the IHS. If required, a Craft Risk Management Plan will be prepared and submitted to Biosecurity New Zealand for approval prior to the MODU entering New Zealand waters; and
- If transportation of the MODU via a heavy-lift vessel is required, the time in transit to New Zealand and the fact that the MODU will be exposed to air on the back of the heavy lift vessel, will likely result in the removal/killing of any NIMS that might have been present on the hull or structures.

Site Surveys and Monitoring

- Pre-drill benthic surveys will be undertaken prior to the commencement of drilling operations. Post-drill monitoring programme will be undertaken and will be repeated annually for a period of up to three years. This monitoring programme will monitor the initial impact of drilling and subsequent recovery and recolonisation over time. This will ideally be undertaken in the same season as the pre-drill monitoring to exclude any seasonality effects;
- All equipment used for the Kupe Phase 2 Development Drilling Programme will be inspected, tested and maintained as per the MODU planned maintenance system requirements and in accordance with applicable industry standards to ensure its integrity;
- Deployment of the sampling equipment will be undertaken in a controlled manner to avoid any deployment wakes and to allow more mobile species time to get out of the way of the descending sampling equipment;
- All equipment utilised for the environmental monitoring programme will be appropriately inspected, tested, and maintained to ensure its integrity; and
- Seabed imaging equipment will be deployed in a manner that avoids contact with the seabed wherever possible.

Proffered Conditions

- **Appendix A** outlines the conditions proposed to ensure that the effects associated with the Kupe Phase 2 Development Drilling Programme on the environment and existing interests are mitigated to the extent that they are temporary and no more than minor.

7.10 Risk Assessment and Effects Summary

The assessment of actual and potential environmental effects and the significance of their effects has drawn on reported literature for potential environmental effects of offshore petroleum activities in combination with site specific modelling and benthic sampling results related to the IAA where applicable, and in accordance with the EEZ Act and other relevant legislation. Based on this, an ERA was completed as described in **Section 7.2.1**, with the outcome being summarised in **Table 34** below.

Table 34 Summary assessment of risks and associated magnitude of environmental impacts associated with the planned activities from Beach's Kupe Phase 2 Development Drilling Programme

	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Planned Marine Consent Activities				
Pre-drill works – effects on the pelagic environment	0 – Negligible	5 – Likely	0 – Negligible	Negligible
Pre-drill works – effects on benthic environment	0 – Negligible	5 – Likely	0 – Negligible	Negligible
Installation and removal of MODU – effects on water quality	0 – Negligible	5 – Likely	0 – Negligible	Negligible
Installation and removal of MODU – effects on marine mammals	0 – Negligible	2 – Rare	0 – Negligible	Negligible
Installation and presence of MODU – effects on seabirds	0 – Negligible	2 – Rare	0 – Negligible	Negligible
Installation and presence of MODU – effects on fish	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Installation and presence of MODU – effects on the benthic environment	0 – Negligible	6 – Certain	0 – Negligible	Negligible
Drilling operations – effects on marine mammals	1 – Minor	5 – Likely	5 – Low	Less than minor
Drilling operations – effects on seabirds	0 – Negligible	2 – Rare	0 – Negligible	Negligible
Drilling operations – effects on fish	0 – Negligible	4 – Possible	0 – Negligible	Negligible
Drilling operations – effects on cephalopods	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible
Drilling operations – effects on benthic environment	0 – Negligible	2 – Rare	0 – Negligible	Negligible
Discharge and deposition of drill cuttings – effects on primary productivity from increased turbidity	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible
Discharge and deposition of drill cuttings – effects on fish, fish larvae and zooplankton from increased turbidity	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible

	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Release of drill cuttings – effects on marine mammals	1 – Minor	3 – Unlikely	3 - Low	Less than minor
Discharge and deposition of drill cuttings – effects on benthic communities	2 – Moderate	5 – Likely	10 – Moderate	Minor
ROV works – effects on pelagic environs	0 – Negligible	4 – Possible	0 – Negligible	Negligible
ROV works– effects on benthic environs	0 – Negligible	3 - Unlikely	0 – Negligible	Negligible
Formation evaluation – effects on seabirds	1 – Minor	4 – Possible	4 – Low	Less than minor
Supporting activities – effects on marine mammals	1 – Minor	5 – Likely	5 - Low	Less than minor
Supporting activities – effects on seabirds	1 – Minor	5 – Likely	5 – Low	Less than minor
Environmental monitoring – effects on pelagic environs	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible
Environmental monitoring – effects on the benthic environs	0 – Negligible	5 – Likely	0 – Negligible	Negligible
Contingent activities – effects of explosives on pelagic environs	1 – Minor	5 – Likely	5 – Low	Less than Minor
Contingent activities – effects of explosives on benthic environment	1 – Minor	2 – Rare	2 – Very Low	Almost Negligible
Cementing operations – effects on pelagic environs	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Cementing operations – effects on benthic environs	0 – Negligible	4 – Possible	0 – Negligible	Negligible
Deck drainage – effects on plankton and primary productivity	0 – Negligible	6 – Certain.	0 – Negligible	Negligible
Deck drainage – effects on benthic invertebrates	0 – Negligible	1 - Remote	0- Negligible	Negligible
Deck drainage – effects on pelagic species	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible
Deck drainage – effects on seabirds	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible
Deck drainage – effects on recreational fishing.	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Deck drainage – effects on commercial fishing.	0 – Negligible	3 – Unlikely	0 – Negligible	Negligible
Other				
Planned activities – effects on cultural values and associations	N/A	N/A	High	Significant

	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Planned activities - effects on human health	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Planned activities – effects outside the EEZ	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Cumulative effects from planned activities				
Cumulative effects from discharge and deposition of drill cuttings – effects on benthic communities	2 – Moderate	5 – Likely	10 – Moderate	Minor
Maritime traffic - Harmful substance discharges	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Maritime traffic - noise and vibration	0 – Negligible	1 – Remote	0 – Negligible	Negligible

In addition to the assessment of planned activities for which consent is sought, an assessment of 'unplanned' activities has been undertaken. **Table 35** below provides a summary of the highest magnitude of environmental impact (i.e. worst possible effect) for each of the unplanned activities assessed under **Section 7.8**.

Table 35 Summary assessment of risks and associated magnitude of environmental impacts associated with the unplanned activities from Beach's Kupe Phase 2 Development Drilling Programme

	Consequence	**Likelihood**	**Risk**	**Predicted Magnitude of Environmental Impact**
Loss of well control – effects on marine mammals	4 – Major	2 – Rare	8 – Moderate	Minor
Loss of well control – effects on seabirds	3 – Severe	2 – Rare	6 – Moderate	Minor
Loss of well control – effects on fish	2 – Moderate	2 – Rare	4 –Low	Less than minor
Loss of well control – effects on plankton and primary production	1 – Minor	2 – Rare	2 – Very low	Almost negligible
Loss of well control – effects on benthic invertebrates	3 – Severe	2 – Rare	6 – Moderate	Minor
Fuel spill from refuelling operations – effects on biological environment	2 – Moderate	2 – Rare	4 – Low	Less than minor
Fuel spill from refuelling operations – effects on fisheries	0 – Negligible	2 – Rare	0 - Negligible	Negligible
Vessel collision – effects on pelagic environs	3 – Severe	1 – Remote	3 – Low	Less than minor
Vessel collision – effects on benthic environs	2 – Moderate	1 – Remote	2 – Very Low	Almost Negligible
Vessel collision – effects on socio-economic environment	3 – Severe	1 – Remote	3 – low	Less than minor
Biosecurity incursion – effects on benthic environs	4 – Major	1 – Remote	4 – Low	Less than minor

	Consequence	Likelihood	Risk	Predicted Magnitude of Environmental Impact
Biosecurity incursion – effects on socio-economic environs	4 – Major	1 – Remote	4 – Low	Less than minor
Dropped objects – effects on pelagic environs	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Dropped objects – effects on benthic environs	0 – Negligible	1 – Remote	0 – Negligible	Negligible
Dropped objects – effects on socio-economic environment	0 – Negligible	1 – Remote	0 – Negligible	Negligible

8 Consideration of Alternatives

As required by section 39(1)(i) of the EEZ Act, Beach has considered possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects. These alternatives are discussed in this section.

This assessment of alternatives has focussed on the location of the well(s), the selection of the MODU, and the discharge of harmful substances as these are the proposed activities that could have potential effects on the receiving environment.

8.1 Well Location

The well locations in the Kupe Phase 2 Development Drilling Programme have been selected because there are existing empty conductors at the Kupe WHP and the completed well can be tied into the existing infrastructure to enable gas and condensate to be efficiently transported to the onshore production station.

For the current drilling campaign, as an alternative to drilling the wells at the Kupe WHP, Beach could drill wells away from the Kupe WHP; however, this would then involve installation of additional infrastructure on the seabed (e.g. xmas tree and pipeline(s)). In addition, drilling wells away from the Kupe WHP would result in more seabed disturbance as the top-hole sections (drilled to install a conductor) would result in drill cuttings being discharged directly onto the seabed. Utilising the existing empty conductors at the Kupe WHP results in less disturbance than drilling wells away from the Kupe WHP.

8.2 Selection of the MODU

The ability to undertake the Kupe Phase 2 Development Drilling Programme requires a MODU that is technically capable of drilling the required wells at the Kupe WHP. This necessitates a MODU which can cantilever over the existing platform and drill through the existing empty conductors.

There are two types of MODU which have the capability to drill on existing platforms like the Kupe WHP, namely a jack-up rig and a tender assisted drilling (**TAD**) unit.

A TAD is typically stationed next to a platform and its drilling package is then lifted onto the platform. The TAD remains in place in order to provide power and other services that support the drilling operation. A TAD is kept in place by way of an anchoring array which can result in increased areas of seabed being disturbed during their placement and retrieval.

A jack-up MODU, as being proposed to be used by Beach, has advantages in that it can be positioned beside the Kupe WHP and cantilever over the Kupe WHP, where the level of seabed disturbance is limited to the installation of its three (or four) legs and spudcans, this being much less than any MODU which utilises an anchoring array. Jack-up MODUs have limitations in terms of water depth; however, the water depth around the Kupe WHP is well within the range of jack-up MODUs.

Drill ships and semi-submersible MODUs are not able to be used for the proposed drilling as they are unable to access the existing conductors on the Kupe WHP.

8.3 Deposition of Drilling Cuttings

The only alternative to avoid the deposition of drilling cuttings is the collection of the cuttings onboard the MODU and returning them to shore for disposal at a consented facility. However, this potential option is not considered practicable for various reasons, including:

- While onshore facilities for disposal of cuttings do exist in Taranaki, the costs associated with transport would be very high and would result in significant increases in the number of support vessel voyages being required, which in itself would increase health, safety, and environmental risks;
- The Kupe WHP is located ~110 km from Port Taranaki. At this distance, with an average speed of 10 knots, it would take approximately six hours each way. When port berthing requirements, unloading, cleaning and mobilising back to the MODU is taken into account, relocation of drill cuttings is a significant operation. This additional transportation will significantly increase fuel usage and associated emissions from the support vessel(s) and there would be a significant number of truck movements required to transport the volume of cuttings from the support vessel to a consented facility, which in turn increases road traffic and associated health, safety and environmental risks;
- In order for the drill cuttings to be stored prior to collection, a MODU with sufficient deck space would need to be contracted for the Kupe Phase 2 Development Drilling Programme. Contracting a MODU that is capable of storing this volume of drill cuttings may not be possible due to the lack of availability of MODUs, the remoteness of New Zealand, and the size of the New Zealand market; and
- There are safety and environmental exposure risks (risk of harm to personnel and/or spills during lifting/pumping operations) associated with transporting large volume of drill cuttings from the MODU to offshore support vessel/s and likewise from the support vessel to suitable road transport for disposal and again at the receiving facility.

For the above reasons, the deposition of drilling cuttings on the seabed is the best practicable option for their disposal. Beach has selected WBMs which will have the least amount of harmful substances present to undertake the drilling process, whilst minimising potential impacts on the receiving environment, and a monitoring programme will be in place to monitor any such impact and the subsequent recovery of the seabed over time.

8.4 Discharge of Excess Cement

As discussed in **Section 2.2.10.4**, there is a potential for excess cement (up to 15 m^3) to be discharged overboard as a contingency in situations during drilling where an error occurs in the cement mixing process or from a mechanical failure during the pumping of the cement. There is a possibility that this discharge will contain harmful substances, likely in small volumes. Nevertheless, as a worst-case scenario, the assessment of this discharge (see **Section 7.2.11.2**) shows that even if the full volume is within the discharge, the resultant magnitude of environment effect is ***negligible***.

Although these effects are considered to be negligible, alternatives to this discharge have been considered. The alternative would be for the excess cement to be stored onboard the MODU in a separate container where it would set and would subsequently need to be transferred to a support vessel and disposed of onshore. Similar to the discussion above in **Section 8.3**, the additional transportation (including fuel usage on the support vessels and trucks onshore) and lifting operations required would increase health, safety and environmental risks. The reduction in environmental effects (those that are already considered negligible) is not considered to outweigh the additional risks associated with this alternative. Therefore, the discharge of this excess cement is considered to be the best practicable option for this disposal.

9 Proffered Conditions

Beach has prepared two sets of proffered conditions and these are included in **Appendix A**. The first set are for the marine consent and the second set are for the marine discharge consent which are generally based on other marine consents and marine discharge consents that the EPA has granted under the EEZ Act. This section presents a summary of the key proffered conditions and the rationale behind their drafting.

Beach considers that the proffered conditions, both singularly and in total, appropriately avoid, remedy, or mitigate potential adverse effects identified by this IA.

9.1 Marine Consent Conditions

Proffered conditions 1 to 7 are administrative conditions.

Proffered condition 2 of the marine consent seeks an expiry date of 31 December 2028, which takes into account the post-drill environmental monitoring which the marine consent requires and authorises. Beach intends to drill the first development well during 2023 and if the second development well is drilled it may be drilled not less than 6 months after the first well, meaning it could be drilled during the 2023, 2024, or later. Proffered condition 13 requires Beach to undertake three rounds of post-drill benthic monitoring, each round being approximately 12 months apart. Therefore, the final post-drill monitoring would occur during the 2026/27 summer period if the second development well is drilled. Beach considers it appropriate to provide some flexibility in terms of the timeframes to drill the development wells to provide for unforeseen circumstances and potential delays (e.g. restrictions associated with the Covid-19 pandemic), and therefore an expiry of 31 December 2028 for the marine consent is sought and considered appropriate.

Proffered condition 8 limits the number of development wells that can be drilled under the marine consent to the two described in this consent application. It is worth noting that a ‘well’ constitutes a single well drilled into the seabed, except where that well is required to be re-spudded, in which case the initial well and the subsequent re-spudded well are together deemed to be a single well.

Proffered conditions 9 to 12 requires Beach to submit an EMP to the EPA for certification prior to drilling activities taking place. The EMP outlines the proposed monitoring approach that will be undertaken after the drilling. The EMP needs to be consistent with OTEMP, being a protocol, which was developed through consultation with industry regulators, MNZ, and the EPA. Advice Note 1 explains that the drilling of the first development well (KS-9) may commence as soon as the EMP has been submitted to the EPA for certification as the pre-drill monitoring will have already been completed under Permitted Activities Regulations.

Proffered conditions 13 requires Beach to undertake monitoring in accordance with the certified EMP. This monitoring includes the requirement for post-drill benthic monitoring to enable comparisons to be made with the pre-drill monitoring and to monitor for the recovery of the benthic environment after drilling activities have ceased. This monitoring is in line with previous marine consents for drilling activities in New Zealand’s EEZ. It should be noted that no specific pre-drill monitoring is necessary for the second development well (if it is drilled) because the first post-drill monitoring for the initial development well will essentially act as the pre-drill monitoring for the second development well due to the timing between the drilling operations.

Proffered condition 14 limits the volume of in-situ material (strata) removed from each of the two development wells to 534 m^3, except where a well is required to be side-tracked or re-spudded, in which case the total volume removed can be increased to 1,068 m^3. These are the anticipated maximum volumes of material to be removed from any one well, and on which the drill cutting dispersal modelling has been based.

Proffered conditions 15 to 21 relate to mitigating potential impacts to seabirds and marine mammals in accordance with similar conditions on existing marine consents as a result of recommendations by DOC.

Proffered condition 22 requires Beach to provide up-to-date information to all persons with existing interests identified in **Section 5.2**.

Proffered conditions 23 and 24 relate to the requirement for notification to the EPA as soon as practicable of the occurrence of an "environmental incident". This term means an incident arising out of, or in connection with, a well which would be declared to be a notifiable incident under the HSWPEE Regulations and which Beach reasonably considers may result in an adverse environmental effect.

Proffered condition 25 requires Beach to notify the EPA as soon as reasonably practicable upon becoming aware of any adverse effects on the environment or existing interests that were not anticipated or are of a scale or intensity not anticipated when the consent application was granted to enable the EPA to undertake a review of the marine consent under section 76(1)(c) of the EEZ Act.

Proffered condition 26 requires Beach to notify the EPA, in writing, when the MODU is positioned on site and the date of departure of the MODU. This condition will provide the EPA with sufficient time to allow organisation of any compliance monitoring that is required under other conditions.

Proffered condition 27 requires Beach to maintain a log for each well drilled and be made available to the EPA upon request. This log will record various parameters specific to each well and can be utilised for compliance monitoring in relation to those parameters recorded.

Proffered conditions 28 and 29 require Beach to provide logs and reports to the EPA at certain stages after the completion of drilling of each well.

Proffered conditions 30 to 32 requires Beach to provide a Compliance Report for each well which includes a description, analysis, evaluation and discussion on all of the environmental monitoring results (including a copy of the raw data obtained during the monitoring activities) and logs of any seabird collisions and marine mammal sightings. In addition, this Compliance Report is also required to assess compliance with the conditions of the marine consent. A timeframe of nine months following the final post-drill monitoring requirements has been included within these conditions to allow adequate time to compile the environmental monitoring results and undertaken an analysis of compliance with the consent conditions.

Advice Note 3 outlines the EPA's ability to review the duration and/or conditions of the marine consent under section 76 and 77 of the EEZ Act. The ability to review the duration and/or conditions do not need to be imposed as formal conditions as the ability to instigate such reviews are codified in the EEZ Act and is not a condition that a consent holder can or must comply with.

A set of General Advice Notes is included which reminds Beach of its obligations under other MMRs, including the requirement for an ESRP under the D&D Regulations, its obligations under the Biosecurity Act 1993 (for ballast water and biofouling on vessels), Marine Mammals Protection Act 1978 (for marine mammals), and the Wildlife Act 1953 (for seabirds and marine mammals).

9.2 Marine Discharge Consent Conditions

Proffered conditions 1 to 6 are administrative conditions which are routinely imposed on other marine discharge consents granted by the EPA.

Proffered condition 7 requires Beach to not store or handle any harmful substances in non-hazard areas which drain directly to the sea.

Proffered condition 8 requires Beach to manage the storage of harmful substances within a secondary containment system. This would mean that any escape of those harmful substances will be contained within the area where they are used and those substances may be recovered, subject to residual amounts remaining. This condition has been proffered to reduce the potential for harmful substances to enter the deck drains and their subsequent discharge to the marine environment; thereby reducing the potential for adverse effects on the environment and persons with existing interests.

Proffered condition 9 requires Beach to ensure that the minimum design requirements stated in the condition are onboard the MODU(s) which is utilised during the drilling. This condition has been developed to reduce the potential uncertainty associated with this marine consent application.

Proffered conditions 10 to 12 are similar in nature to the requirements of the ESRP in that they require Beach to notify the EPA in the event of a spill of any harmful substances, seek advice regarding the monitoring of that spill and provide the results of any monitoring undertaken to the EPA. This would be in addition to undertaking activities in accordance with an ESRP.

Proffered condition 13 seeks an expiry date of 31 December 2026. Beach intends to drill the first development well during the 2023 and the second development well (if drilled) may be drilled not less than 6 months later, meaning it could be drilled during the 2023, 2024, or later. While this is the anticipated timetable for the drilling, Beach considers it appropriate to allow some additional time to provide for unforeseen circumstances and potential delays, and therefore an expiry of 31 December 2026 for the marine discharge consent is sought and considered appropriate. The expiry of the marine discharge consent is earlier than the marine consent because the latter authorises activities associated with post-drill monitoring which is required to be undertaken for a three-year period after the drilling is completed.

An Advice Note is included which outlines the EPA's ability to review the duration and/or conditions of the marine discharge consent under section 76 and 77 of the EEZ Act. The ability to review the duration and/or conditions do not need to be imposed as formal conditions as the ability to instigate such reviews are codified in the EEZ Act and is not a condition that a consent holder can or must comply with.

10 Purpose of the EEZ Act

Section 10 of the EEZ Act outlines its purposes and states:

> *(3) The purpose of this Act is –*
>
> *(c) to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf; and*
>
> *(d) in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter.*
>
> *(4) In this Act,* ***sustainable management*** *means managing the use, development, and protection of natural resources in a way, or at a rate, that enables people to provide for their economic well-being while –*
>
> *(d) sustaining the potential of natural resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(e) safeguarding the life-supporting capacity of the environment; and*
>
> *(f) avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

The recent decision of the New Zealand Supreme Court on TTRL's application to extract seabed material in the STB[32] provides the authoritative direction on how applications are to be assessed in terms of the purpose of the EEZ Act, as set out in section 10 of the Act.

The majority of the Court held that the purpose provision in section 10 of the EEZ Act provides an overarching framework for decision-making and, to this extent, has substantive or operative force.

It is important to note the difference in language between sections 10(1)(a) and 10(1)(b) of the EEZ Act. Section 10(1)(a) of the EEZ Act is aimed at achieving a balance between protecting the environment and exploiting it for economic reasons – namely because it promotes 'sustainable management' of natural resources, with section 10(2) of the EEZ Act confirming that sustainable management relates to the enabling of people to provide for their economic well-being while balancing the protection of the environment. However, section 10(1)(b), which is applicable in this case for the marine discharge consent, seeks to protect the environment from pollution – there is no mention of economic well-being or sustainable management and this part of the EEZ Act's purpose is therefore not premised on any form of compromise.

The Supreme Court disagreed with the Court of Appeal that section 10(1) EEZ Act provides the main operative criteria for the determination of an application, namely because section 10(3) of the EEZ Act expressly describes the matters set out in section 59 as being the 'decision-making criteria'. Section 10(1) of the EEZ Act sets out guiding principles but it is not the section under which particular decisions are made, however the section 10(1) purposes are not merely context for decision-makers, nor are they factors to be given special weight.

[32] Trans-Tasman Resources Limited v Taranaki-Whanganui Conservation Board, [2021] NZSC 127 [30 September 2021].

The majority of the Supreme Court found that section 10(1)(b) creates an environmental bottom line in the sense that, if the environment cannot be protected from 'material harm' through regulations, then the discharge must be prohibited[33]. While section 10(1)(b) does not use the term 'material harm', the Supreme Court agreed with the Court of Appeal that the term 'protect' in this section is to be interpreted as being a threshold of 'material harm'.

The majority of the Supreme Court outlined a three-step test that decision-makers must follow when assessing applications for marine discharge consents under the EEZ Act, as follows:

(a) Is the decision-maker satisfied that there will be no material harm caused by the discharge or dumping? If yes, then step (c) must be undertaken. If not, then step (b) must be undertaken.

(b) Is the decision-maker satisfied that conditions can be imposed that mean:

(i) material harm will be avoided;

(ii) any harm will be mitigated so that the harm is no longer material; or

(iii) any harm will be remedied within a reasonable timeframe so that, taking into account the whole period harm subsists, overall the harm is not material?

If not, the consent must be declined. If yes, then step (c) must be undertaken.

(c) If (a) or (b) is answered in the affirmative, the decision-maker should perform a balancing exercise taking into account all the relevant factors under s 59, in light of s 10(1)(a), to determine whether the consent should be granted.

The Court confirmed the assessment of whether there is material harm in any one case will require assessment of a multiplicity of factors, such as the volume of the harmful substance discharged into the expanse of the sea, the flora, fauna and natural characteristics of the area of seabed affected, the size of seabed or volume of water affected, and the time for which the harm will last. That is, the determination of whether any harm is material or not requires qualitative, temporal, quantitative, and spatial aspects to be weighed.

While there is no definition of what constitutes 'material harm', guidance can be gained from recent decisions the EPA has made on marine discharge and dumping consents. There have been two decisions issued by the EPA since the Court of Appeal's decision which provide guidance on what scale of effect may constitute material harm, or not. The two decisions are:

1. the EPA's decision in its first marine dumping consent application, involving the Dong Won 701[34] in an application to dump a damaged fishing vessel 25 nautical miles offshore from Otago Harbour; and
2. the EPA's decision on OMV Taranaki Limited's application for marine consent and marine discharge consent within the Māui Field[35].

Both decisions considered the Court of Appeal's reasoning regarding section 10(1)(b).

[33] For completeness, the minority of the Court differed and did not consider section 10(1)(b) set an environmental bottom line and that material harm was not automatically decisive.
[34] DW New Zealand Ltd Marine Dumping Consent EEZ400012, 30 April 2020.
[35] OMV Taranaki Ltd Marine Consent EEZ200011-1 and Marine Discharge Consent EEZ200011-2, 8 May 2020.

In the context of the Dong Won 701 decision, the EPA appears to have concluded that "no material harm" essentially means "no significant" (or more than minor) effect. In terms of benthic effects, which were the most relevant effects in that matter, this included taking scale into account.

Relevant excerpts from the decision indicate that the assessment of material harm involves a consideration informed by both evidence and context (emphasis added):

> *209. As such I find that no significant effect on species and biodiversity, nor material harm, to the environment will arise and it is highly unlikely there will be loss to benthic communities at a population level. I find the effects on the benthic communities of the vessel landing on the seabed to be less than minor.*
>
> *212. Taken in over the whole of the ADS[36], I find there is no material harm from the vessel landing on the seabed.*
>
> *217. The scale of that effect is highly localised and only occurs from the vessel breaking up. There is potential harm, but not material harm, outside the direct footprint of the vessel and its components from the sediment plume. It is an almost instantaneous effect with limited short-term smothering effects at the time.*
>
> *228. I have imposed conditions that require the vessel is cleaned to such a state that it, as a "clean" vessel, will not have significant nor long term adverse effects on the environment from waste and substances escaping the vessel when it is on the seabed. The dumping is a short-term limited effect activity which only leaves the legacy of a vessel on the seabed. I find possible cumulative effects, should such arise, is almost beyond any measure, and not of a scale, nature or duration that could possibly impact on future use of the ADS or adjoining areas.*
>
> *248. Despite the possible presence of some protected and sensitive benthic environments, and as indicated in the assessment of benthic effects as described above in paragraph 205 -217, I conclude that it is most unlikely that there will be material harm to rare and vulnerable ecosystems that may be present in the ADS. This is based on the scale and duration of the activity, the small footprint of the vessel, the small amount of anticipated benthic disturbance, and the known presence of such ecosystems outside the ADS that means the effect on potential rare and vulnerable benthic ecosystems will be measurable but localised in the ADS.*
>
> *264. I am most mindful that the Court of Appeal in its TTR Decision stated that it is not consistent with section 10(1)(b) of the EEZ Act to permit marine dumping that will cause material harm to the environment, on the basis that the harm will subsequently be remedied or mitigated by consent conditions. If material harm is likely to arise from the dumping activity, then the application fails to meet the purpose of section 10(1)(b) and must be refused. Only if I determine that harm will be avoided through regulation can the consent be granted and conditions be imposed under section 63.*
>
> *290. The Disposal Brief used to guide cleaning and preparation of the vessel for scuttling was not, in my view, sufficiently detailed and specific about the removal of certain substances and materials. I wanted to be assured that all materials and substances which are potentially ecotoxic or could result in bioaccumulation are removed from the vessel. If that was not practicable, I wanted to assure myself that the volumes and quantities of such material remaining do not create significant risk or material harm to the marine environment and through that create risk to human health.*

[36] ADS refers to the 'Authorised Dump Site'.

In the context of the OMV Taranaki Limited decision, the EPA concluded that negligible or less than minor adverse effects on the environment did not amount to "material harm" to the environment. Relevant excerpts from the decision are presented below (emphasis added):

> *Executive Summary*
>
> *xiv. We find that while the discharge activity causes adverse effects to the environment, these effects are less than minor and do not amount to material harm to the environment. The conditions we have imposed that regulate which harmful substances are authorised to be discharged ensures this.*
>
> *510. The starting point for determining whether granting the marine discharge consent achieves section 10(1)(b) is whether the environment is protected from pollution caused by the discharge.*
>
> *511. The discharges applied for include a range of harmful substances which have the potential to create adverse effects. However, the discharges we have authorised have only negligible or less than minor effects on the environment, and we do not consider that this amounts to material harm to the environment. We have imposed conditions which avoid any potential harm to the environment from the discharge by regulating which harmful substances, and the amount of those harmful substances, that are authorised to be discharged.*
>
> *512. Overall, we find that the assessment of the activity against sections 10 and 59 matters was adequately set out in OTL's IA. In summary, we find:*
>
>> *(a) The proposed discharges will have only negligible or less than minor effects on the environment, and we do not consider these will result in material harm to the environment. We have imposed conditions to avoid, remedy or mitigate any actual and/or potential adverse effects on the environment from the activities by regulating the type and quantities of harmful substances that can be discharged.*

A more recent decision by the EPA on Beach's application for marine discharge consent to discharge residual amounts of harmful substances via deck drains in the Canterbury Basin[37] did not specifically address the question of what constituted material harm or not, but it did address the second limb of section 10(1) of the EEZ Act. In that decision, the EPA concluded the adverse effects on the environment would be negligible and the granting of the marine discharge consent would protect the environment from pollution and therefore the second limb of section 10(1) of the EEZ Act was met.

In terms of the current application, the environmental risk assessment presented in **Section 7.3** shows that the adverse effects of the discharge of residual amounts of harmful substances via the deck drains, if indeed any occur, will be negligible (even if worst-case assumptions are adopted). Therefore, based on the EPA's recent decisions, it is considered that any such discharges will not lead to any material pollution or harm as contemplated by the Court of Appeal in TTRL (confirmed by the Supreme Court), and the proposed conditions would ensure the marine environment is protected.

In terms of section 10(1)(a), the proposed activities will provide for the economic well-being of Beach, its contractors, and the New Zealand Government (through royalties and taxes) whilst safeguarding the life-supporting capacity of the environment and mitigating adverse effects on the environment. Accordingly, the proposed activities and the granting of the marine consent and marine discharge consent meet the purposes of the EEZ Act.

[37] Beach Energy Resources NZ (Holdings) Limited Marine Discharge Consent EEZ100019, 27 October 2020.

11 Conclusion

Beach is applying for a marine consent and a marine discharge consent under section 38 of the EEZ Act. This consent application is to permit various activities associated with the Kupe Phase 2 Development Drilling Programme within PML 38146.

The primary objective of the Kupe Phase 2 Development Drilling Programme is to fully develop the Kupe field to maximise production and extend the production plateau length of the field, thereby providing energy security to New Zealand into the future – a positive effect. In addition, potential economic benefits arising from the Kupe Phase 2 Development Drilling Programme could be significant on a regional and national scale. If successful, the proposed activities will enable significant incremental field production, which itself will generate material economic national benefits in respect of production-related jobs, demand-side (consumption) impacts, support for just transition, fiscal benefits to the Crown, gas market impacts, avoidance of higher carbon alternatives, economic efficiency of maximising existing assets/investments, electricity price stability, and export earnings. At a regional level, the projected regional (Taranaki) economic impact equates to 164 full time equivalent years, an increase in household incomes of $11 million, and a boost to the regional Gross Domestic Product of $20.9 million.

An ERA has been undertaken to identify the actual and potential effects on the environment and existing interests that may arise from the activities associated with the Kupe Phase 2 Development Drilling Programme. The ERA is a qualitative assessment which takes into account the potential consequences of an effect occurring as well as the likelihood of such an effect occurring.

Key considerations when assessing the actual and potential effects on the environment and existing interests from those planned activities and potential unplanned events from the Kupe Phase 2 Development Drilling Programme are as follows:

- The activities and their consequential impacts are spatially restricted, with the majority of the works being undertaken within the Kupe Safety Zone;
- The activities will be temporary in nature, with impacts ceasing once the operations have been completed, with colonisation of the seabed in and around the disturbed areas beginning quickly;
- The potential impacts from the discharge of harmful substances within the deck drainage will be intermittent, if they occur at all, and will stop once sufficient mixing has occurred which is expected to occur rapidly in the high-energy offshore environment; and
- Potential effects associated with the Kupe Phase 2 Development Drilling Programme will be monitored as per the EMP (set out in the conditions proffered in **Appendix A**) which will outline the pre- and post-drilling monitoring required.

Given the above points, in combination with the full suite of mitigation measures and operational procedures outlined in **Section 7.9**, and the proffered conditions contained in **Appendix A**, the overall environmental risk of adverse effects occurring from the Kupe Phase 2 Development Drilling Programme, excluding effects on cultural values and associations, is, at worst, ***moderate***, with the predicted magnitude of effects being ***minor***. The collaborative CIA prepared by Ngāti Ruanui and Ngāruahine has assessed the overall magnitude of impact of the proposed activities on cultural values and associations as 'significant'. The CIA prepared by Ngāti Manuhiakai has assessed there to be a 'high' residual impact on mauri from some of the proposed activities.

Based on the information present in this consent application, granting consents for the proposed Kupe Phase 2 Development Drilling Programme will promote the purpose of the EEZ Act. The proposed activities will provide for the economic well-being of Beach, its contractors, and the New Zealand Government whilst safeguarding the life-supporting capacity of the environment and mitigating adverse effects on the environment.

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APPENDIX A

Proffered Conditions

MARINE CONSENT CONDITIONS

DEFINITIONS:

Terms used in this Schedule of Conditions shall have the following meanings:

Consent holder has the meaning given in section 4 of the EEZ Act.

Cuttings means sediments, rock and other materials removed from the well during drilling.

EEZ Act means the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, as amended from time to time.

EMP means Environmental Monitoring Plan.

EPA means the Environmental Protection Authority or any equivalent Authority having an equivalent role under the EEZ Act.

Existing Interest has the same meaning given in section 4 of the EEZ Act.

IA means the document entitled "Kupe Phase 2 Development Drilling Programme – Marine Consent and Marine Discharge Consent Application" (dated April 2022) prepared by SLR Consulting NZ Limited provided by Beach Energy Resources NZ (Kupe) Limited.

IAA means Impact Assessment Area as seen within the IA.

MODU means a Mobile Offshore Drilling Unit.

Pre-drill works means the activities of seabed surveys and site clearance described under Section 2.2.1 of the IA.

Strata means the layers of sediments, rock and surface benthic material that are penetrated by the drill bit.

Suitably qualified and experienced person means a person who:

(a) holds a degree qualification in the relevant subject matter, or holds relevant professional certification from a relevant professional body; and

(b) has at least eight years' relevant experience.

Working day has the same meaning given in section 4 of the EEZ Act.

CONDITIONS:

Administrative –

1 Subject to compliance with these consent conditions, the activities authorised by this marine consent shall be undertaken in general accordance with the application document entitled "Kupe Phase 2 Development Drilling Programme – Marine Consent and Marine Discharge Consent Application" (dated April 2022) prepared by SLR Consulting NZ Limited. Where there is any conflict between this document and any of the conditions of this marine consent, the conditions of this marine consent shall prevail.

2 This marine consent shall expire on 31 December 2028.

3 All monitoring authorised by this marine consent shall be undertaken in accordance with the certified EMP required by Condition 9.

4 The consent holder shall ensure that a copy of this marine consent, and any variations of it, is available for inspection by the EPA at the consent holder's head office in New Zealand, and on any MODU undertaking activities authorised by this marine consent.

5 The consent holder shall ensure that all personnel, including any contractors, involved in undertaking any of the activities authorised by this marine consent are fully informed of their obligations and responsibilities in exercising this marine consent.

6 The consent holder shall keep a record to show that the personnel, including contractors, referred to in Condition 5, have been informed of their obligations under this marine consent. The consent holder shall provide a copy of this record to the EPA upon request.

7 The consent holder shall, prior to first commencing the activities authorised by this marine consent, provide to the EPA, in writing, the name and contact details of the person(s) who has responsibility for compliance management, collating information, and reporting in accordance with the requirements of this marine consent. In the event that the responsible person changes, the consent holder shall advise the EPA, in writing, of the name and contact details of the new person within 20 working days of the change.

Effects management –

8 No more than two (2) development wells shall be drilled under this marine consent and the two wells shall be drilled within existing conductor slots at the Kupe Wellhead Platform. For the purposes of this condition a 'well' means a single well drilled into the seabed except where that well is required to be re-spudded, in which case the initial well and the re-spudded well are together deemed to be a single well.

Environmental Monitoring Plan –

9 Prior to undertaking any activities authorised by this marine consent the consent holder must submit an EMP to the EPA for certification and provide a copy to Te Rūnanga o Ngāti Ruanui Trust, Te Korowai o Ngāruahine Trust, and Ngāti Manuhiakai hapū. The purpose of the EMP is to outline the details of monitoring that will be undertaken to assess the environmental effects of the activities authorised by this marine consent. Drilling the first development well can commence as soon as the EMP has been submitted to the EPA. The EMP must specify:

a) the frequency and duration of sampling;

b) the parameters to be monitored;

c) the sampling methodologies to be employed;

d) reporting requirements and reporting frequencies; and

e) the monitoring methodology to be employed that will ensure that any effects of monitoring on marine mammals, fish, and benthic communities are no more than has been described in the IA.

Advice Note 1:

For the avoidance of doubt, drilling the first development well (referred to as well KS-9) can commence as soon as the EMP has been submitted to the EPA for certification because the pre-drill monitoring (and some other pre-drill works) has already been completed (undertaken under the Exclusive Economic Zone and Continental Shelf (Environmental Effects—Permitted Activities) Regulations 2013); however, the post-drill monitoring for that well must be undertaken in accordance with the certified EMP as required by Condition 13.

10 The EMP shall be prepared by a suitably qualified and experienced person(s) in consultation with Te Rūnanga o Ngāti Ruanui Trust, Te Korowai o Ngāruahine Trust, and Ngāti Manuhiakai hapū. In the event that consent holder does not accept any recommendation(s) of Te Rūnanga o Ngāti Ruanui Trust, Te Korowai o Ngāruahine Trust, and/or Ngāti Manuhiakai hapū in respect of the contents of the EMP then the consent holder shall provide a copy of these recommendations (including any supporting comments from Te Rūnanga o Ngāti Ruanui Trust, Te Korowai o Ngāruahine Trust, and/or Ngāti Manuhiakai hapū regarding the basis of the recommendations) and an explanation why the recommendation(s) has not been accepted, to the EPA with the EMP. The EMP shall, except for the timeframes specified under Condition 13, be consistent with the report entitled "Recommendations for an Offshore Taranaki Environmental Monitoring Protocol: Drilling- and production-related discharges" (OTEMP) Cawthron Report No. 2124 dated 14 April 2014 unless otherwise agreed by the EPA.

11 Before certifying the EMP required by Condition 9, the EPA may:

a) engage a suitably qualified experienced person(s) to review the EMP, if it does not have the relevant expertise in-house; and

b) at any time request further information from the consent holder or advice from a suitably qualified and experienced person(s). If an extension of time for certification of the EMP is required, the EPA shall provide a revised certification timeframe and process to the consent holder.

12 Within 20 working days following receipt of an EMP, or receipt of information or advice under Condition 11b), the EPA shall either:

a) certify the EMP; or

b) advise the consent holder that it has not yet been certified, including the reasons for any extension of time for certification; or

c) refuse to certify the EMP providing its reasons in writing.

13 The consent holder shall undertake post-drill benthic monitoring following the drilling of each well authorised by this marine consent. The post-drill monitoring shall:

a) be in accordance with the EMP certified by the EPA;

b) be undertaken within 12 months of the drilling of the well(s);

c) be repeated approximately 12 months and 24 months after the completion of the monitoring required by Condition 13b); and

d) be undertaken at the same time of year as the pre-drill monitoring at that well location. For the purposes of this condition, the "same time of year" means within six (6) weeks (either before or after) of the end date of the pre-drill monitoring, unless otherwise agreed to in writing by the EPA.

Volume of cuttings –

14 The total in-situ volume of seabed material removed as a result of drilling any one well authorised by this marine consent shall not exceed 534 cubic metres, except in the event that the consent holder determines that a well is required to be side-tracked or re-spudded, in which case the total volume removed may be increased by an additional 534 cubic metres (a cumulative total of 1,068 cubic metres for any one well). All volumes in this condition shall be calculated during well design.

Marine mammal and seabird conditions –

15 The consent holder shall make available to offshore personnel a New Zealand marine mammal and seabird species identification guide(s) to assist in the accurate identification of species.

16 To minimise potential adverse effects on seabirds, the consent holder shall ensure that all nocturnal (night-time) lighting utilised on the MODU or any other support vessel associated with activities authorised by this marine consent is minimised to the greatest practicable extent while still meeting operational and safety requirements. Measures to minimise such effects shall include the following where operationally possible:

a) Deck light use shall be limited to the minimum time and illuminated areas required for safe operations;

b) Deck lights shall be directed downwards onto work areas and shielded to reduce peripheral light emissions;

c) Deck lighting shall be mounted as low as possible to minimise the illuminated area;

d) Where possible deck lights shall be directed away from reflective surfaces;

e) Search lights shall only be used in emergencies;

f) Blinds or curtains shall be kept drawn on all portholes and windows at night;

g) Decks shall be kept as free from clutter and/or non-essential items as possible to reduce the entanglement and entrapment potential for seabirds that do become involved in a bird strike incident; and

h) Periodic reviews of on-board lighting and behaviour shall be undertaken.

17 The consent holder shall maintain a log of any seabird collisions with any MODU or any support vessels associated with activities authorised by this marine consent, including the following information where available:

a) date and time of collision;

b) weather conditions;

c) species (where known);

d) condition of the bird (dead, released alive and unharmed or injured); and

e) photographs (where practicable).

18 Where a live injured seabird is found on any MODU or support vessel associated with activities authorised by this marine consent, the consent holder shall notify the Department of Conservation as soon as reasonably practicable by the fastest possible means in the circumstances.

19 All employees and contractors of the consent holder undertaking watch-keeping duties will be informed of their obligations under the Marine Mammals Protection Act 1978 and the Marine Mammals Protection Regulations 1992 or any subsequent regulations.

20 The consent holder shall maintain a log of all marine mammal sightings from any MODU and support vessels associated with activities authorised by this marine consent, including the following information where available:

a) the date and location of all marine mammal sightings;

b) the species of marine mammal(s) (where known) and the number of individuals (including the presence of juveniles) associated with each sighting;

c) the behaviour of marine mammal(s) sighted including their direction of travel;

d) any marine mammal injuries or mortalities observed;

e) the approximate size in metres of each marine mammal;

f) any physical interaction between any marine mammals and any equipment, vessels, or other inanimate objects (including but not limited to vessel strike or entanglement); and

g) be completed on the Department of Conservation's marine mammal sighting form.

21 The logs referred to under Conditions 17 and 20 shall be provided to the EPA and/or the Department of Conservation upon request.

Existing interest condition –

22 The consent holder shall periodically provide all persons with existing interests identified in the IA with up-to-date information on the activities authorised by this marine consent, including the scheduling and location of the MODU anticipated for the drilling, and environmental monitoring undertaken in accordance with the conditions of this marine consent. The consent holder shall make this information available through standard communications channel(s), namely email or post, and on the consent holder's website. Evidence of this communication shall be provided to the EPA upon request.

Reporting conditions –

23 The consent holder shall notify the EPA as soon as practicable and by the fastest possible means in the circumstances, of the occurrence of an environmental incident. For the purposes this condition, "environmental incident" means an incident arising out of, or in connection with, a well which would be declared to be a notifiable incident under regulation 70 of the Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016 and which the consent holder reasonably considers may result in an adverse environmental effect.

24 The consent holder shall provide to the EPA a detailed written report as described in regulation 71(5) of the Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016 in relation to any environmental incident notified to the EPA in accordance with Condition 23.

25 For the purposes of enabling the EPA to review this marine consent under section 76(1)(c) of the EEZ Act, the consent holder shall notify the EPA as soon as reasonably practicable upon becoming aware of any adverse effects on the environment or existing interests that arise that:

a) were not anticipated when this marine consent was granted; or

b) are of a scale or intensity that were not anticipated when this marine consent was granted.

26 For each well, the consent holder shall notify the EPA, in writing, of:

a) the date that any MODU is on site, including latitude and longitude of the location of the MODU, within five (5) working days after the MODU is on site; and

b) the date of the departure of any MODU from its location at the conclusion of each well, within five (5) working days of that date.

27 While undertaking the drilling activities authorised by this marine consent, the consent holder shall maintain a written log for each well, to be kept on the MODU and made available to the EPA on request, of the following:

a) the name and location of the well drilled;

b) the total volume of cement used in the well drilling (including any cement discharged overboard from the MODU), estimated by dry weight;

c) the total weight of milling swarf taken onshore for disposal;

d) the total volume of water-based muds used in the well; and

e) the in-situ volume of drill cuttings removed from the well.

28 Within three (3) months after the completion of each well, the consent holder shall provide a report to the EPA that includes a digital copy of the logs required by Conditions 17, 20, and 27.

29 The consent holder shall, within nine (9) months after each stage of post-drill monitoring required under Condition 13, provide the results of that stage of post-drill monitoring and any preceding pre-drill and post-drill monitoring to the EPA.

30 The consent holder shall provide to the EPA a Compliance Report for each well drilled, within nine (9) months of the completing all that well site’s post-drill monitoring requirements under Condition 13.

31 Each Compliance Report required under Condition 30 shall be prepared by a suitably qualified and experienced person(s).

32 Each Compliance Report required under Condition 30 shall include the following:

a) a description, analysis, evaluation and discussion of all that well site's environmental monitoring results, including that obtained in accordance with Condition 13;

b) a complete copy of all raw data obtained from the environmental monitoring at that well site, including all data obtained under Condition 13, in an electronic format agreed to be the EPA;

c) an assessment of how each drilling campaign has complied with the conditions of this marine consent; and

d) the information recorded under Condition 17 and 20.

Advice Note 2: Review of conditions

The EPA may serve notice on the consent holder, in accordance with sections 76 and 77 of the EEZ Act, of its intention to review the duration or conditions of this marine consent for any of the reasons set out in section 76(1).

General advice notes –

The consent holder is reminded that it has obligations under other marine management regimes, including, but not necessarily limited to, the following:

a) Regulation 24 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects—Discharge and Dumping) Regulations 2015 requires that the consent holder may not operate an offshore installation without an Emergency Spill Response Plan approved by the EPA.

b) The Biosecurity Act 1993 requires that the consent holder complies with the Import Health Standard – Ballast Water from All Countries and the Craft Risk Management Standard – Biofouling on Vessels Arriving to New Zealand prepared under that Act.

c) The Marine Mammals Protection Act 1978 requires that the consent holder complies with sections 16(2) to (5), which require:

(2) Any person (not being a person to whom subsection (1) applies) who, by any means whatsoever, accidentally or incidentally kills or injures any marine mammal shall report the event to an officer or a fishery officer (as defined in section 2(1) of the Fisheries Act 1996) as soon as practicable.

(3) Every report under subsection (1) or subsection (2) shall include—

(a) the location of the area where the event took place; and

(b) the species (if known) of the marine mammal killed or injured, or a general description of the mammal; and

(c) a description of conditions and the circumstances of the event.

(3A) In addition to providing the particulars required by subsection (1) or subsection (2), a person required to report an event to which that subsection applies shall provide to the Director-General such other particulars relating to the event as the Director-General may require for the purposes of this Act.

(4) Every person commits an offence against this Act who contravenes subsection (1) or subsection (2).

(5) Every person commits an offence against this Act who refuses or fails to furnish any information or particulars required by the Director-General under subsection (3A).

d) The Wildlife Act 1953, which applies to seabirds and marine mammals, requires the consent holder to comply with sections 63B(2) to (4), which require:

(2) Any person (other than a person to whom subsection (1) applies) who, by any means whatever, accidentally or incidentally kills or injures any marine wildlife, shall, as soon as practicable, report the event to a ranger or a fishery officer (as defined in section 2(1) of the Fisheries Act 1996).

(3) Every report under subsection (1) or subsection (2) shall include—

(a) the location of the area where the event took place; and

(b) the species (if known) of the marine wildlife killed or injured, or a general description of the wildlife; and

(c) a description of the conditions and the circumstances of the event.

(4) In addition to providing the particulars required by subsection (1) or subsection (2), a person required to report an event to which that subsection applies shall provide to the Director-General such other particulars relating to the event as the Director-General may require for the purposes of this Act.

MARINE DISCHARGE CONSENT CONDITIONS

DEFINITIONS:

Terms used in this Schedule of Conditions shall have the following meanings:

Consent holder:	has the meaning given in section 4 of the EEZ Act.
EEZ Act:	means the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, as amended from time to time.
EPA:	means the Environmental Protection Authority or any equivalent Authority having an equivalent role under the EEZ Act. Where any condition requires notification, reports, or any other material to be provided to the EPA or where a plan is required to be submitted to the EPA 'for certification' this shall be addressed to the EPA's "General Manager – Climate, Land & Oceans" in the first instance.
ESRP:	means the approved Emergency Spill Response Plan required by regulation 24 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015.
Hazard area:	means any MODU deck drainage area whose drains are routed to a closed drainage water treatment system.
IA:	means the Impact Assessment (Kupe Phase 2 Development Drilling Programme – Marine Consent and Marine Discharge Consent Application) prepared by SLR Consulting NZ Limited dated December 2021 prepared by SLR Consulting NZ Limited for Beach Energy Resources NZ (Kupe) Limited as part of its marine consent application.
MODU:	Mobile Offshore Drilling Unit.
Non-Hazard area:	means a MODU deck drainage area whose drainage feeds directly into the sea.

CONDITIONS:

1. Subject to compliance with these consent conditions, the activities authorised by this marine discharge consent shall be undertaken in general accordance with the application document entitled "Kupe Phase 2 Development Drilling Programme – Marine Consent and Marine Discharge Consent Application" (dated April 2022) prepared by SLR Consulting NZ Limited. Where there is any conflict between this document and any of the conditions of this marine consent, the conditions of this marine consent shall prevail.

2. The consent holder shall ensure that a copy of this marine discharge consent, and any variations of it, are available for inspection by the EPA at the consent holder's head office in New Zealand, and on any MODU undertaking activities authorised by this marine discharge consent.

3. The consent holder shall ensure that all personnel, including contractors, involved in undertaking any of the activities authorised by this marine discharge consent are fully informed of their obligations and responsibilities in exercising this marine discharge consent.

4. The consent holder shall keep a record to show that the personnel, including contractors, referred to in Condition 3 have been informed of their obligations under this marine discharge consent. The consent holder shall provide a copy of this record to the EPA upon request.

5. The consent holder shall, prior to first commencing the activities authorised by this marine discharge consent, provide to the EPA, in writing, the name and contact details of the person(s) who has responsibility for compliance management, collating information, and reporting in accordance with the requirements of this marine discharge consent. In the event that the responsible person changes, the consent holder shall advise the EPA, in writing, of the name and contact details of the new person within 20 working days of the change.

6. The consent holder shall, for any MODU undertaking activities authorised by this marine discharge consent, hold deck plans that show the extent of the non-hazard areas and hazard areas on board. The consent holder shall provide a copy of these deck plans to the EPA upon request.

7. The consent holder shall ensure that no harmful substances are stored or handled in non-hazard areas which drain directly to the sea.

8. The consent holder shall ensure that any harmful substances that have a reasonable potential for discharge from hazard and/or non-hazard area deck drains on-board any MODU are stored within a secondary containment system. For the purposes of this condition a 'secondary containment system' means a system or systems:

    a) In which pooling substances held in the workplace will be contained if they escape from the container or containers in which they are being held; and

    b) From which they can, subject to unavoidable wastage, be recovered.

9. All deck drains from hazard areas shall, as a minimum, include the following design requirements:

    a) Full containment of deck drainage runoff directed to a settlement tank(s);

    b) Settlement tanks shall have a minimum combined capacity of at least five (5) cubic metres; and

    c) All deck drainage runoff from hazard areas shall pass through an oil-in-water separator system prior to discharge to the sea.

10. The consent holder shall notify the EPA, as soon as reasonably practicable but within 24 hours, after a spill into the sea of any harmful substances, described in regulation 4(a) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015, first becomes known, or should have become known, to the consent holder.

11. In the event of a spill of any harmful substances, described in regulation 4(a) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015, into the sea the consent holder:

    a) Shall seek advice from the EPA as to whether monitoring is necessary and is likely to detect any environmental effects, applicable timeframes of any monitoring necessary, and whether any other relevant authorities should be notified. Other relevant authorities may include Maritime New Zealand, regional councils, iwi entities, the Ministry for Primary Industries, and/or the Department of Conservation;

    b) Provide the results of the monitoring to the EPA on request; and

    c) Provide a written summary report to the EPA within 24 hours of the consent holder receiving the results of testing from the laboratory.

12. The consent holder shall respond to any harmful substances spilled onto hazard and non-hazard area decks in accordance with the emergency spill response procedures contained in the MODU's approved ESRP (required under regulation 24 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015).

13. This marine discharge consent shall expire on 31 December 2026.

    Advice Note: Review of conditions

    The EPA may serve notice on the consent holder, in accordance with sections 76 and 77 of the EEZ Act, of its intention to review the duration or conditions of this marine discharge consent for any of the reasons set out in section 76(1).

APPENDIX B

Drill Cuttings Deposition and Dispersion Modelling

DRILL CUTTINGS DISPERSAL MODELLING FOR THE KS-9 DEVELOPMENT WELL

Report prepared for Beach Energy Resources NZ (Holdings) Ltd

Version	Date	Status	Approved by
RevA	30/10/2021	Draft for internal review	Zyngfogel
RevB	01/11/2021	Draft for client review	McComb
RevC	05/11/2021	Updated draft for client review	Zyngfogel
RevD	11/11/2021	Updated draft for client review	Zyngfogel
Rev0	16/11/2021	Approved for release	Zyngfogel
Rev1	03/12/2021	Updated and approved for release	Zyngfogel
Rev2	08/03/2022	Updated	Zyngfogel

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Beach Energy Resources NZ (Holdings) has commissioned an assessment of the effects of drill cuttings discharged into the sea during the drilling activities for the KS-9 development well in the Kupe Field. The well site is in the South Taranaki Bight, New Zealand (39° 51' 03.241" S, 174° 07' 11.977" E) in approximately 34 m water depth (Fig. 1.1).

Drill cuttings are particles of the native bedrock. The grinding action of the drill bit crushes the bedrock into fragments, which are flushed from the hole by the flow of drilling mud. During drilling operations, mud is pumped down the core of the drill pipe, exits from the drill bit and returns to the surface via the annulus, along with the cuttings. On the rig floor, the cuttings are separated from the mud (which is reused), then cuttings are discharged to the ocean.

In this study, a stochastic approach has been adopted to define the statistical probabilities related to settlement and dispersal of drill cuttings. To achieve that, we have simulated the discharge from 100 synthetic drilling events, randomly distributed over the previous decade. The results from these events are collated and used to generate statistics and probabilities for impact assessment. In these simulations, we have considered the deposition of cuttings to the seabed and the concentrations of suspended sediments within the water column.

This report is structured as follows. A description of the deposition modelling methodology is provided in Section 2. In Section 3 we present the results of the modelling and provide an interpretation of the results. The findings are summarised in Section 4, and the references cited are listed in the final Section 5.

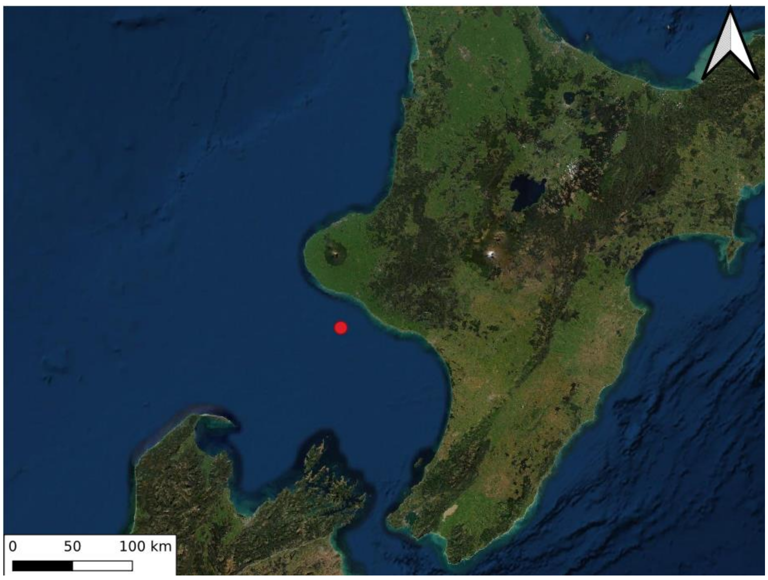

Figure 1.1 Location of the KS-9 development well in the South Taranaki Bight.

2. METHODOLOGY

2.1. Discharge scenario

The total estimated volume of the KS-9 development well is 534 m^3, to which a bulking factor of 2.0 is applied to derive an estimate of the total volume of cuttings discharged (i.e., 1,068 m^3). Over the 33-day drilling program, a constant discharge rate is simulated, with the cuttings being introduced to the sea surface over a 10 m diameter below the rig floor. A total of 100 drilling events have been simulated for random times selected over a contemporary decade (2008-2017), with stratification by season (i.e., 25 per season). The profile of the cuttings has been provided by Beach Energy; reproduced here in Table 2.1.

Table 2.1 Grain size distribution, settling velocities and percentage composition.

Class	Grain size (mm)	Settling velocity (cm/s)	Composition (%)
Large cuttings	6.0	53.62	8.6
	5.0	49.46	8.6
	2.0	28.55	8.6
	1.0	12.73	5.8
	0.5	7.50	5.8
	0.45	6.60	2.9
Medium cuttings	0.40	6.00	2.9
	0.35	5.00	2.9
	0.30	4.00	2.9
	0.25	3.10	2.9
	0.20	2.30	2.9
	0.15	1.60	2.9
Light cuttings	0.10	0.80	2.9
	0.05	0.22	2.9
	0.04	0.15	2.9
	0.03	0.08	2.9
	0.02	0.04	2.9
Drilling mud solids	0.063	0.34	0.3
	0.050	0.22	1.5
	0.035	0.11	3.6
	0.026	0.06	6.0
	0.020	0.038	7.3
	0.016	0.026	9.1

2.2. Oceanographic conditions

A 10-year hindcast of the oceanic flows was prepared for the study, using the Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) to replicate the hour-by-hour three-dimensional flows.

SCHISM is a hydrodynamic model (Zhang et al., 2016) based on an unstructured grid suitable for 2D or 3D baroclinic/barotropic circulation from ocean to coastal regions. The model grid (Fig. 2.1) has resolution ranging from 2 km near the open ocean boundaries to 300 m near the coast. Near the well the resolution is also 300 m.

SCHISM was run in 3D baroclinic mode, with vertical sigma layers varying from 26 layers in the deeper ocean (>1000 m) and 10 layers in the coastal areas. Elevation and current amplitudes and phases of the dominant tidal constituents (M2, S2, N2, K2, K1, O1, P1, Q1) were sourced from the OTIS (Oregon State University Tidal Inversion Software) assimilated barotropic model. Residual velocities and water column properties were defined from the global 1/12-degree reanalysis products released by the EU-funded Copernicus Project. Atmospheric forcing (10 m wind speed, temperature, humidity, mean sea-level pressure, precipitation, and solar radiation) were sourced from ERA5 (ECMWF, 2019).

Measured currents from 2004 were used to validate the hydrodynamical model. Results from two locations are presented in Figure 2.2; KUP is within a few hundred m of the well site, and KU2 is to the northeast and approximately mid-way to the coast. The validation plots show that the model provides a reliable characterisation of the tidal flows as well as the non-tidal residual flows that occur in response to the regional wind stresses. An annual depth averaged current rose for the Kupe Platform is presented in Figure 2.3.

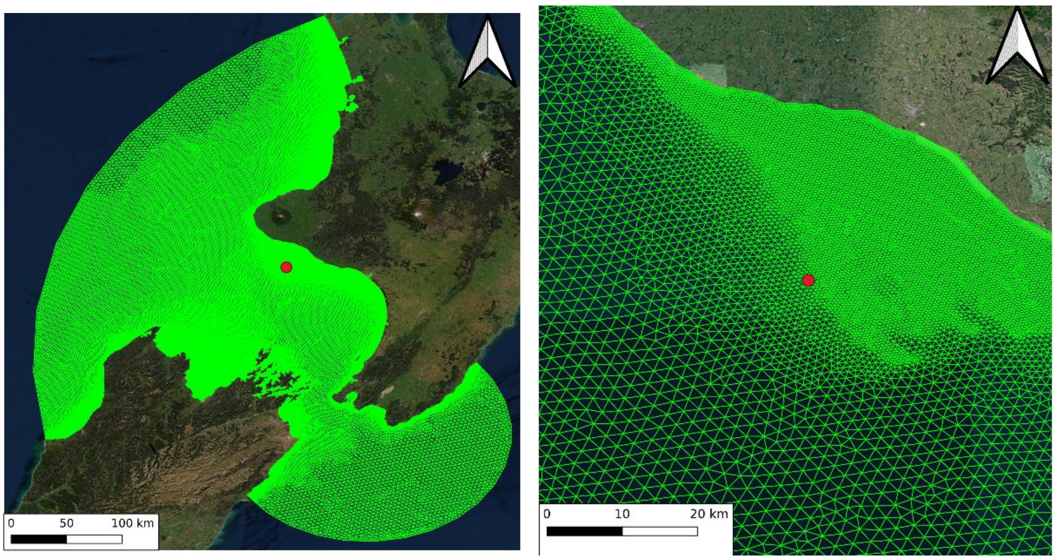

Figure 2.1 Numerical domain for the hydrodynamical modelling, with the KS-9 location shown by the red dot.

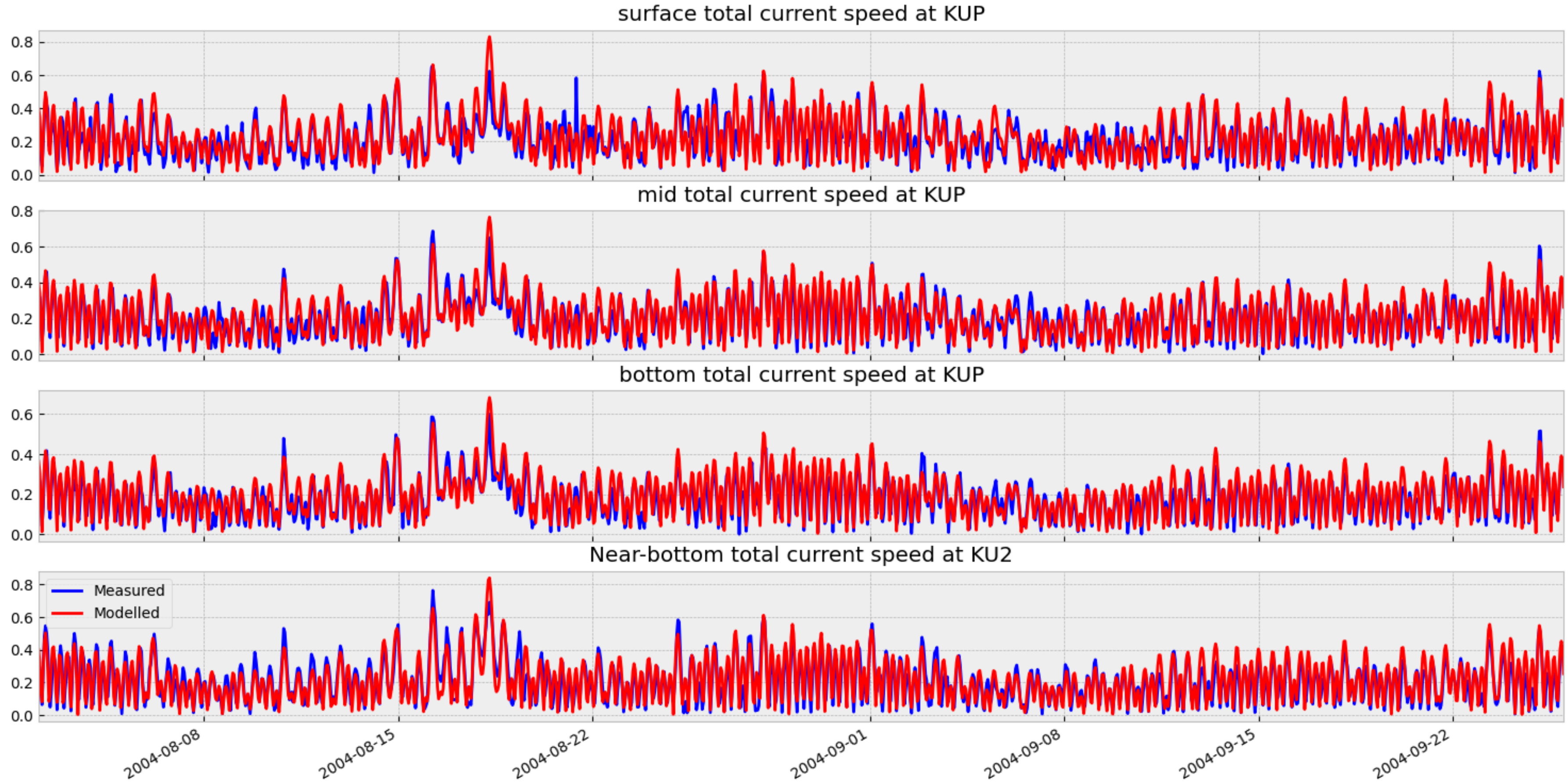

Figure 2.2 Time series plot showing the measured and modelled current speeds from two locations in the Kupe Field. Total currents include the tidal and the non-tidal flows, and validation at three levels in the water column are shown. Normally, the water column is well mixed in this region and highly stratified flows are uncommon.

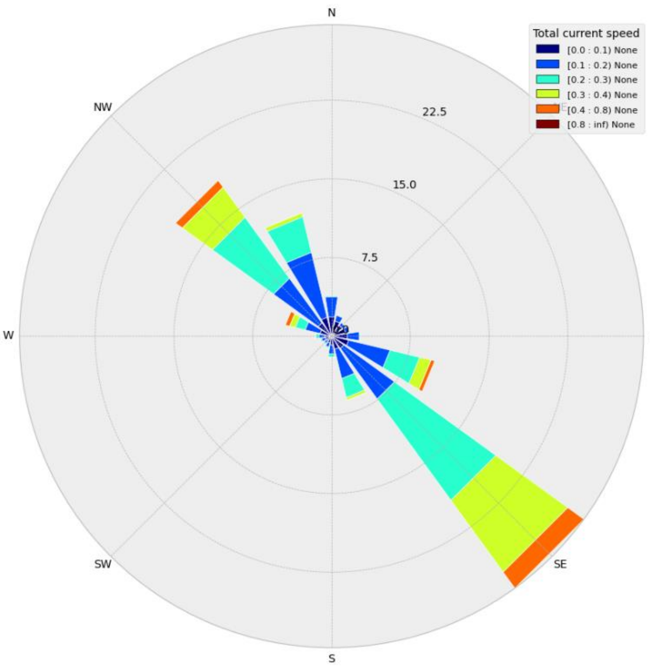

Figure 2.3 Annual current rose showing the depth-averaged flows (tidal and non-tidal) at the Kupe Platform.

2.3. Modelling framework

The SedimentDrift simulation framework was used to model the dispersion, and trajectory of the plume. This module is part of the OpenDrift project[1] which is an open-source code base with considerable community input and ongoing peer review. Full technical details of the model are reported by Dagestad *et al*. (2018), and the key model settings used in the present study are provided in Table 2.1.

Note, the model does not account for flocculation, and therefore the initial grain size distributions are conserved throughout the simulation process. Also, a sticky seabed is modelled so that resuspension or entrainment by waves and currents is not considered. In this way the simulations provide conservative outcomes regarding the potential depositional footprint.

[1] https://github.com/OpenDrift/opendrift

Table 2.2 OpenDrift model settings.

Parameter	**Value applied**
Windage	3%
Horizontal diffusion	1.0 $m^2.s^{-1}$
Stokes drift	from SedimentDrift model
Vertical diffusion coefficient	constant at 0.0001 $m^2 \cdot s^{-1}$
Model time step	300 s
Particles per release	23000
Duration of each simulation	40 days
Seabed	Sticky, no resuspension
Shoreline	Sticky, no re-float

2.4. Processing of results

For deposition, at each model timestep a kernel density estimate (KDE) was calculated at 20 m resolution over a grid of 2500 x 2500 m. Then, each simulation was summed to obtain the deposited volume in m^3. This was divided by the cell size to define the depositional thickness, which is plotted to a minimum increment of 0.1 mm.

For Total Suspended Solids (TSS), at each model timestep a KDE was calculated at 60 m resolution over a grid of 6000 x 6000 m. Then, a depth-averaged concentration was calculated (in mg/L) for each timestep, applying 2710 kg/m^3 for mud density and 2400 kg/m^3 for cuttings density. To create coherent times series data, a 6-h rolling maxima was extracted, and the minimum plotted concentration was set to 1 mg/L.

2.5. Revisiting KS-9

Beach may drill a second development well after the first is drilled and if this is to occur it would be drilled not less than 6 months after the initial well. The option to drill another well 6 months or more after the first requires the consideration of cumulative impacts. A conservative approach might be to simply double the depositional footprint. However, this will not account for material that has been eroded from the previously deposited mound over that period and subsequently dispersed by waves and currents. Indeed, the Kupe Field and adjacent regions are well-known for having a highly active sediment transport regime (see Hadfield and MacDonald, 2015), which necessitates routine monitoring of scour around the platform and along the pipeline route to shore.

Since 2008, there have been 3 wells drilled (KS-6, KS-7 and KS-8) with approximately 1326 m^3 of material (without bulking) discharged to the seabed in the immediate vicinity of the Well Head Platform (WHP). There have also been two MBES (multibeam echo sounding survey) undertaken to monitor seabed scour near the platform (2011 and 2021), and regular ROV inspections for the same purpose. The most recent ROV inspection was in 2016.

We can make further estimates of the sediment transport potential by calculating the percentage of time that the individual grain size fractions will be mobilised and entrained by the combined action of nearbed wave orbital motions and ocean currents. For this, the Soulsby (1997) equations are applied to define the critical shear stress for entrainment, with wave orbital velocities derived from the parametric estimates of significant height and peak period, extended to the seabed with linear wave theory. The results reveal that medium (0.3 mm) and light (0.05 mm) cuttings are mobilised for 34% and 63% of the time, respectively. The particle size threshold for 1% mobilisation time per annum is 1.2 mm, while cuttings larger than 2.5 mm are not expected to be regularly mobilised by waves and currents. Thus, at least 83% of the discharged volume (see Table 2.1) can be expected to have some degree of mobility on the seabed in the Kupe Field.

Finally, the pre-drill baseline surveys of the sediment chemistry (sampled during 2021) show low levels of barium that are consistent with the natural environment, with no evidence of significant spatial gradients consistent with cuttings. Barium can be a trace element that is a signature for water-based muds that have adhered to discharged cuttings.

In conclusion, the receiving environment for the development well has high sediment transport potential. Based on the observational data, is clear that most of the historically deposited cuttings (1,326 m^3 plus bulking) have not persisted on location over multiyear time scales. Over a 6-month (or more) period there is an expectation that a significant proportion of the cuttings will further disperse, with only the coarser fractions (i.e., >1 mm) remaining near the initial deposition position. This has been simulated by modelling the release of cuttings of >1 mm in size only (Fig. 2.4 and 2.5). Accordingly, if a second well is contemplated 6 months or more after the first, consideration of the cumulative effects of discharge should recognise the gradual winnowing of cuttings over the intervening period.

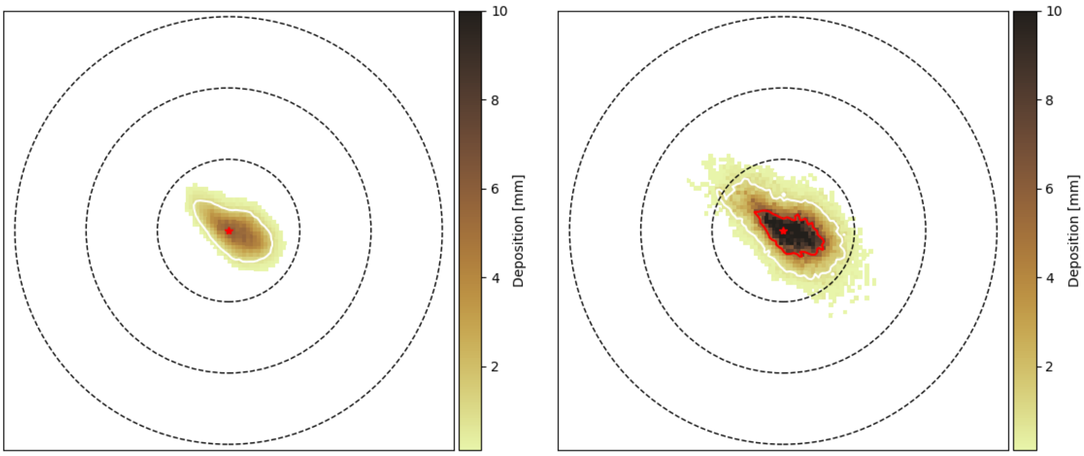

Figure 2.4 Median (left) and maximum (right) deposition thickness of cuttings greater than 1 mm in size (annual). The white and red lines represent thresholds at 1.0 and 6.3 mm thickness respectively, while the dashed circles are centred over the release location and are plotted every 400 m

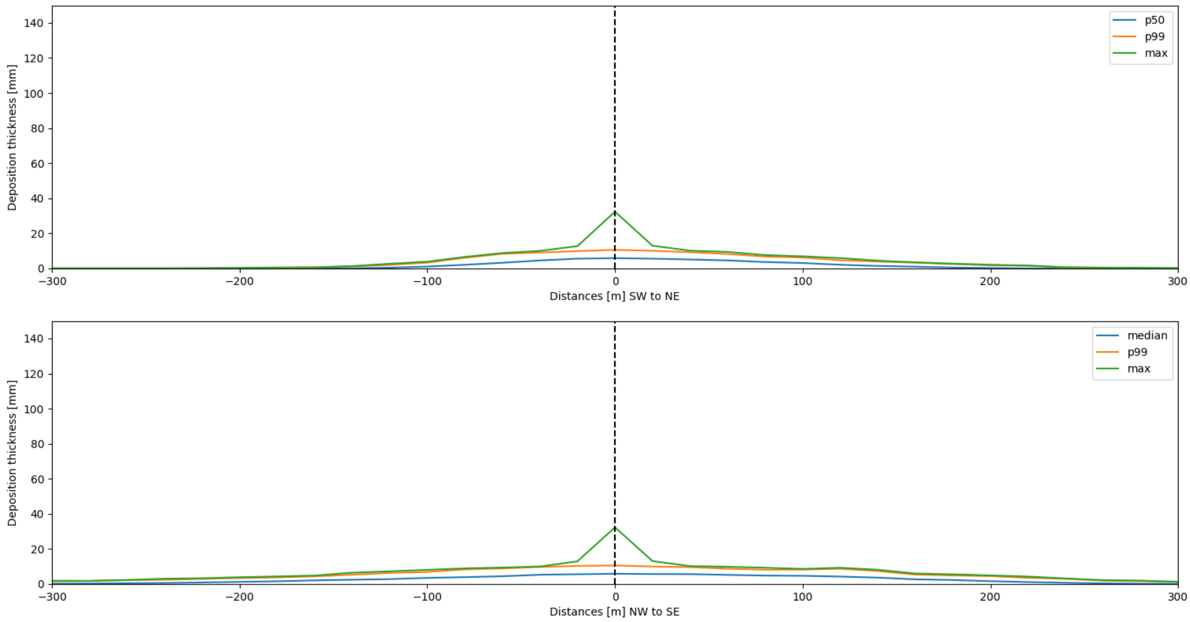

Figure 2.5 Cross sections of the statistics of depositional thickness (annual) for cutting sizes greater than 1 mm. The worst-case deposition has around 32 mm over a 20 m grid containing the well, while the 99th percentile (P99) shows up to 11 mm deposited within 100 m of the well

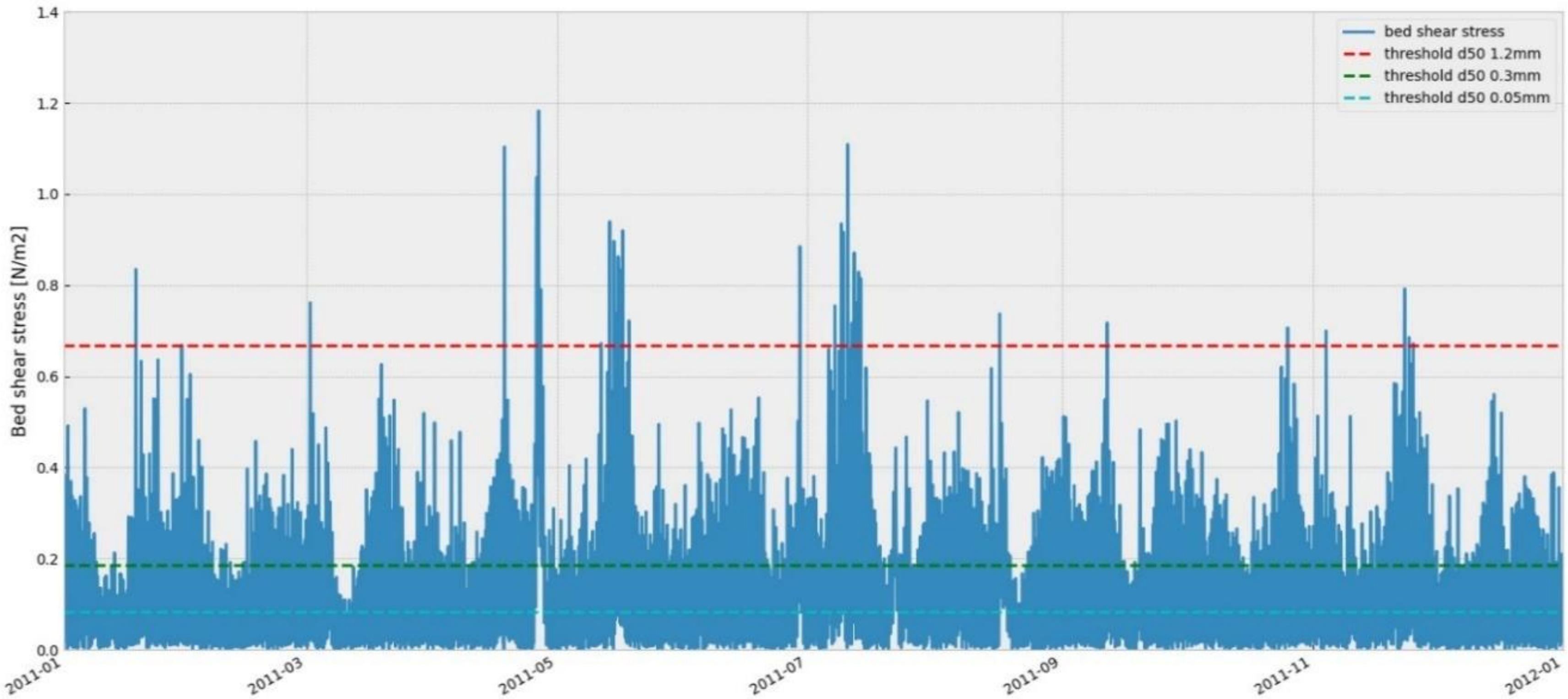

Figure 2.6 Example time series of bed shear stress at the KS-9 well site. The three lines represents the threshold for entrainment for individual grain sizes.

3. RESULTS

Results from all 100 simulations are provided here, while the following subsections detail the individual seasonal results. TSS results are provided in Table 3.1 and in Figures 3.1 and 3.2, while the depositional results are presented in Table 3.2 and Figure 3.3. Cross sections of depositional thickness are provided in Figure 3.4.

Note the statistics for TSS are defined from 60 m gridded data, while deposition is from 20 m grids. Thus, the reported distances and areas are derivatives of that minimum resolution.

Table 3.1 Distance and area where the depth-averaged TSS exceeds the 2, 5 and 25 mg/L thresholds (annual).

Mg/L	days	stat	Distance from the discharge [m]	Area [m^2]
2	7	P50	96	7343
		P99	96	14687
		Max	96	14687
5	1	P50	43	3672
		P99	43	3672
		Max	43	3672
	7	P50	43	3672
		P99	43	3672
		Max	43	3672
25	1	P50	43	3672
		P99	43	3672
		Max	43	3672

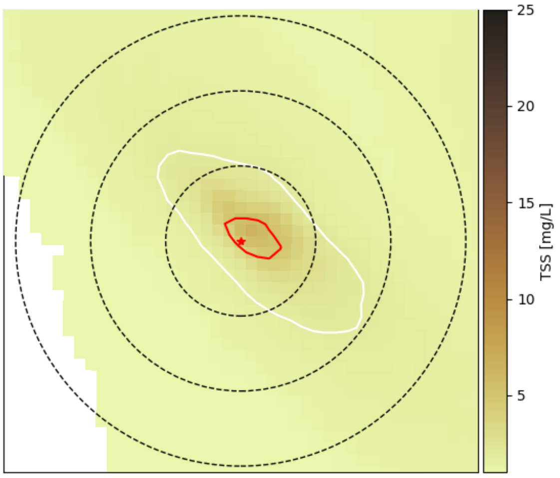

Figure 3.1 Median (left) and maximum (right) depth-averaged TSS from the 100 simulations. The red line represents the 5 mg/L threshold, and the white line is 2 mg/L. Dashed circles are centred over the release location and plotted every 400 m.

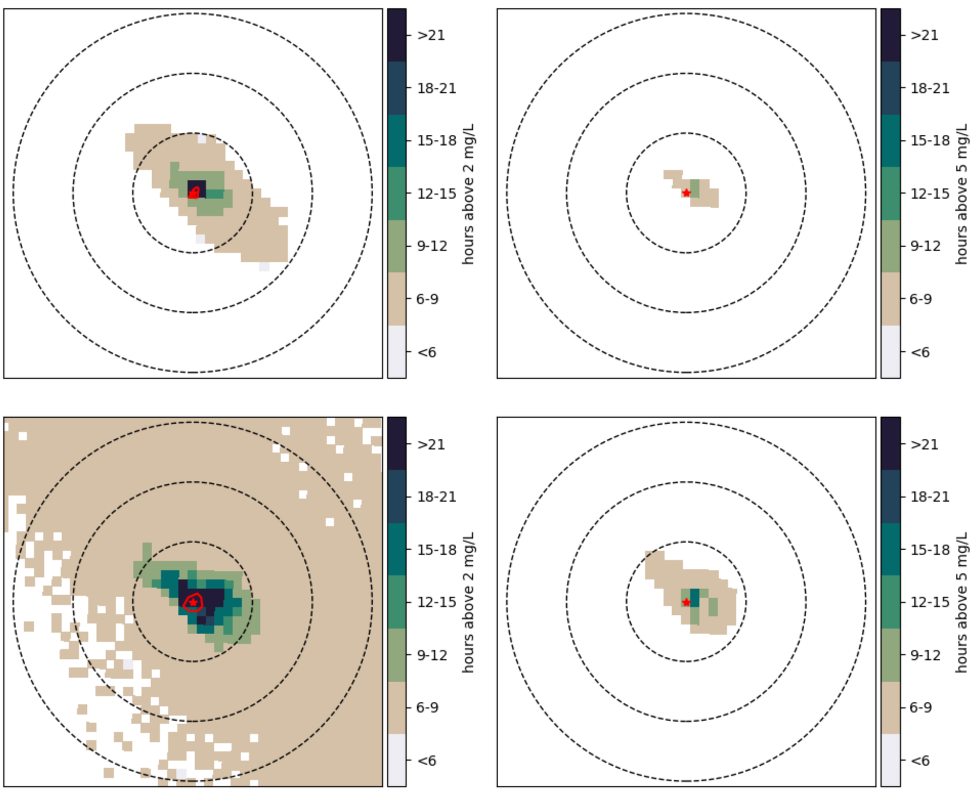

Figure 3.2 The median (top) and P99 (bottom) time that depth-averaged TSS exceeds 2 mg/ L (left) and 5 mg/L (right) on an annual basis. The red polygon denotes persistence for more than 7 days. Note that data are averaged over 60 m spatial grids.

Table 3.2 Maximum distance and area for each deposition threshold (annual).

		Distance from the discharge [m]	**Area [m²]**
1.0 mm	P50	353	147108
	P99	457	268207
	Max	509	298279
6.3 mm	P50	154	19100
	P99	255	71522
	Max	270	81275

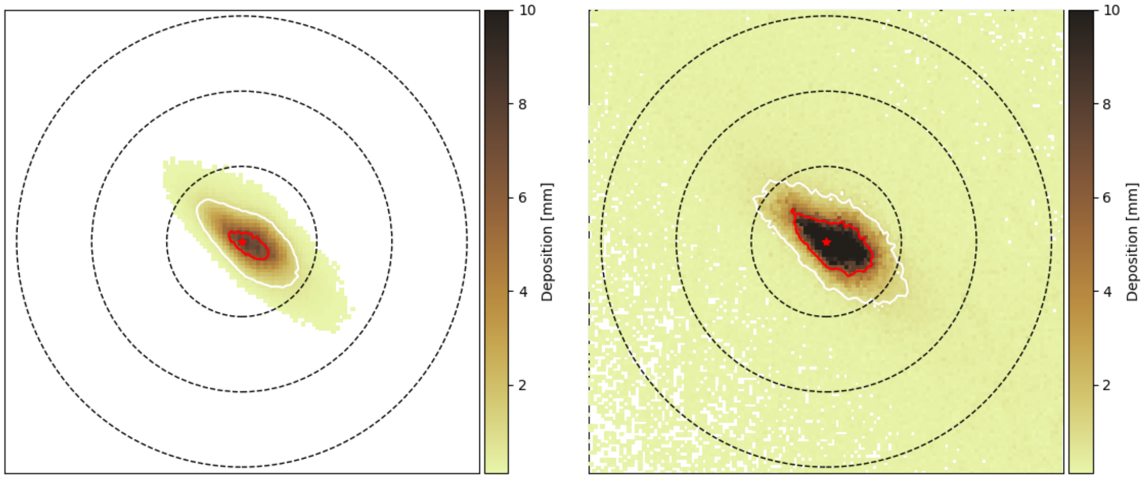

Figure 3.3 Median (left) and maximum (right) deposition thickness in mm during the 100 simulations. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

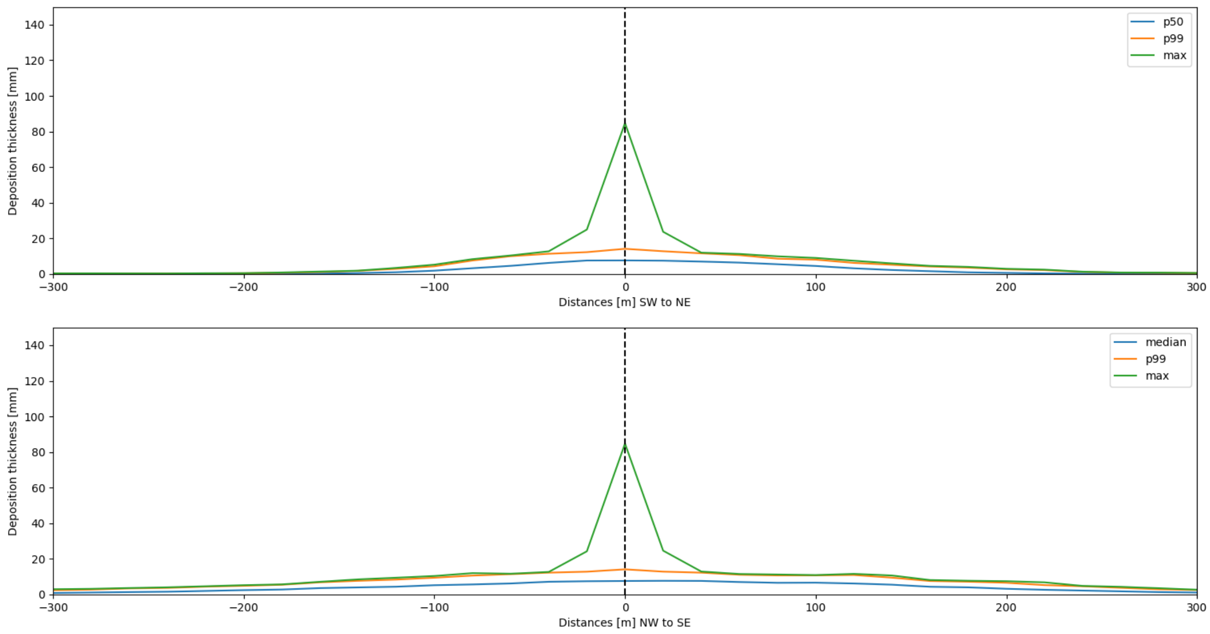

Figure 3.4 Cross sections of the statistics of depositional thickness (annual). The worst-case deposition has around 80 mm in 20 m grid containing the well, while the 99th percentile (P99) shows up to 14 mm deposited within 100 m of the well.

3.1. Summer simulations

Results from simulations starting in Summer (December, January, February) are provided below. TSS results are provided Table 3.3 and in Figures 3.5 and 3.6, while the depositional results are presented in Table 3.3 and Figure 3.7.

Table 3.3 Distance and area where the depth-averaged TSS exceeds the 2, 5 and 25 mg/L thresholds during Summer.

Mg/L	days	stat	Distance from the discharge [m]	Area [m^2]
2	7	P50	96	7343
		P99	96	14687
		Max	96	14687
5	1	P50	43	3672
		P99	43	3672
		Max	43	3672
	7	P50	43	3672
		P99	43	3672
		Max	43	3672
25	1	P50	43	3672
		P99	43	3672
		Max	43	3672

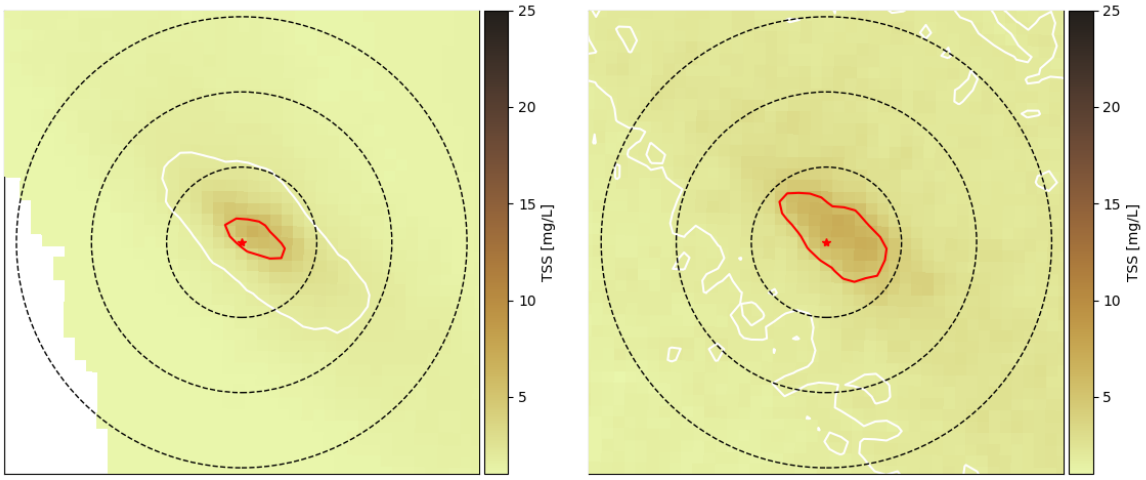

Figure 3.5 Median (left) and maximum (right) depth-averaged TSS during Summer. The red line represents the 5 mg/L threshold, and the white line is 2 mg/L. Dashed circles are centred over the release location and plotted every 400 m.

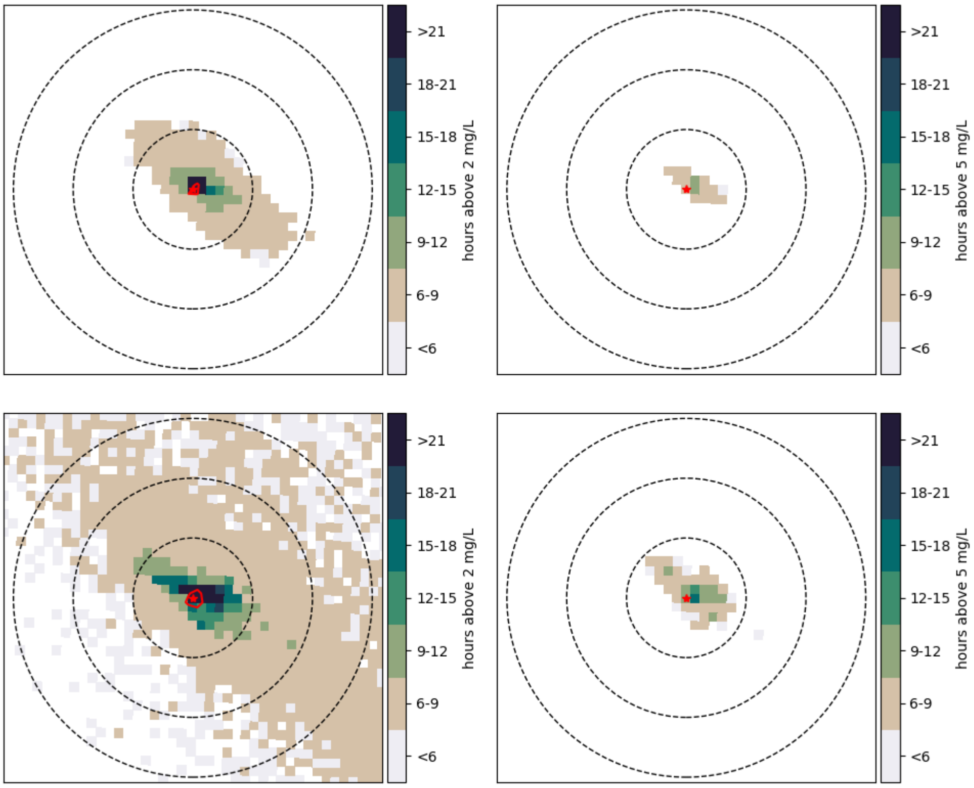

Figure 3.6 The median (top) and P99 (bottom) time that depth-averaged TSS exceeds 2 mg/ L (left) and 5 mg/L (right) during Summer. The red polygon denotes persistence for more than 7 days. Note that data are averaged over 60 m spatial grids.

Table 3.4 Maximum distance and area for each deposition threshold during Summer.

		Distance from the discharge [m]	**Area [m²]**
1.0 mm	P50	370	138980
	P99	498	230414
	Max	509	234072
6.3 mm	P50	199	23976
	P99	253	56486
	Max	255	59737

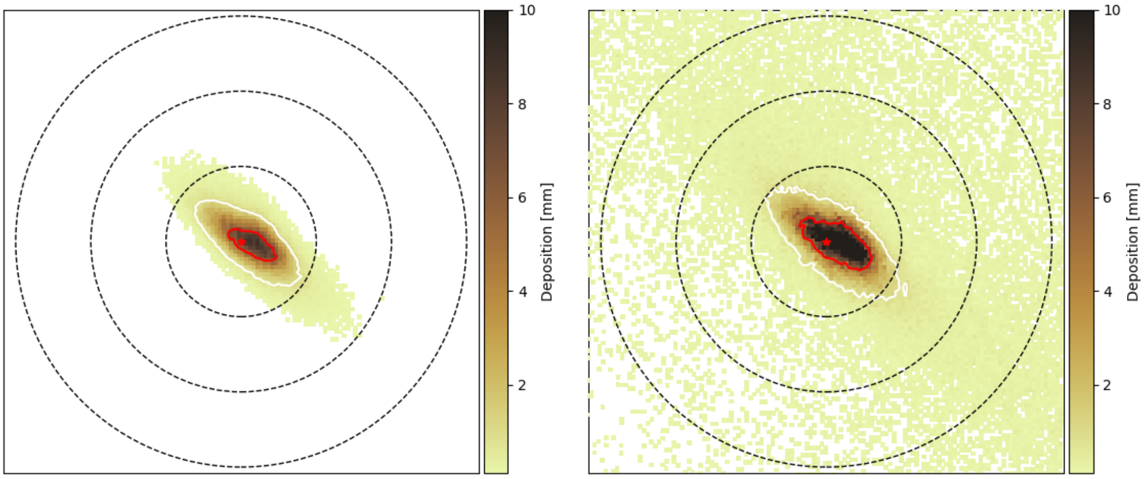

Figure 3.7 Median (left) and maximum (right) deposition thickness in mm during Summer. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

3.2. Autumn simulations

Results from all 25 simulations starting in Autumn (March, April, May) are provided below. TSS results are provided in Table 3.5 and in Figures 3.8 and 3.9, while the depositional results are presented in Table 3.6 and Figure 3.10.

Table 3.5 Distance and area where the depth-averaged TSS exceeds the 2, 5 and 25 mg/L thresholds during Autumn.

Mg/L	days	stat	Distance from the discharge [m]	Area [m^2]
2	7	P50	96	11015
		P99	96	14687
		Max	96	14687
5	1	P50	43	3672
		P99	43	3672
		Max	43	3672
	7	P50	43	3672
		P99	43	3672
		Max	43	3672
25	1	P50	43	3672
		P99	43	3672
		Max	43	3672

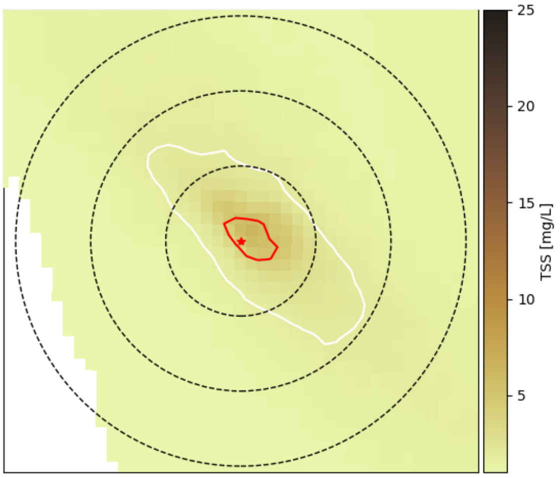

Figure 3.8 Median (left) and maximum (right) depth-averaged TSS during Autumn. The red line represents the 5 mg/L threshold, and the white line is 2 mg/L. Dashed circles are centred over the release location and plotted every 400 m.

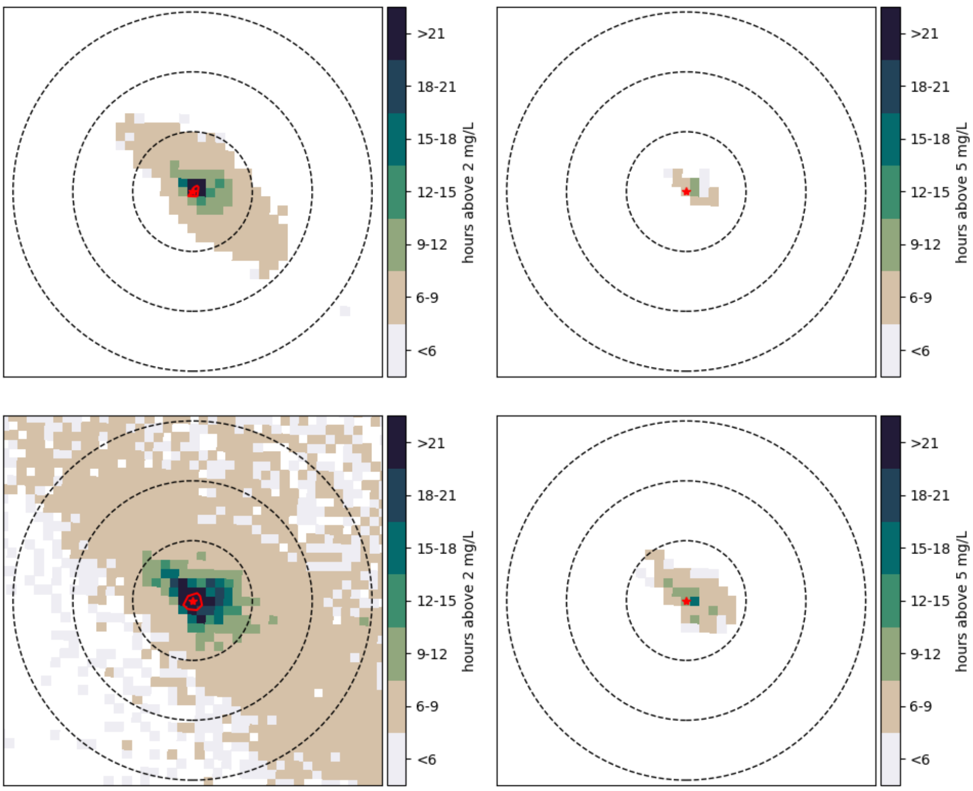

Figure 3.9 The median (top) and P99 (bottom) time that depth-averaged TSS exceeds 2 mg/ L (left) and 5 mg/L (right) during Autumn The red polygon denotes persistence for more than 7 days. Note that data are averaged over 60 m spatial grids.

Table 3.6 Maximum distance and area for each deposition threshold during Autumn.

		Distance from the discharge [m]	Area [m^2]
1.0 mm	P50	328	142231
	P99	444	249108
	Max	492	262518
6.3 mm	P50	157	19912
	P99	225	59331
	Max	225	62175

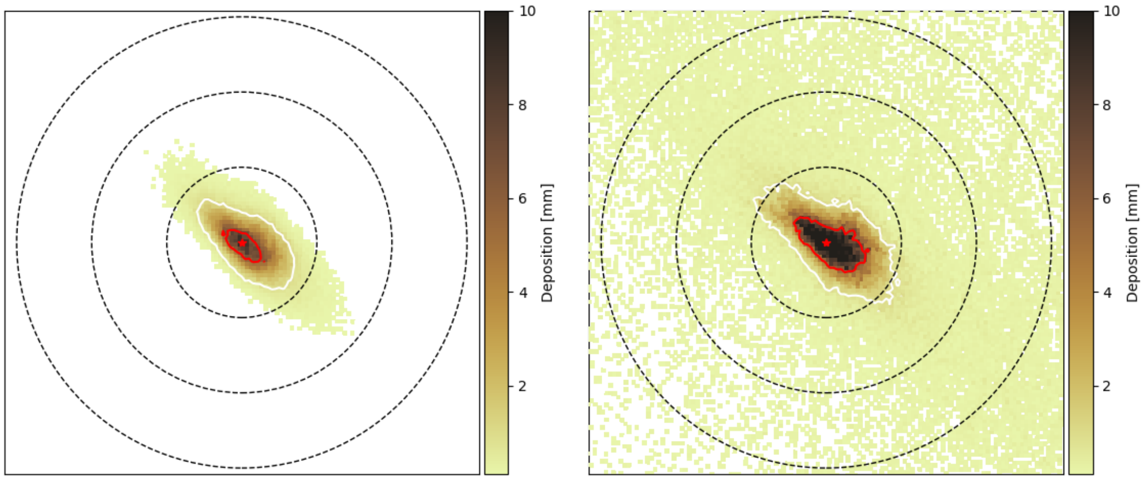

Figure 3.10 Median (left) and maximum (right) deposition thickness in mm during Autumn. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

3.3. Winter simulations

Results from all 25 simulations starting in Winter (June, July, August) are provided below. TSS results are provided in Table 3.7 and in Figures 3.11 and 3.12, while the depositional results are presented in Table 3.8 and Figure 3.13.

Table 3.7 Distance and area where the depth-averaged TSS exceeds the 2, 5 and 25 mg/L thresholds during Winter.

Mg/L	days	stat	Distance from the discharge [m]	Area [m^2]
2	7	P50	96	11015
		P99	96	14687
		Max	96	14687
5	1	P50	43	3672
		P99	43	3672
		Max	43	3672
	7	P50	43	3672
		P99	43	3672
		Max	43	3672
25	1	P50	43	3672
		P99	43	3672
		Max	43	3672

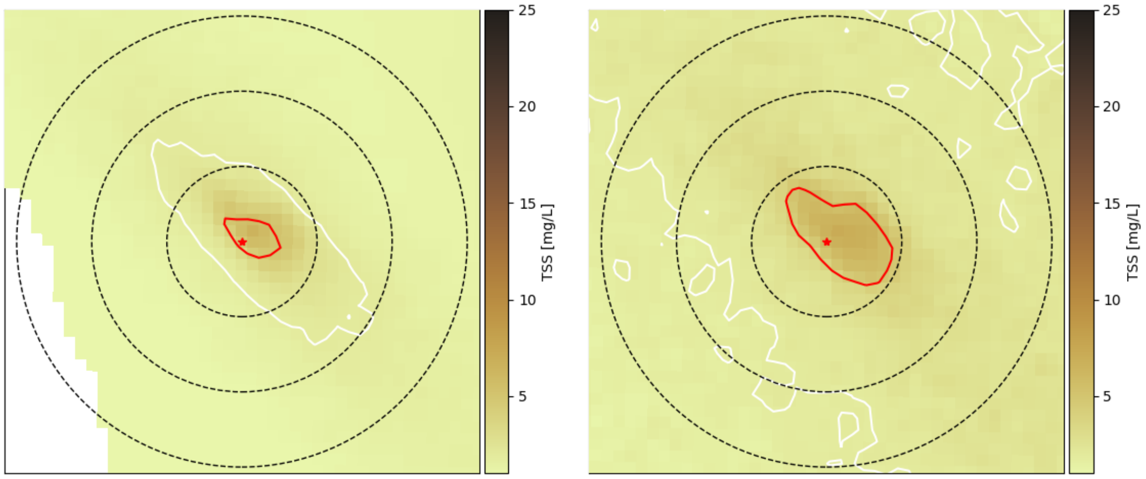

Figure 3.11 Median (left) and maximum (right) depth-averaged TSS during Winter. The red line represents the 5 mg/L threshold, and the white line is 2 mg/L. Dashed circles are centred over the release location and plotted every 400 m.

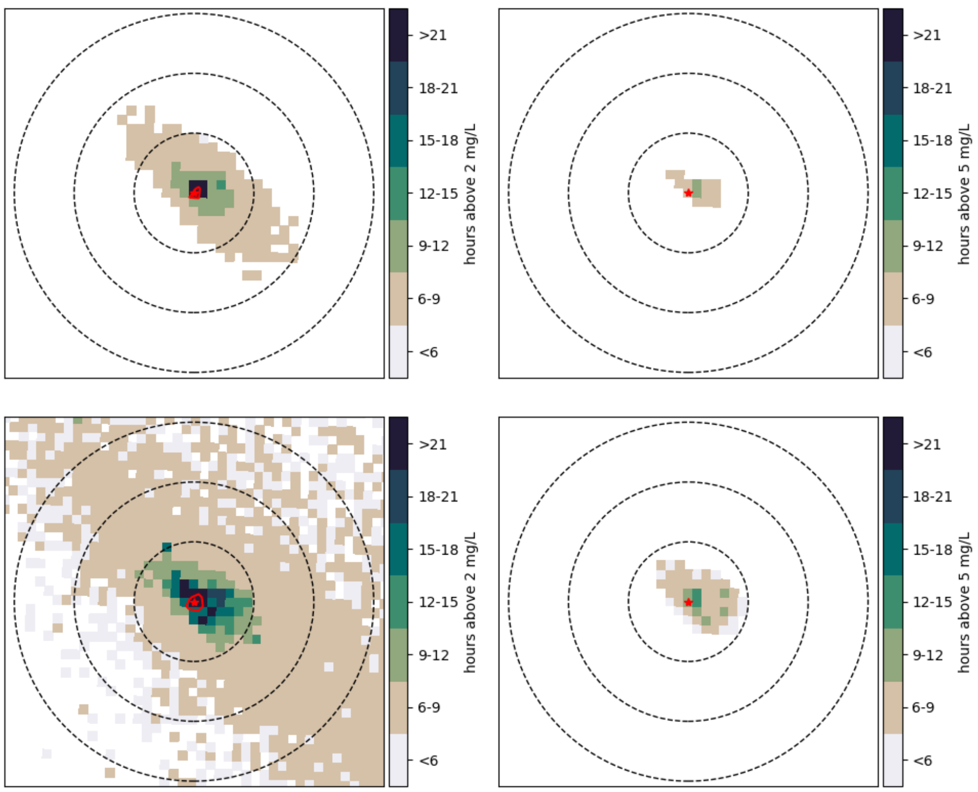

Figure 3.12 The median (top) and P99 (bottom) time that depth-averaged TSS exceeds 2 mg/ L (left) and 5 mg/L (right) during Winter. The red polygon denotes persistence for more than 7 days. Note that data are averaged over 60 m spatial grids.

Table 3.8 Maximum distance and area for each deposition threshold during Winter.

		Distance from the discharge [m]	Area [m^2]
1.0 mm	P50	334	152390
	P99	481	252359
	Max	485	264143
6.3 mm	P50	101	11785
	P99	230	65020
	Max	230	66645

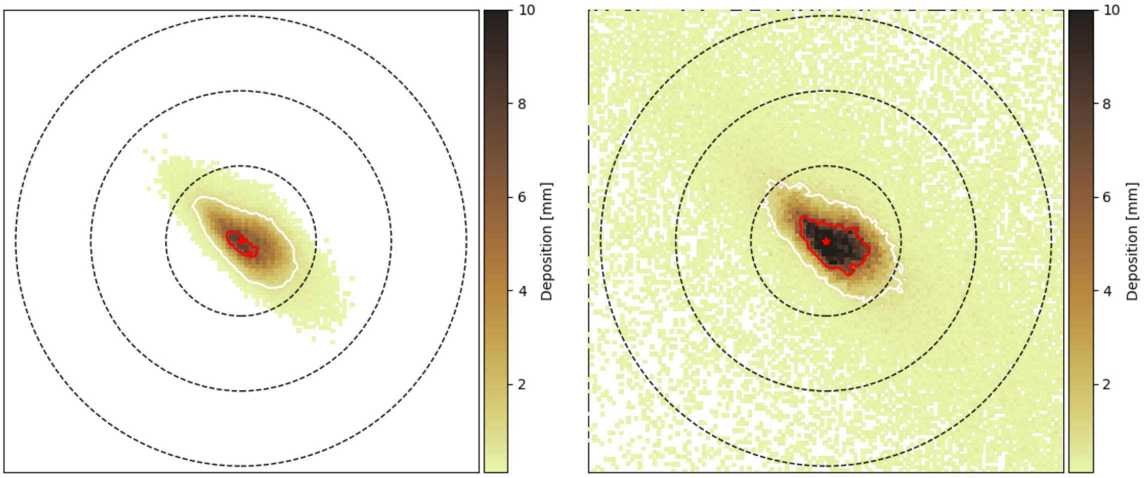

Figure 3.13 Median (left) and maximum (right) deposition thickness in mm during Winter. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

3.4. Spring simulations

Results from all 25 simulations starting in Spring (September, October, November) are provided below. TSS results are provided in Table 3.9 and in Figures 3.14 and 3.15, while the depositional results are presented in Table 3.10 and Figure 3.16.

Table 3.9 Distance and area where the depth-averaged TSS exceeds the 2, 5 and 25 mg/L thresholds during Spring.

Mg/L	days	stat	Distance from the discharge [m]	Area [m^2]
2	7	P50	96	7343
		P99	96	11015
		Max	96	11015
5	1	P50	43	3672
		P99	43	3672
		Max	43	3672
	7	P50	43	3672
		P99	43	3672
		Max	43	3672
25	1	P50	43	3672
		P99	43	3672
		Max	43	3672

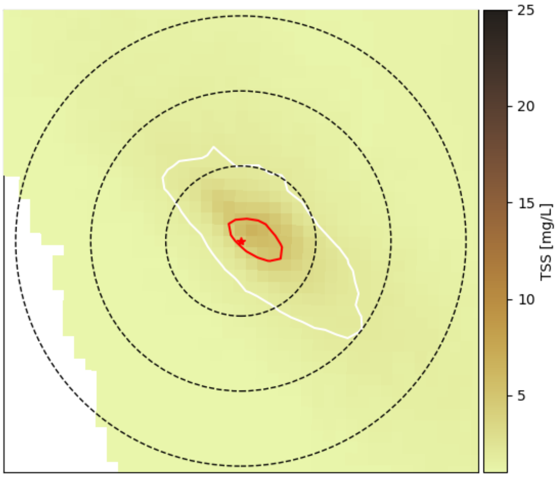

Figure 3.14 Median (left) and maximum (right) depth-averaged TSS during Spring. The red line represents the 5 mg/L threshold, and the white line is 2 mg/L. Dashed circles are centred over the release location and plotted every 400 m.

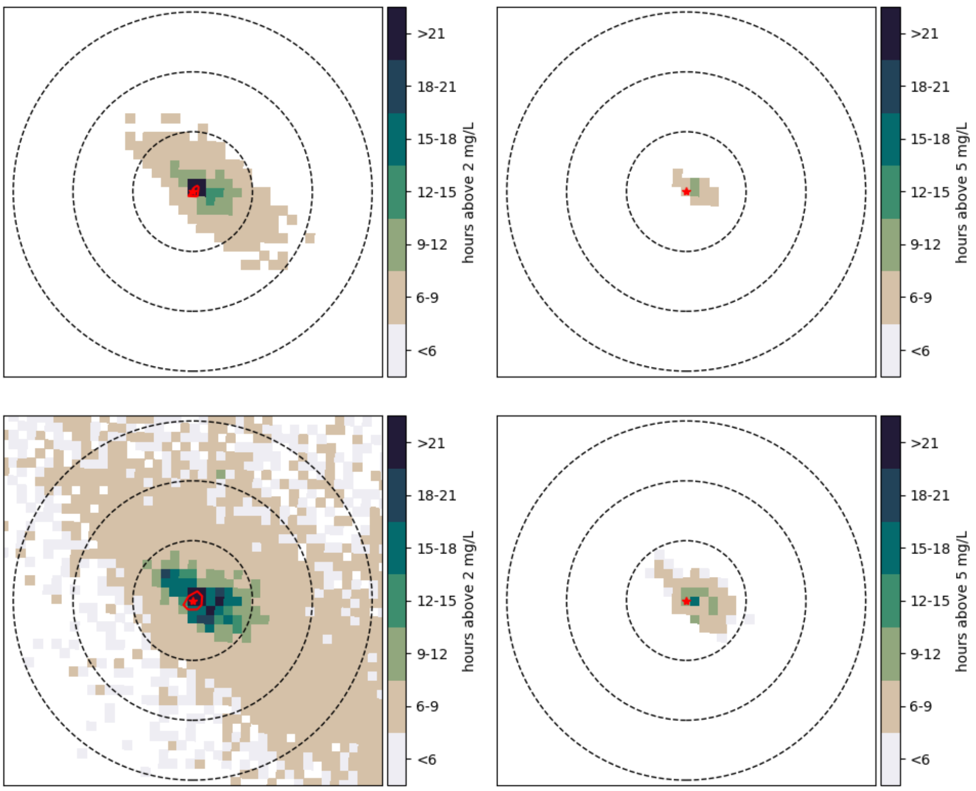

Figure 3.15 The median (top) and P99 (bottom) time that depth-averaged TSS exceeds 2 mg/ L (left) and 5 mg/L (right) during Spring. The red polygon denotes persistence for more than 7 days. Note that data are averaged over 60 m spatial grids.

Table 3.10 Maximum distance and area for each deposition threshold during Spring.

		Distance from the discharge [m]	Area [m^2]
1.0 mm	P50	359	146295
	P99	464	241793
	Max	476	253171
6.3 mm	P50	191	20319
	P99	255	61769
	Max	270	65426

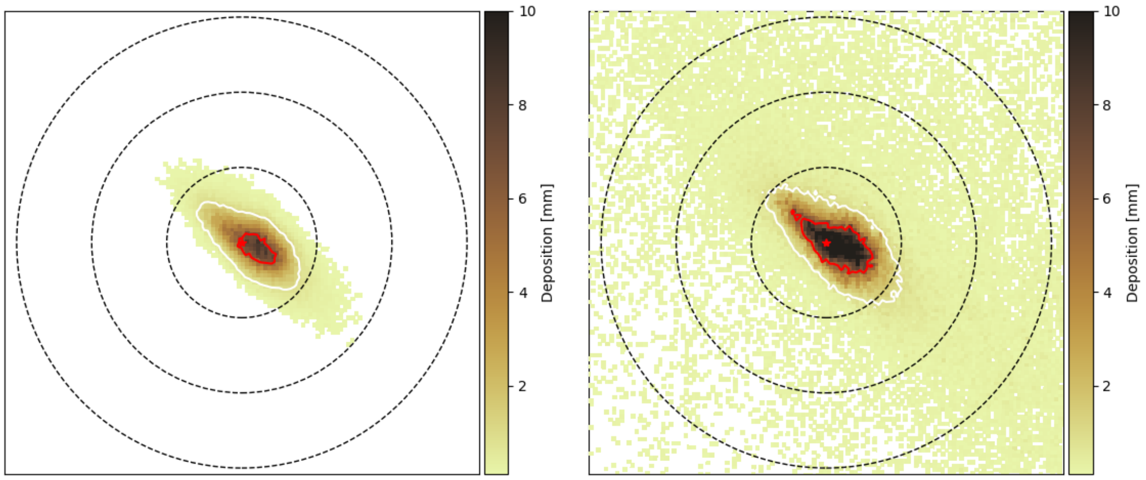

Figure 3.16 Median (left) and maximum (right) deposition thickness in mm during Spring. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

3.5. Re-spud simulations

Simulations have been made with a generic discharge profile arising from the unlikely event that a re-spud of the well is required. Here, the assumption has been made that a full well depth is completed but downhole problems mean an entirely new well needs to be drilled. Accordingly, we have extended each of the 100 simulations from 33 days to 66 days duration, resulting in a doubling of the total volume released while capturing the realistic time varying weather conditions that might be expected under a re-spud situation.

Results for the annual case are provided here, with TSS findings presented in Table 3.9 and in Figures 3.17 and 3.18, while the depositional results are presented in Table 3.10 and Figures 3.19 and 3.20.

Table 3.11 Distance and area where the depth-averaged TSS exceeds the 2, 5 and 25 mg/L thresholds (annual).

Mg/L	days	stat	Distance from the discharge [m]	Area [m^2]
2	7	P50	96	7343
		P99	96	14687
		Max	96	14687
5	1	P50	43	3672
		P99	43	3672
		Max	96	3672
	7	P50	43	3672
		P99	43	3672
		Max	43	3672
25	1	P50	43	3672
		P99	43	3672
		Max	43	3672

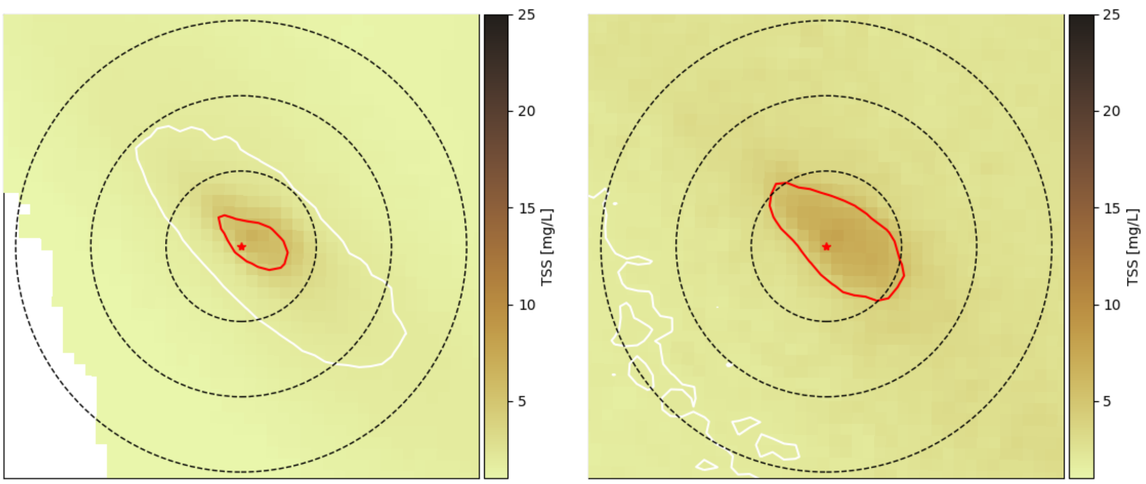

Figure 3.17 Median (left) and maximum (right) depth-averaged TSS from the 100 simulations. The red line represents the 5 mg/L threshold, and the white line is 2 mg/L. Dashed circles are centred over the release location and plotted every 400 m.

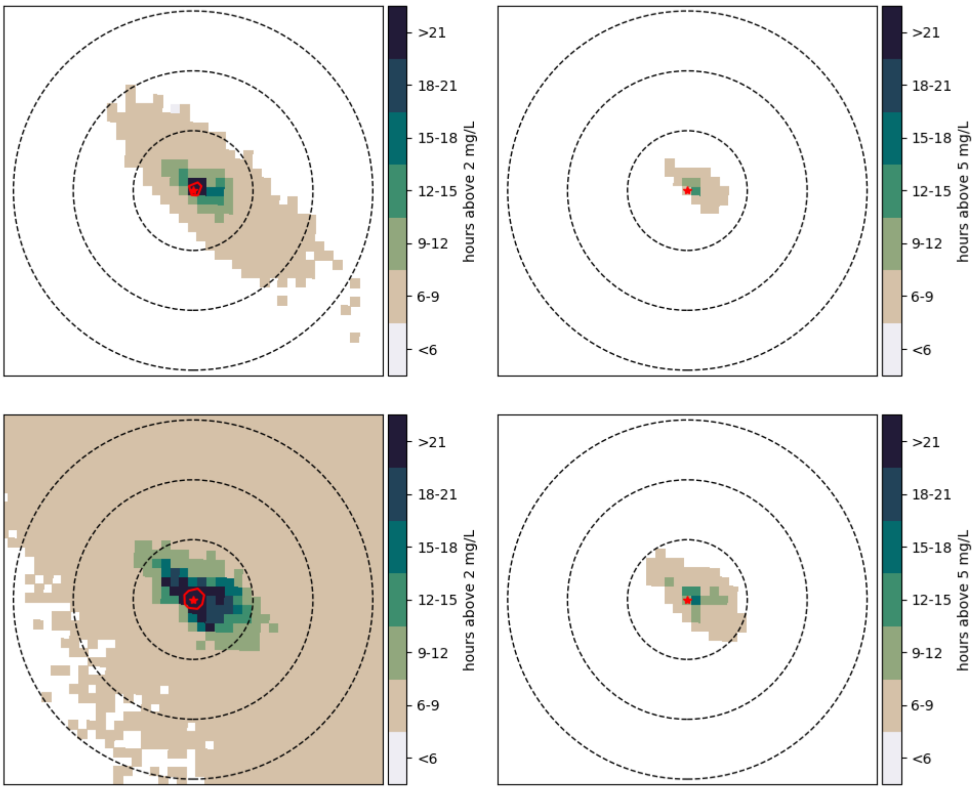

Figure 3.18 The median (top) and P99 (bottom) time that depth-averaged TSS exceeds 2 mg/ L (left) and 5 mg/L (right) on an annual basis. The red polygon denotes persistence for more than 7 days. Note that data are averaged over 60 m spatial grids.

Table 3.12 Maximum distance and area for each deposition threshold (annual) for the re-spud scenario.

		Distance from the discharge [m]	**Area [m^2]**
1.0 mm	P50	431	212127
	P99	573	351514
	Max	1242	384837
6.3 mm	P50	244	66645
	P99	302	117036
	Max	302	121912

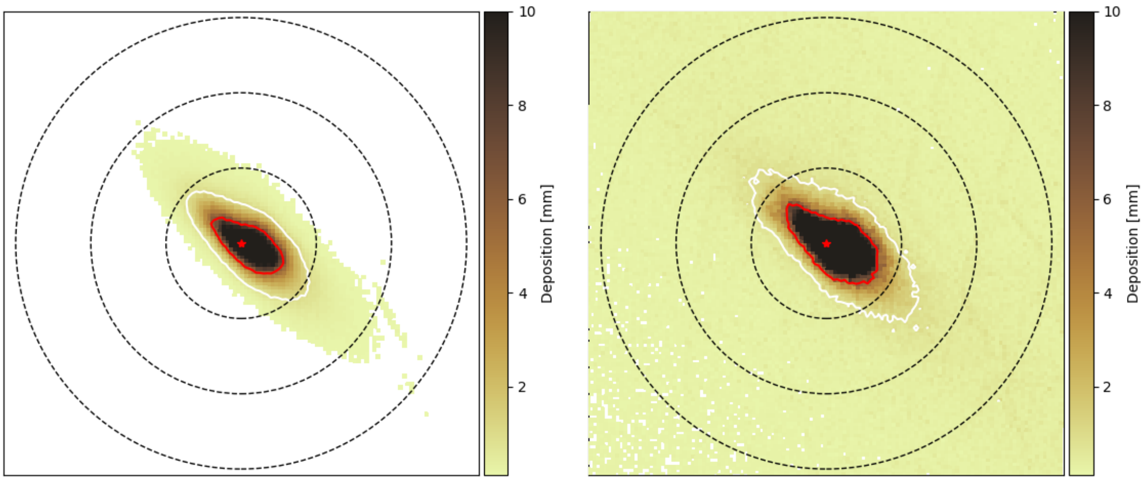

Figure 3.19 Median (left) and maximum (right) deposition thickness in mm during the 100 simulations for the re-spud scenario. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

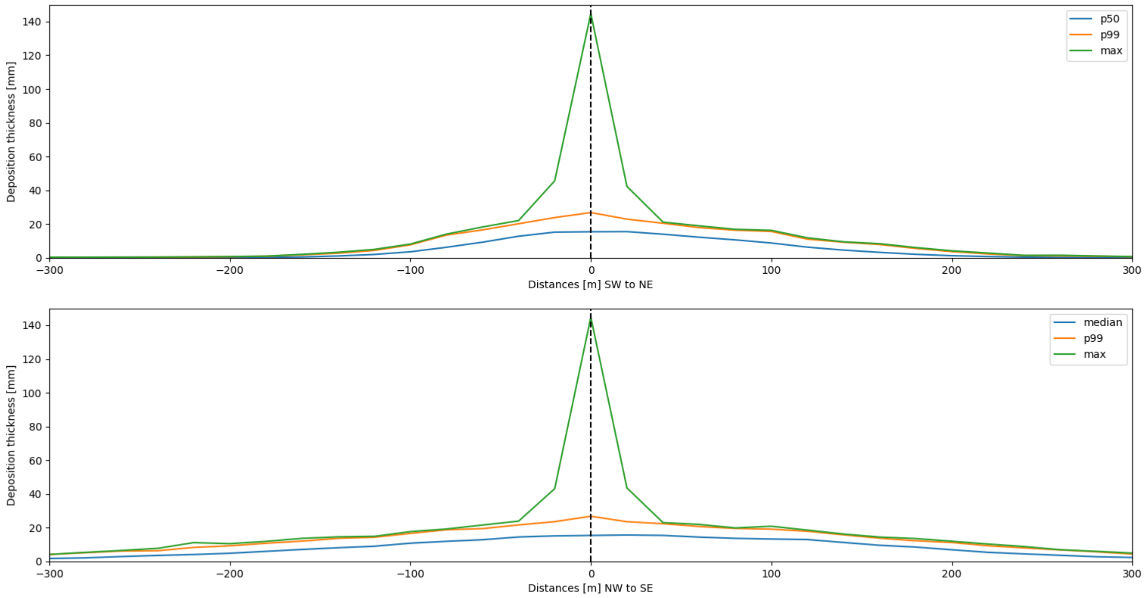

Figure 3.20 Cross sections of the statistics of depositional thickness (annual) for the re-spud scenario. The worst-case deposition has around 145 mm in 20 m grid containing the well, while the 99th percentile (P99) shows up to 27 mm deposited within 100 m of the well.

3.6. Revisit simulations

Estimates of the deposition footprint due to a revisit scenario are provided in this section. Here, we have defined the cumulative impact as being the sum of the statistics presented in Figures 2.4 and 2.5 with those from Figures 3.3 and 3.4. That is, particles of >1 mm size fraction from one drilling campaign are added to the full distribution from a second campaign.

Table 3.13 Maximum distance and area for each deposition threshold (annual) for the revisit scenario.

		Distance from the discharge [m]	**Area [m^2]**
1.0 mm	P50	353	147108
	P99	457	268207
	Max	509	297872
6.3 mm	P50	154	18693
	P99	255	71116
	Max	270	81275

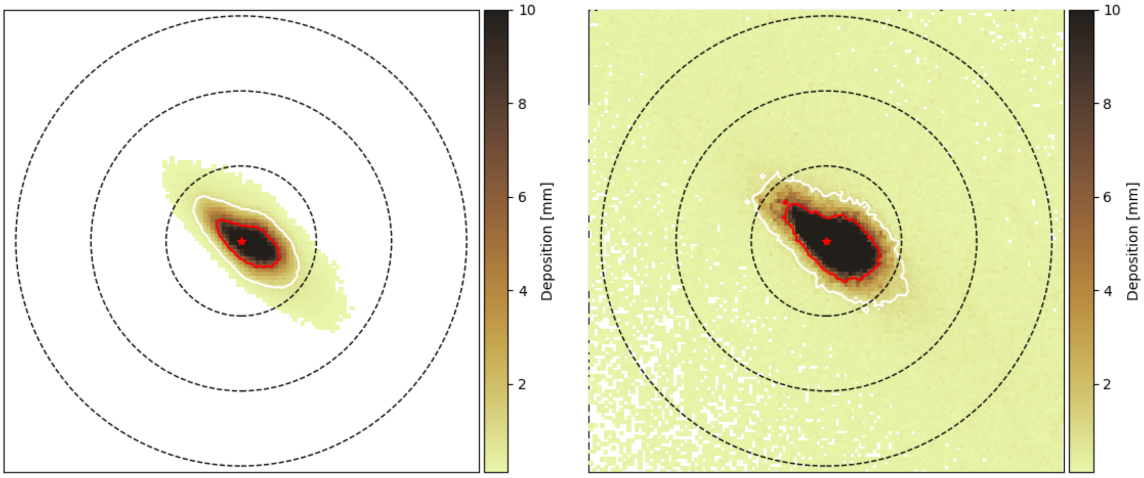

Figure 3.21 Median (left) and maximum (right) deposition thickness in mm during the 100 simulations for the revisit scenario. The white and red lines represent thresholds at 1.0 and 6.3 mm respectively, while the dashed circles are centred over the release location and plotted every 400 m.

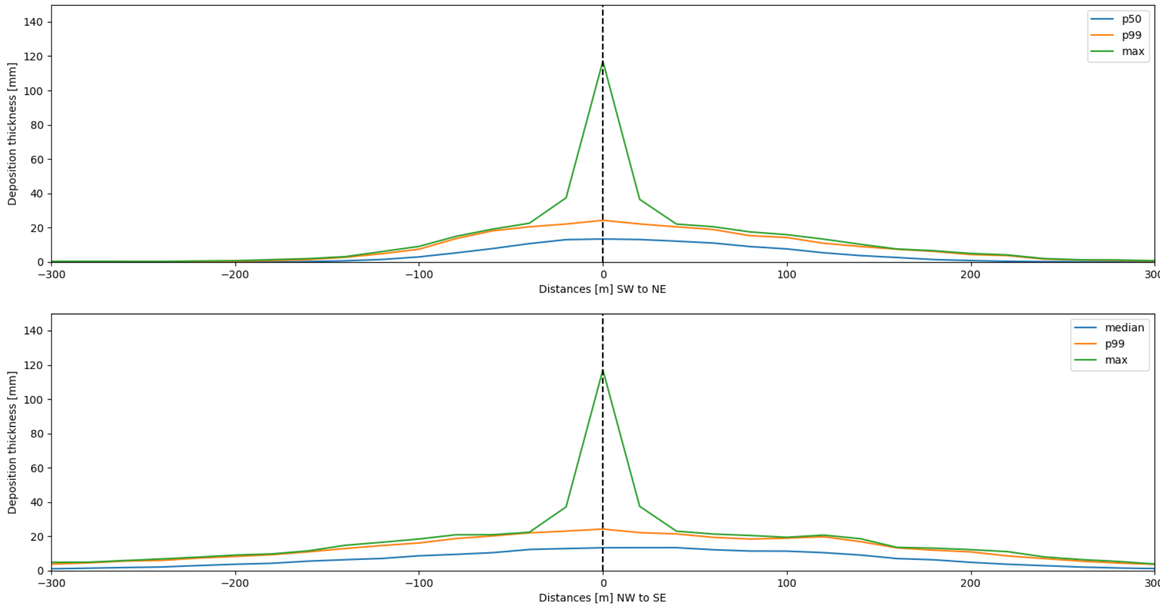

Figure 3.22 Cross sections of the statistics of depositional thickness (annual) for the revisit scenario. The worst-case deposition has around 117 mm in 20 m grid containing the well, while the 99th percentile (P99) shows up to 24 mm deposited within 100 m of the well.

4. SUMMARY

The proposed KS-9 development well is expected to produce 534 m^3 of drill cuttings, which will be discharged from the rig into the ocean over a 33-day drilling program.

Drill cuttings are fragments of the native bedrock which have been ground into small pieces (<6 mm) during the drilling operation. In this study, a stochastic approach has been used to define the statistical probabilities related to settlement and dispersal of the discharged cuttings. To achieve that, a total of 100 synthetic drilling operations have been simulated, randomly distributed over the previous decade, and modelled with the conditions imposed by an oceanographic hindcast. The results from these events are used to generate statistics on the concentration of particles in the water column during settling, and the depositional footprint of cuttings once they land on the seabed.

The oceanography of the Kupe Field is reasonably well known from various historical measurement campaigns and numerical modelling exercises. The region is dominated by strong parabathic tidal currents, plus local flows generated by regional wind stresses. Accordingly, there are two main modes of flow, with a predominance toward the southeast sector. The surficial sediments in this area are regularly mobilised by waves and currents.

Simulations of the total suspended solids (TSS) have been processed to consider three depth-averaged concentration thresholds of interest (2, 5 and 25 mg/L). The results show that the 2 mg/L concentration threshold extends to around 750 m from the rig (on average) while for 5 mg/L the range is 180 m. The 25 mg/L threshold is only met with proximity to the rig (<60 m). The spatial pattern of concentrations broadly follows the current rose, with a slight predominance to the southeast sector. Because of the strong tidal modulation on currents, TSS concentrations also exhibit modulations that coincide with the reversal of flow. Notably, around 26% of the discharged volume will remain in the water column 6 hours following release, including 94% of any remnant drilling mud.

Simulations of the deposition to the seabed have been processed to consider two thresholds of thickness (1.0 and 6.3 mm). The 1.0 mm threshold can extend up to a round 500 m from the rig, while the 6.3 mm threshold extends on average 154 m. The maximum thickness (averaged over a 20 m cell) was found to be 84 mm directly adjacent to the rig. However, on average the depositional thickness was less than 10 mm, and for 99 of the 100 simulations the maximum thickness was 14 mm.

Two contingent scenarios have been modelled to consider cumulative effects:

- In the case where a second development well is drilled 6 month or more later (i.e., the revisit scenario), estimates of the potential for drill cuttings to be transported by natural processes have been made, with the finding that cuttings of < 1 mm size may be regularly entrained by the waves and currents. Based on this, the depositional footprint arising from cuttings >1 mm has been calculated, and these values have been added to the footprint from a full campaign to estimate cumulative deposition.

- In the case where a re-spud is required, simulations have been made for two wells to be drilled, back-to-back. The same discharge profile has been adopted, but the duration has been extended to 66 days thereby doubling the total volume released.

5. REFERENCES

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APPENDIX C

Fish Species Potentially Present in Kupe IAA

For the purpose of this table, only species that have been known to be found in the depth range 20 to ~60 m have been included based on the depths found within the Kupe IAA. Also, note that some species have been identified as occurring at the 'surface' which refers to vertical distribution in the water column, not water depth; for example, basking sharks can be found at the surface in shallower coastal waters, or at the surface over deep pelagic/offshore waters.

Fish species potentially present within and surrounding the Kupe IAA (20 – 60 m water depth)

Species	Depth distribution and habitat
Ahuru [2]	Pelagic occurring from the surface to depths of 80 m.
Albacore tuna [1]	Surface to depths of at least 500 m vertical depth. Typically occurs January to April.
Anchovy	Pelagic species mostly found inshore (0 – 40 m) in dense schools.
Banded stargazer	Sandy or muddy seabeds at depths of 10 – 500 m, but more frequently taken in 100 – 300 m depth.
Banded wrasse	0 – 15 m but has been recorded as deep as 91 m. Generally in areas of high kelp cover.
Barbeled flying fish	Epipelagic. Rare in STB waters.
Barracouta	Surface to 300 m vertical depth, both inshore and offshore. Moves inshore during summer and autumn and feeds in surface waters.
Basking shark	Surface to 1,000 m vertical depth. Commonly seen on surface in spring and summer.
Bass	Demersal at depths of 30 – 900 m but most common at 350 – 700 m. Associated with rocky reefs, pinnacles, cliffs and canyons.
Black angelfish [2]	0 – 24 m.
Black goby	0 – 30 m in rockpools and deeper reefs, particularly in narrow crevices and holes where fine silt accumulates.
Black rockfish	Benthic at depths of 0 – 25 m. Found in rockpools and sub tidally.
Blue maomao	Found along exposed coasts and in sheltered bays and reefs.
Blue cod	Benthic over sand or reef edges at depths of 5 – 200 m.
Blue mackerel	1 – 145 m. Epipelagic in coastal waters.
Blue shark	Surface to at least 1,000 m vertical depth. Primarily oceanic but may be abundant inshore during summer.
Blue warehou	0 – 430 m. Referred to as common warehou in MacDiarmid *et al*. (2013b).
Bluedot triplefin	Low tidal pools to subtidally at depths of 0 – 40 m, more commonly below 10 m. Found predominantly in association with encrusting invertebrates on walls and overhangs.
Bluenose	Large adults' school in deep waters (200 – 800 m) but have been recorded in 40 – 1,050 m.
Bronze whaler	Surface to at least 100 m vertical depth.
Butterfly perch	Among and above rocky reefs at depths of 5 – 151 m.
Butterfly tuna	Surface down to 250 m vertical depth.
Carpet shark	Benthic in 0 – 700 m depth. Common on sand to shelly-cobble bottoms.
Chilean mackerel (*Trachurus murphyi*)	0 – 350 m.

Species	Depth distribution and habitat
Common roughy	3 – 500 m. Associates with rocky reefs, living beneath overhands and in caves during daylight hours.
Common triplefin	Open areas of pebbles or small rocks, turfing crustose algae in rockpools, and subtidally, to depths of 0 – 30 m, commonly 0 – 10 m.
Copper moki	Coastal reef and sedimentary substrata to 60 m depth.
Crested blenny	0 – 25 m in areas of broken rock and reef.
Cucumberfish	20 – 600 m. Prefers a hard seabed substratum to sand or mud.
Dark ghostshark [1]	32 – 800 m but most abundant at 150 – 500 m.
Dark toadfish	Benthic in depths of 16 – 1,100 m, most often at less than 100 m on sandy and muddy seabeds.
Eagle ray	Over soft sediments and rocky reefs from 0 – 422 m depth, but uncommon below 50 m.
Electric ray	1 – 1,135 m but majority taken on soft bottoms (mud to shell-cobbles) in 100 – 500 m.
Elephant fish	Inshore – 200 m. Exhibits seasonal migrations into bays and estuaries to spawn.
Estuary stargazer	Benthic in shallow bays and tidal estuaries to nearshore depths of 60 m.
Frostfish	20 – 800 m.
Giant boarfish	Benthic near seabed over open sand and mud at depths of 10 – 170 m.
Globefish	1 – 55 m.
Great white shark	Shallow coastal waters from surface to more than 1,200 m vertical depth. Readily enters water only a few meters deep.
Greenbone butterfish	Reef-dwelling generally at depths shallower than 20 m and associated with *Macrocystis*, *Ecklonia* and *Carpophyllum* on which it feeds.
Hake	50 – 1,010 m.
Hapuku [1]	Demersal juveniles common at 50 – 100 m depth, adults at 100 – 400 m.
Hiwihiwi	0 – 30 m on reefs.
Horse mackerel (*T. novaezelandiae*)	0 – 550 m. Form dense concentrations near seabed during daytime and disperse in mid-water at night.
Jack mackerel (*T. declivis*)	Coastal and oceanic waters. Form dense concentrations near seabed in depths of 160 – 500 m during daytime and disperse in mid-water at night.
Jock Stewart	Benthic occurring on hard and soft substrata at depths of 0 – 350 m.
John dory	Benthopelagic in habitats ranging from rocky reefs and kelp beds to open sandy or muddy seabed areas, at depths of 1 – 183 m.
Kahawai	Coastal pelagic species in 0 – 223 m.
Kingfish	0 – 820 m over a range of habitats; shallow bays, harbours and estuaries, and deep rocky outcrops and reefs. Often associated with floating objects.
Lancelet	*Epigonichthys hectori*. Technically an invertebrate. Small and semi-transparent – burrows in sand/shellhash/gravel from just below subtidal to ~100m.
Leatherjacket	1 – 300 m, often associated with rocky reefs.
Lemon sole [2]	4 – 618 m, but more commonly 20 – 150 m.

Species	Depth distribution and habitat
Little rockfish	Widespread in coastal and offshore waters on foul ground at depths of 0 – 110 m. Absence from coastline usually due to lack of reef habitat.
Marblefish	0 – 20 m water depth.
Moonfish	Surface to 700 m vertical depth.
New Zealand crested flounder	15 – 200 m, usually 30 – 150 m over sandy and sand-mud substrata.
New Zealand sole	Subtidal to around 55 m on sandy substrata.
Northern spiny dogfish	Near the bottom on the outer shelf and upper slope over reefs and soft sediments from 15 m to 668 m depth. Uncommon shallower than 50 m depth.
Oblique swimming triplefin	0 – 50 m. Forms large schools that hover up to 5 m above kelp beds.
Ocellate triplefin	6 – 256 m. Appears to be more abundant in depths >20 m.
Olive rockfish	Coastal wherever there is reef habitat and also found in rock pools. Benthic in 0 – 10 m depths.
Opalfish[3]	Hemerocoetes monopterygius. 5-200 m. Found generally across softer seabeds such as mud.
Orange clinid	Benthic at depths of 0 – 30 m. Usually found in rockpools and on reefs in association with dense areas of algae.
Orange rockfish	10 – 203 m, usually below 55 m.
Parore	Shallow waters on rocky reefs, at depths of 1 – 15 m.
Peregrin dealfish	0 – 1,200 m. Juveniles commonly beach cast in Cook Strait region during spring. Epipelagic.
Pilchard	Found in dense schools at the surface and mid-water down to 60 m vertical depth.
Pink clingfish	Found in association with reefs and on coarse mixed shell/bryozoan-brachiopod substrata at depths of 0 – 91 m, most commonly below 15 m.
Piper	Coastal at depths of 0 – 10 m.
Pipefish[3]	*Leptonotus norae*. 37-212 m. Very little known of habitat preferences.
Pōrae	On sand near reefs at depths of 7 – 107 m.
Porbeagle shark	0 – 715 m. Coastal and oceanic.
Red baitfish [2]	Schools in shallow coastal and offshore waters, epipelagic at depths of 20 – 122 m. Referred to as redbait in MacDiarmid *et al*. (2013b).
Red bandfish	20 – 360 m, usually deeper than 100 m. Benthic in sandy sediments.
Red cod	2 – 570 m from deep water on soft sediments, coastal rocky reefs, and sandy shores.
Red gurnard	5 – 200 m on soft to sandy substrata.
Red moki	Broken rocky reefs at depths of 1 – 54 m.
Red mullet	Benthic in depths of 0 – 70 m. Referred to as goatfish in MacDiarmid *et al.* (2013b).
Red pigfish [2]	Found along ‘broken rocky coasts’ at depths of 6 – 60 m.
Red scorpionfish	Widespread in rocky reef areas at depths of 0 – 188 m, but most commonly shallower than 50 m. Referred to as Dwarf scorpionfish in MacDiarmid *et al*. (2013b).
Redbanded perch	Rocky reefs at depths of 2 – 70 m.
Rig	Intertidal to 1,000 m depth. Occurs mainly over sand and mud.

Species	Depth distribution and habitat
Rock cod	Rocky reef habitats at depths of 0 – 30 m.
Rough skate [1]	17 – 600 m.
Sand flounder	Subtidally to depths of around 100 m, but more commonly at 20 – 70 m. Found mostly on soft seabeds.
Sand stargazer	Benthic in coastal waters at depths of 0 – 10 m.
Scaly gurnard	11 – 300 m on sand and mud seabeds.
Scarlett wrasse	4 – 40 m; common at subtidal depths below 10 m. Usually found in areas of broken rock and crevices rather than areas of seaweed.
School shark	Coastal and pelagic. From shallow water to depths of 1,100 m.
Seal shark	Found in 50 – 1,000 m depths.
Shortfin mako shark	Coastal and oceanic occurring from surface to at least 550 m vertical depth.
Short-tail stingray [2]	Mainly benthic in water depths 5 – 300 m. Referred to as short-tailed black ray in MacDiarmid *et al*. (2013b).
Silver conger	Common in shallow waters from 5 m. Maximum recorded depth 183 m, but rarely deeper than 100 m.
Silver dory	20 – 550 m.
Silver drummer	Coastal reefs in depths of 0 – 20 m.
Slender roughy [2]	1 – 74 m. Usually seen in daylight hours among rocky reefs sheltering in overhangs and in small caves.
Smooth hammerhead shark	Throughout the Pacific in coastal and oceanic waters. No further habitat details provided in Roberts *et al*. (2015).
Snapper	To depths of 280 m.
Snipefish	30 – 500 m but most often at 100 – 200 m. Benthic to demersal.
Southern bastard cod [2]	Reef-dwelling species living at depths of 0 – 520 m.
Southern burrfish	0 – 363 m.
Spectacled triplefin	0 – 34 m, often in exposed sites.
Spiny dogfish	Surface to 1,446 m vertical depth. More common in surface waters at night.
Spiny seadragon	27 – 375 m. Associates with deepwater corals, sponges and bryozoans
Spotted gurnard	25 – 500 m on soft seabeds.
Spotted stargazer	0 – 200 m.
Spotty	Shallow inshore rocky reefs to depths of 145 m.
Sprat	Surf zone to 110 m depth.
Stout rockfish	Benthic at depths of 0 – 91 m. Found in rockpools, but more common below 10 m depth.
Sweep	Shallow coastal waters to depths of 30 m, often around rocky reefs.
Tarakihi	3 – 462 m.
Thresher shark	50 m – 400 m
Thripenny	0 – 23 m wherever suitable reef habitat is present. Often in areas of high turbulence.

Species	Depth distribution and habitat
Tommyfish[3]	*Limnichthys rendahli*, *Creediidae* sp. 1-150 m, most commonly associated with sandy/rubble seabeds.
Trevally	0 – 240 m depth. Juveniles generally in shallow coastal waters; adults in deeper water and may form large surface-feeding schools.
Trumpeter	Rocky reef habitats at depths of 6 – 300 m.
Twosaddle rattail	Benthopelagic at continental shelf to upper slope depths of 4 – 549 m.
Umbrella conger	0 – 731 m, most commonly in 70 – 300 m.
Variable triplefin	0 – 33 m, most commonly shallower than 10 m.
Weedfish[3]	Acanthoclinus sp
Witch	4 – 737 m on coarse sand and muddy substrata.
Yellowback triplefin	0 – 110 m but more common below 10 m depth.
Yellow-bellied flounder [2]	Coastal subtidal to depths of around 25 m (occasionally to 50 m).
Yelloweye mullet	Surface to a depth of 50 m (vertical depth). Commonly schools in coastal and estuarine waters.
Yellowfin foxfish	30 – 150 m in caves and archways of reefs.
Yellowtail triplefin	20 – 500 m but generally shallower than 100 m.

1 Not identified in Roberts *et al*. (2015) as present in STB but commercial catch is taken as reported in MacDiarmid and Ballara (2016).

2 Not identified in Roberts *et al*. (2015) as present in STB but identified as present in MacDiarmid *et al*. (2013b)

3 Not identified in Roberts *et al*. (2015) as present in STB but collected by Beaumont *et al*. (2013) during the broader Patea Shoals survey.

APPENDIX D

Cetaceans Species Potentially Present in Kupe IAA

Common Name	Scientific Name	NZ Conservation Status (Baker *et al.*, 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Sightings database (No. of reports in PML38146 + 20 km buffer / No. reports in wider STB)	DOC Stranding database (from nearby coasts) **	Probability of occurrence modelling (Stephenson *et al.*, 2020)	Note re wider presence in Taranaki waters (Torres, 2012 and Stephenson *et al.*, 2020)	Ecological considerations and Likelihood of Presence in and around PMP 38146
Baleen Whales									
Blue whales (Pygmy blue whale ◊)	*Antarctic blue whales* *Balaenoptera musculus intermedia*	Data deficient	TO	Critically endangered	×	×	Low - High	Sightings common in STB	Two subspecies of blue whale occur in New Zealand waters. Both subspecies known to occur in the STB. Feeding and breeding of resident pygmy blue whales has been confirmed and migrating Antarctic blue whales pass through (Barlow *et al.*, 2018). Feeding distribution is driven by concentrations of *Nyctiphanes australis* prey (Torres & Klinck, 2016). While high numbers of blue whales occur in the STB, few sightings have been recorded in the vicinity of PML 38146. Modelling suggests a low probability of occurrence in the Kupe field, but increasing dramatically towards central STB (Stephenson *et al.*, 2020); hence, it is **possible** that blue whales could occasionally be present in PML 38146 and **likely** that blue whales will be present in the wider STB particularly in autumn.
	Pygmy blue whales *Balaenoptera musculus brevicauda*	Data deficient	S?O	Data deficient	1/60***	Yes (7)			
Bryde's whale	*Balaenoptera edeni*	Nationally critical	CD, DP, SO	Data deficient	0/2	Yes (1)	Low - Moderate	Occasional sightings in offshore waters	In New Zealand, Bryde's whales are typically known from the north-eastern coastal region between East Cape and North Cape (Gaskin, 1963); with the Hauraki Gulf and Northland region supporting one of the few known resident populations in the world (Constantine *et al.*, 2012). Sightings outside this range are less frequent and typically occur in deep water; therefore, this species is **unlikely** to be routinely present.
Fin whale	*Balaenoptera physalus*	Data deficient	TO	Endangered	0/2	Yes (4)	Low - Moderate	Occasional sightings in offshore waters	Fin whales undertake long seasonal migrations and are usually found in deep offshore waters (Shirahai and Jarrett, 2006). They are occasionally seen in deep waters of the STB (Torres, 2012) and while habitat around PML 38146 is of low suitability, habitat is moderately suitable in the central STB (Stephenson *et al.*, 2020); hence, occasional sightings are **possible.** No information about seasonality is available, but during summer they feed at high latitude waters near the Antarctic; hence, would not be expected in STB in summer.
Humpback whale	*Megaptera novaeangliae*	Migrant	SO	Endangered	0/16	Yes (2)	Low - Moderate	Migrating whales pass through the STB	Humpback whales migrate northwards along coastal NZ from May to August (Gibbs & Childerhouse, 2000), and southward from September to December (Dawbin, 1956). During migrations they typically use continental shelf waters (Jefferson *et al.*, 2008) and can approach closely to shore when passing headlands or moving through confined waters (e.g. Gibbs *et al.*, 2017). A well-established northward migration route passes through Cook Strait and on through the STB in winter. Hence, it is **possible** that this species will be present in PML 38146 on a seasonal basis, and **likely** that humpback whales will be present in the wider STB in winter.
Minke whales	*Antarctic minke whale* *Balaenoptera bonaerensis*	Data deficient	DP, SO	Data deficient	×	Yes (4)	NA	Occasional sightings during migration; mostly in > 100 m water	The Antarctic minke is very abundant in Antarctic waters in summer, but outside of the summer months their distribution is less well-known (Cooke *et al.*, 2018). Southern Hemisphere Dwarf minke whales also feed in Antarctic waters in summer and have a broad latitudinal distribution in other seasons (Cooke, 2018). Most minke whale sightings around New Zealand occur in spring; aligning with the southern migration to Antarctic feeding grounds (Berkenbusch *et al.*, 2013). Based on this, occasional presence is **possible** in spring.
	Dwarf minke whale *Balaenoptera acutorostrata*	Data deficient	DP, SO	Least concern	1/2	Yes (12)	Low - Moderate		
Pygmy right whale	*Caperea marginata*	Data deficient	S?O	Data deficient	×	Yes (17) Most in Golden Bay	NA	NA	Pygmy right whales are the smallest, most cryptic and least known of the baleen whales (Fordyce & Marx, 2012). In New Zealand, sightings typically occur near Stewart Island and Cook Strait (Kemper, 2002). Therefore, it is **possible** that this species could be present given their apparent association with nearby Cook Strait, but ecological information is very scant for this species. No information about seasonality is available.

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Sei whale	*Balaenoptera borealis*	Data deficient	TO	Endangered	0/6	Yes (1)	Low - Moderate	Occasional sightings in waters > 100 m	This species is generally found in offshore, deep waters beyond the continental slope (Horwood, 2009). They are occasionally seen in deep waters of the STB (Torres, 2012) and while habitat modelling suggests moderate habitat suitability in parts of the STB, habitat suitability is predicted to be low around PML 38146 (Stephenson *et al.*, 2020); therefore, occasional sightings are **possible** in the wider STB, but sightings are **unlikely** in PML 38146. No information about seasonality is available, but during summer they feed at high latitude waters near the Antarctic; hence would not be expected in STB in summer.
Southern right whale ◊	*Eubalaena australis*	Recovering	OL, RR, SO	Least concern	1/17	Yes (1)	Low	Occasional coastal sightings in winter	Coastal waters around mainland New Zealand represent a historic calving ground for this species, with recent evidence suggesting a slow recolonization of this breeding range (Carroll *et al.*, 2014). Southern right whales utilise shallow coastal waters as their winter calving and nursery grounds (Patenaude, 2003). One sighting has been reported from the immediate vicinity. On this basis it is **possible** that southern right whales could have a seasonal winter presence both in PML 38146 and in other coastal parts of STB.
Odontocetes									
Bottlenose dolphin ◊	*Tursiops truncatus*	Nationally endangered	De, PF, SO, Sp	Least concern	×	Yes (18) Most in Tasman Bay	Low	Occasional sightings in offshore waters	The Marlborough Sounds supports a resident population of inshore bottlenose dolphins (Constantine, 2002). Offshore sightings are less common and typically occur in waters beyond the 100 m depth contour (Torres, 2012); therefore, occasional sightings are **possible** in the wider STB, but sightings are **unlikely** in PML 38146. There are no strong indicators of seasonal patterns of occurrence for this species in the STB.
Common dolphin	*Delphinus delphis*	Not threatened	DP,SO	Least concern	9/45	Yes (56)	Low - High	Most frequently sighted species in STB.	This species is commonly seen in Taranaki waters (Torres, 2012) and habitat modelling suggests high habitat suitability in and around PML 38146 (Stephenson *et al.*, 2020). While the modelling results suggest lower habitat suitability in central STB, the number of sightings reported in the DOC Sightings Database remains relatively high throughout the region. Hence, common dolphins are **likely** to be present both in PML 38146 and throughout the STB, particularly in spring and summer.
Dusky dolphin	*Lagenorhynchus obscurus*	Not threatened	S?O	Data deficient	0/4	Yes (48) Most in Tasman Bay	Low	Occasional sightings	Dusky dolphins are known to feed in Admiralty Bay between April and July (Wursig *et al.*, 2007). Sightings in the wider STB occur occasionally, but habitat modelling suggests low habitat suitability (Stephenson *et al.*, 2020). It is **unlikely** that this species will be present in PML 38146, or in the wider STB.
Dwarf sperm whale	*Kogia sima*	Data deficient	S?O	Data deficient	×	×	NA	NA	Based on the lack of sightings, this species is **unlikely** to be present.
False killer whale	*Pseudorca crassidens*	Naturally uncommon	DP, T?O	Data deficient	0/2	Yes (2)	Low	Occasional sightings in offshore waters	Mostly found in deep, offshore waters but also occasionally over the continental shelf and shallower areas (Berkenbusch *et al.*, 2013). Forage down to water depths of 500 m (Shirihai & Jarrett, 2006). Based on the lack of sightings data and the low habitat suitability (Stephenson *et al.*, 2020), it is **unlikely** they will be routinely present.
Fraser's dolphin	*Lagenodelphis hosei*	Data deficient	SO	Least concern	×	×	NA	NA	Based on the lack of sightings, this species is **unlikely** to be present.
Hourglass dolphin	*Lagenorhynchus cruciger*	Data deficient	SO	Least concern	×	×	Low	No sightings or strandings in STB	Based on the lack of sightings and the low habitat suitability (Stephenson *et al.*, 2020), this species is **unlikely** to be present in PML 38146, or in the wider STB.
Hector's/Māui's dolphin	*Maui's dolphin* *Cephalorhynchus hectori maui*	Nationally critical	CD	Not assessed	1/5	Yes (3)	Low		

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(Maui's dolphin ◊)	*South Island Hector's dolphin* *Cephalorhynchus hectori hectori*	Nationally vulnerable	CD, DP, PF	Endangered	0/13	Yes (18) Most in Golden Bay	Low - High	Sightings mostly inshore	Two subspecies: Maui's dolphins on the west coast of the North Island, and South Island Hector's dolphins around the South Island. Māui's and Hector's cannot be readily differentiated at sea; however, both subspecies have coastal distributions thought to be largely constrained within the 100 m isobath (Slooten *et al.*, 2006; Du Fresne, 2010). Māui's dolphins have a population stronghold between Manakau Harbour and Port Waikato (Slooten *et al.*, 2005), but their total distribution is wider; from Maunganui Bluff (Currey *et al.*, 2012) to Taranaki (DOC 2020a). Summer distributions are close to shore, while winter distributions are broader offshore and alongshore (Constantine, 2019). The inshore portion of PML 38146 occurs within the southern extreme of the Māui's sub-species distribution and overlaps with the WCNI MMS. One live sighting of a Māui dolphin was made in the vicinity of PML 38146 in 2012. It is **possible** that Hector's/Māui's dolphins will occasionally be present both within PML 38146 and the wider STB.
Killer whale ◊	*Orcinus orca*	Nationally critical	DP, S?O, Sp	Data deficient	3/23	Yes (3)	Low. But habitat modelling by Torres (2015) concludes a moderate habitat suitability.	Sightings occur from coastal areas to deeper offshore waters	Small groups of killer whales are typically seen around New Zealand where they travel an average of 100 – 150 km per day (Visser, 2000). Some groups are thought to feed predominantly on rays which can bring them into very shallow coastal waters (Visser, 2000). Sightings not uncommon in Taranaki waters (Torres, 2012). On this basis, it is **likely** that this species will pass through the area on a sporadic basis. There are no strong indicators of seasonal patterns of occurrence for this species in the STB.
Long-finned pilot whale	*Globicephala melas*	Not threatened	DP, S?O	Data deficient	0/18	Yes (84) Most in Golden Bay	Low - High	Common particularly in summer	Pilot whale sightings occur in NZ waters year-round (Berkenbusch *et al.*, 2013). Long-finned pilot whales commonly strand on New Zealand coasts; with the stranding rate peaking in spring and summer (O'Callaghan *et al.*, 2001). Pilot whales forage at depth (i.e. several hundred metres; Berkenbusch *et al.*, 2013). But given their presence in the sighting record and the modelling results it is **likely** they will be present in the wider STB during warmer months and an occasional presence in PML 38146 is **possible**.
Melon-headed whale	*Peponocephala electra*	Vagrant	SO	Least concern	×	×	NA	NA	This species occurs in deep oceanic waters. Sightings are relatively rare over the continental shelf (Brownell *et al.*, 2009). They are primarily distributed in waters ranging from 300 to 2,000 m in depth (Brownell *et al.*, 2009). Based on this, and the lack of sightings, it is **unlikely** that this species would be present.
Pantropical spotted dolphin	*Stenella attenuata*	Vagrant	SO	Least concern	×	Yes (1)	NA	NA	This species is considered a vagrant to New Zealand waters. Therefore, it is **unlikely** to be present.
Pygmy killer whale	*Feresa attenuata*	Vagrant	DP, S?O	Data deficient	×	×	NA	NA	This species is considered a vagrant to New Zealand waters. Therefore, it is **unlikely** to be present.
Pygmy sperm whale	*Kogia breviceps*	Data deficient	DP, S?O	Data deficient	×	Yes (25) All in the south part of the North Island	Low	No sightings in STB. Not a coastal species	Pygmy sperm whales are seldom seen at sea on account of their low profile in the water and lack of a visible blow; for this reason, little information is available on this species. They are known to be a deep-water species (Kiszka *et al.*, 2020) and this is reflected by habitat modelling (Stephenson *et al.*, 2020). Despite this, a reasonable number of strandings occur nearby and given that ecological information is relatively scant for this species it would be appropriate to conclude that it is **possible** that this species could be occasionally present in the wider STB but based on its preference for deeper water it is **unlikely** to occur in PML 38146. No information about seasonality is available.
Risso's dolphin	*Grampus griseus*	Data deficient	SO	Least concern	0/3	Yes (4)	Low	Occasional sightings	Found throughout tropical and temperate oceans in deep waters of the continental slope and outer shelf (Kruse *et al.*, 1999). Based on the low habitat suitability (Stephenson *et al.*, 2020), this species is **unlikely** to be routinely present.
Rough-toothed dolphin	*Steno bredanensis*	Data deficient	SO	Least concern	×	×	NA	NA	Based on the lack of sightings, this species is **unlikely** to be routinely present.

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Short-finned pilot whale	*Globicephala macrorhynchus*	Data deficient	S?O	Data deficient	×	Yes (1)	Moderate to High****	Occasional sightings	The short-finned pilot whale is less frequently encountered than the long-finned pilot whale in New Zealand waters on account of its preference for warmer sub-tropical habitat in deep offshore waters (Berkenbusch *et al.*, 2013). Given the low level of both sightings and stranding this species is **unlikely** to be routinely present.
Southern right whale dolphin	*Lissodelphis peronii*	Data deficient	DP,S?O	Data deficient	×	Yes (8) Most in Golden Bay	Low	Occasional sightings	Southern right whale dolphins are circumpolar and common throughout their range (Lipsky, 2002). They are predominantly oceanic, preferring deep, offshore waters (Lipsky, 2002); therefore, are **unlikely** to be routinely present.
Spectacled porpoise	*Phocoena dioptrica*	Data deficient	S?O	Data deficient	×	Yes (1)	Low	No sightings in STB	Spectacled porpoises occur only in cold temperate waters, with their distribution thought to be restricted to the circumpolar sub-Antarctic (Baker, 1999; Goodall, 2002). Based on this and the lack of sightings and strandings, it is **unlikely** that this species would be routinely present.
Sperm whale	*Physeter macrocephalus*	Data deficient	DP, TO	Vulnerable	0/1	Yes (39)	Low	Occur in deep offshore waters over summer.	Sperm whales have a wide global distribution but are predominantly found in deep waters (> 1,000 m) in the open ocean over the continental slope (Berkenbusch *et al.*, 2013). However, given the common occurrence of strandings nearby it is **possible** that sperm whales are occasionally be present in the wider STB, but their preference for deep water means they are **unlikely** to occur in PML 38146. Torres (2012) noted that sightings in the STB largely occurred in summer.
Striped dolphin	*Stenella coeruleoalba*	Data deficient	SO	Least concern	×	Yes (3)	Low	No sightings in STB. Not a coastal species.	Based on the lack of sightings, the low number of strandings and the low predicted habitat suitability (Stephenson *et al.*, 2020), this species is **unlikely** to be present.
Odontocetes – Beaked Whales									
Andrew's beaked whale	*Mesoplodon bowdoini*	Data deficient	S?O	Data deficient	×	Yes (3)	Low	No sightings in STB. Not a coastal species.	Found between 32 – 55°S in the southern hemisphere. Presumed to inhabit deep, offshore waters (Pitman, 2002). Based on the global stranding record, New Zealand might represent an area of concentration (Pitman & Brownell, 2020b). However, based on the lack of sightings, the low number of strandings and the low predicted habitat suitability (Stephenson *et al.*, 2020), it is **unlikely** that this species will be present.
Arnoux's beaked whale	*Berardius arnuxii*	Data deficient	S?O	Data deficient	×	Yes (12)	Low	No sightings in STB	Circumpolar distribution in deep, cold temperate and sub-polar waters. Considered to be naturally rare throughout its range; however, higher densities may occur seasonally in Cook Strait (Brownell *et al.*, 2021). New Zealand has the highest number of strandings recorded for this species (Jefferson *et al.*, 1993). However, based on the lack of acoustic or visual detections and the low habitat suitability (Stephenson *et al.*, 2020), it is **unlikely** that this species will be routinely present.
Blainville's/Dense beaked whale	*Mesoplodon densirostris*	Data deficient	S?O	Data deficient	×	×	Low	No sightings or strandings in STB	Little known about this species. However, beaked whales are generally considered to prefer deep water as they are deep divers and feed predominantly on deep-water squid and fish species. Based on this and the lack of sightings, it is **unlikely** that this species will be present.
Cuvier's beaked whale	*Ziphius cavirostris*	Data deficient	SO	Least concern	×	Yes (24)	Low	Occasional sightings	Found in deep waters (> 200 m) and is thought to prefer steep bathymetry near the continental slope in water depths greater than 1,000 m (Baird *et al.*, 2020). Despite the predicted habitat suitability being low (Stephenson *et al.*, 2020), a reasonable number of strandings have occurred in the vicinity and acoustic recordings of this species have been made in Cook Strait (Goetz, 2017); therefore, it is **possible** that Cuvier's beaked whales will be occasionally present in deep waters of the wider STB. However, due to their preference for deep water, this means they are **unlikely** to occur in PML 38146. No information about seasonality is available.
Gingko-toothed whale	*Mesoplodon ginkgodens*	Data deficient	S?O	Data deficient	×	Yes (2)	NA	NA	Most stranding and capture records for this species are from the tropical and warm temperate waters of the Indo-Pacific (esp. Japan). Only a few records from New Zealand. This species is **unlikely** to be present.

Common Name	Scientific Name	NZ Conservation Status (Baker *et al.*, 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Sightings database (No. of reports in PML38146 + 20 km buffer / No. reports in wider STB)	DOC Stranding database (from nearby coasts) **	Probability of occurrence modelling (Stephenson *et al.*, 2020)	Note re wider presence in Taranaki waters (Torres, 2012 and Stephenson *et al.*, 2020)	Ecological considerations and Likelihood of Presence in and around PMP 38146
Gray's beaked whale	*Mesoplodon grayi*	Not threatened	S?O	Data deficient	×	Yes (38)	Low	No sightings in STB. Not a coastal species	This species has a circumpolar distribution south of 30° and occurs in deep waters beyond the shelf edge (Pitman & Taylor, 2020). Based on acoustic detections (Goetz, 2017) and reasonable number of strandings, it is **possible** that they could have an occasional presence in deep waters of the STB. However, due to their preference for deep water, this means they are **unlikely** to occur in PML 38146. No information about seasonality is available.
Hector's beaked whale	*Mesoplodon hectori*	Data deficient	S?O	Data deficient	×	×	NA	NA	A southern hemisphere species. Majority of records are from New Zealand waters. There has only been one confirmed live sighting, suggesting Hector's beaked whales are naturally rare (WDC, 2018). Because of the lack of sightings, it is **unlikely** that this species will be present.
Lesser/pygmy beaked whale	*Mesoplodon peruvianus*	Data deficient	S?O	Data deficient	×	×	NA	NA	Very little known about this species. However beaked whales are generally considered to prefer deep water as they are deep divers and feed predominantly on deep-water squid and fish species. Based on this and the lack of sightings, it is **unlikely** that this species will be present.
Shepherd's beaked whale	*Tasmacetus shepherdi*	Data deficient	SO	Data deficient	×	Yes (4)	Low	No sightings in STB. Not a coastal species	A circumpolar distribution in cold temperate waters is presumed. Thought to be relatively rare and occur in deep water usually well offshore (Braulik *et al.*, 2018). Based on this and the lack of sightings and low habitat suitability (Stephenson *et al.*, 2020), it is **unlikely** that this species would be present.
Southern bottlenose whale	*Hyperoodon planifrons*	Data deficient	SO	Least concern	×	Yes (2)	Low	No sightings in STB. Not a coastal species	This species has a circumpolar distribution in the southern hemisphere, south of about 30°S (Jefferson *et al.*, 1993); however, most sightings are from about 57°S to 70°S (Lowry *et al.*, 2020). Knowledge of the biology of this species is scarce, but they are thought to be a deep-water species (Baker, 1999). Based on this and the lack of sightings and low number of strandings, it is **unlikely** that this species would be present.
Spade-toothed whale	*Mesoplodon traversii*	Data deficient	S?O	Data deficient	×	×	NA	NA	Little is known about this species. However, beaked whales are generally considered to prefer deep water as they are deep divers and feed predominantly on deep-water squid and fish species. Based on this and the lack of sightings, it is **unlikely** that this species will be present.
Strap-toothed whale	*Mesoplodon layardii*	Data deficient	S?O	Data deficient	×	Yes (15)	NA	NA	This species occurs between 35-60°S in cold temperate waters and prefers deep waters beyond the shelf edge (Pitman & Brownell, 2020a). Acoustic recordings of this species have been made in Cook Strait (Goetz, 2017) and explain the presence of this species in the stranding record. Despite the lack of sightings, it is **possible** that this species will occasionally be present in deep waters of the wider STB. However, due to their preference for deep water, this means they are **unlikely** to occur in PML 38146. No information about seasonality is available.
True's beaked whale	*Mesoplodon mirus*	Data deficient	S?O	Data deficient	×	×	NA	NA	Very little known about this species. However beaked whales are generally considered to prefer deep water as they are deep divers and feed predominantly on deep-water squid and fish species. Based on this and the lack of sightings, it is **unlikely** that this species will be present.

* Qualifiers to the New Zealand Threat Classification System are as follows: Secure Overseas (SO), Uncertain whether the taxon is secure overseas (S?O), Threatened Overseas (TO), Data Poor (DP), Conservation Dependent (CD), Sparse (Sp), Range Restricted (RR), Increasing (Inc), One Location (OL), Designated (De), Population Fragmentation (PF)

** Including the following coastlines: Golden Bay, Tasman Bay, Outer Sounds, Kapiti Coast, Whanganui, South Taranaki

*** Species unspecified, but have assumed pygmy blue whale based on available ecological data

**** Habitat modelling did not distinguish between long-finned and short-finned pilot whales, given the higher representation of long-finned pilot whales in the sighting and stranding record, these model results are biased towards long-finned pilot whales.

◊ Species listed in Schedule 4 of the PRCP for Taranaki: indigenous species identified as being regionally significant for their coastal indigenous biodiversity values

APPENDIX E

Seabirds Potentially Present in Kupe IAA

New Zealand Seabirds and Potential Presence in Kupe IAA

Common Name	Scientific Name	IUCN Threat Status [1]	NZ Threat Status [2]	Seasonality [3]	Breeding Season [3]	Breeding locations in STB [3]
Antipodean albatross*	*Diomedea antipodensis antipodensis*	Endangered	Nationally critical	Year-round.	Not available.	Does not breed in area.
Black-billed gull	*Larus bulleri*	Near threatened	Nationally critical	Year-round.	August – March	Unlikely within STB but cannot be ruled out.
Gibson's albatross	*Diomedea antipodensis gibsoni*	Endangered [4]	Nationally critical	Year-round.	Not available.	Does not breed in area.
Salvin's mollymawk	*Thalassarche salvini*	Vulnerable	Nationally critical	Occurs throughout NZ waters during breeding season	August – April	Does not breed in area.
Black-fronted tern*	*Chlidonias albostriatus*	Endangered	Nationally Endangered	Disperses to coastal areas after breeding season.	October – January	Does not breed in area.
Black petrel*	*Procellaria parkinsoni*	Vulnerable	Nationally vulnerable	Migrate to South American waters outside breeding season.	October – July	Does not breed in area.
Campbell Island mollymawk	*Thalassarche impavida*	Vulnerable	Nationally vulnerable	Common around Cook Strait in summer.	August – May	Does not breed in area.
Caspian tern*	*Hydroprogne caspia*	Least concern	Nationally vulnerable	Year-round.	September - January	Potentially throughout distribution.
Flesh-footed shearwater*	*Puffinus carneipes*	Near threatened	Nationally vulnerable	Migrate to North Pacific Ocean after breeding season.	September - May	Does not breed in area.
Grey-headed mollymawk*	*Thalassarche chrysostoma*	Endangered	Nationally vulnerable	Potentially seasonal during austral autumn.	September – May	Does not breed in area.
Hutton's shearwater	*Puffinus huttoni*	Endangered	Nationally vulnerable	Mostly absent from NZ waters outside breeding season.	October – March	Does not breed in area.

Common Name	Scientific Name	IUCN Threat Status [1]	NZ Threat Status [2]	Seasonality [3]	Breeding Season [3]	Breeding locations in STB [3]
Little blue penguin*	*Eudyptula minor*	Least concern	At risk - Declining	Year-round.	July – February	Along coastline throughout distribution.
Red-billed gull*	*Larus novaehollandiae scopulinus*	Least concern [4]	At risk - Declining	Year-round.	September - January	Potentially throughout distribution.
Sooty shearwater/Muttonbird*	*Puffinus griseus*	Near threatened [4]	At risk - Declining	Migrates to North Pacific Ocean after breeding.	September – May	Potentially throughout distribution.
White-capped/shy mollymawk	*Thalassarche cauta steadi*	Near threatened [4]	At risk - Declining	Present throughout coastal NZ during breeding season.	November – June	Does not breed in area.
White-fronted tern*	*Sterna striata striata*	Near threatened [4]	At risk - Declining	Year-round.	October - January	Potentially throughout distribution.
Little shearwater	*Puffinus assimilis haurakiensis* [5]	Least concern	At risk - Recovering	Year-round.	Not available.	Does not breed in area.
Northern giant petrel*	*Macronectes halli*	Least concern	At risk - Recovering	Potentially seasonal during winter and early spring but may be present year-round.	August – February	Does not breed in area.
Pied shag*	*Phalacrocorax varius varius*	Least concern [4]	At risk - Recovering	Year-round.	Throughout year.	Potentially throughout distribution but unlikely in STB.
Sooty tern*	*Onychoprion fuscata serratus*	Least concern [4]	At risk - Recovering	Rare visitor to NZ waters, remaining well offshore outside breeding season.	October – December	Does not breed in area.
Broad-billed prion*	*Pachyptila vittata*	Least concern	Relict	Year-round.	August – January	Does not breed in area.
Cook's petrel	*Pterodroma cookii*	Vulnerable	Relict	Migrate to North Pacific outside breeding season.	September – April	Does not breed in area.

Common Name	Scientific Name	IUCN Threat Status [1]	NZ Threat Status [2]	Seasonality [3]	Breeding Season [3]	Breeding locations in STB [3]
Fairy prion*	*Pachyptila turtur*	Least concern	Relict	Year-round.	October - February	Does not breed in area.
Fluttering shearwater*	*Puffinus gavia*	Least concern	Relict	Year-round.	August – January	Potential to be recolonising within STB towards Cook Strait.
Grey-backed storm petrel	*Garrodia nereis*	Least concern	Relict	Range further offshore outside breeding season.	September – April	Does not breed in area.
Mottled petrel	*Pterodroma inexpectata*	Near threatened	Relict	Rare near NZ waters as forages well offshore during breeding season and migrates to North Pacific after breeding.	December – May	Does not breed in area.
Northern diving petrel*	*Pelecanoides urinatrix urinatrix*	Least concern [4]	Relict	Year-round.	August - December	Major colony at Sugar Loaf Islands, North Taranaki.
White-faced storm petrel*	*Pelagodroma marina maoriana*	Least concern [4]	Relict	Present only in breeding season, migrating to eastern Pacific after breeding.	August – April	Potentially throughout distribution.
Antarctic prion*	*Pachyptila desolata*	Least concern	Naturally uncommon	Disperse widely around Southern Ocean after breeding.	Not available.	Does not breed in area.
Black shag*	*Phalacrocorax carbo novaehollandiae*	Least concern [4]	Naturally uncommon	Year-round.	Throughout year	Potentially throughout distribution.
Brown skua/southern skua	*Catharacta antarctica lonnbergi*	Least concern	Naturally uncommon	Present outside breeding season.	September – February	Does not breed in area.
Buller's mollymawk	*Thalassarche bulleri bulleri*	Near threatened	Naturally uncommon	Migrates to Peru and Chile after breeding.	January – September	Does not breed in area.

Common Name	Scientific Name	IUCN Threat Status [1]	NZ Threat Status [2]	Seasonality [3]	Breeding Season [3]	Breeding locations in STB [3]
Buller's shearwater*	*Puffinus bulleri*	Vulnerable	Naturally uncommon	Migrate to North Pacific Ocean after breeding.	September – May	Does not breed in area.
Grey petrel	*Procellaria cinerea*	Near threatened	Naturally uncommon	Migrates to Peru outside breeding.	April – November	Does not breed in area.
Northern royal albatross*	*Diomedea sanfordi*	Endangered	Naturally uncommon	Majority spend non-breeding season off southern South America.	Not available.	Does not breed in area.
Little black shag	*Phalacrocorax sulcirostris*	Least concern	Naturally uncommon	Year-round but disperse wider in autumn.	October - December	Potentially throughout distribution.
Snare's petrel	*Daption capense australe*	Least concern [4]	Naturally uncommon	Year-round	November – February	Does not breed in area.
Southern royal albatross*	*Diomedea epomophora*	Vulnerable	Naturally uncommon	Potentially year-round.	Not available.	Does not breed in area.
Westland petrel	*Procellaria westlandica*	Endangered	Naturally uncommon	Most likely present in winter but can be present year-round.	March – December	Does not breed in area.
Arctic skua	*Stercorarius parasiticus*	Least concern	Migrant	Present in NZ waters in austral summer.	Not available.	Does not breed in area.
Blue petrel	*Halobaena caerulea*	Least concern	Migrant	Rare visitor but occasionally washes up in large numbers in late winter and spring.	Not available.	Does not breed in area.
Cape pigeon/petrel	*Daption capense capense*	Least concern [4]	Migrant	Year-round	November - February	Does not breed in area.
Kerguelen petrel	*Lugensa brevirostris*	Least concern	Migrant	Rarely seen in NZ but strand ashore in winter and spring.	Not available.	Does not breed in area.

Common Name	Scientific Name	IUCN Threat Status [1]	NZ Threat Status [2]	Seasonality [3]	Breeding Season [3]	Breeding locations in STB [3]
Medium-billed/Salvin's prion	*Pachyptila salvini*	Least concern	Migrant	Often storm-wrecked on beaches in late winter.	Not available.	Does not breed in area.
Narrow-billed prion	*Pachyptila belcheri*	Least concern	Migrant	Low numbers found storm-wrecked on beaches in late winter.	Not available.	Does not breed in area.
Pomarine skua	*Coprotheres pomarinus* [6]	Least concern [4]	Migrant	Present in austral summer.	Not available.	Does not breed in area.
Short-tailed shearwater	*Puffinus tenuirostris*	Least concern	Migrant	Present at sea off mainland NZ from October – January and in May.	Not available.	Does not breed in area.
Snowy albatross	*Diomedea exulans*	Vulnerable	Migrant	Not available.	Not available.	Does not breed in area.
Southern giant petrel	*Macronectes giganteus*	Least concern	Migrant	Likely to range to NZ waters in winter to early spring.	Not available.	Does not breed in area.
White-winged black tern	*Childonias leucopterus*	Least concern	Migrant	Summer.	Not available.	Does not breed in area.
Wilson's storm petrel	*Oceanites oceanicus exasperatus*	Least concern [4]	Migrant	Seasonality not described; however, pass through NZ waters during migration to/from non-breeding feeding areas.	November – April	Does not breed in area.
Wedge-tailed shearwater	*Puffinus pacificus chlororhynchus*	Least concern [4]	Vagrant	Rarely reaches NZ waters but few records outside breeding season.	October – May	Does not breed in area.

Common Name	Scientific Name	IUCN Threat Status [1]	NZ Threat Status [2]	Seasonality [3]	Breeding Season [3]	Breeding locations in STB [3]
Black-browed mollymawk	*Thalassarche melanophris*	Least concern	Coloniser	Disperses widely outside NZ waters outside breeding season. More common in winter.	September – May	Does not breed in area.
Indian ocean yellow-nosed mollymawk	*Thalassarche carteri*	Endangered	Coloniser	May be present in winter.	Not available.	Does not breed in the area.
Australasian gannet	*Morus serrator*	Least concern	Not threatened	Year-round.	August - March	Potential for small colonies throughout distribution, typically on offshore islands.
Grey-faced petrel*	*Pterodroma macroptera gouldi*	Least concern [4]	Not threatened	Disperse across Tasman Sea during summer moult period.	March – January	Potentially within STB. Large colony at Sugar Loaf Islands, North Taranaki.
Southern black-backed/Kelp gull	*Larus dominicanus dominicanus*	Least concern [4]	Not threatened	Year-round.	September - March	Potentially throughout distribution.
Spotted shag	*Stictocarbo puncatus puncatus*	Least concern [4]	Not threatened	Year-round.	Potentially year-round.	Potentially throughout distribution.
Little shag	*Phalacrocorax melanoleucos brevirostris*	Least concern [4]	Not threatened	Year-round.	August - March	Potentially throughout distribution.
White-chinned petrel	*Procellaria aequinoctialis*	Vulnerable	Not threatened	Potentially year-round but moves northward to more subtropical waters following breeding season.	November – May	Does not breed in the area.
White-headed petrel	*Pterodroma lessonii*	Least concern	Not threatened	Moves north from Antarctic waters outside breeding season.	November – June	Does not breed in area.

1 IUCN Red List https://www.iucnredlist.org/

2 Robertson *et al*., 2017

3 New Zealand Birds Online, 2021

4 Scientific names are based on those provided in the New Zealand Threat Classification System (Roberston *et al*., 2017) and differ to those listed on the IUCN Red List. The IUCN Red List is generally at species level while Robertson *et al*. (2017) goes further to sub-species level.

5 Identified within Thompson (2015) as '*P. assimilis*'; however, the New Zealand Threat Classification System identifies three sub-species of little shearwater; *P. assimilis haurakiensis, P. assimilis kermadecensis, P. assimilis assimilis*. For this analysis it has been assumed that *P. assimilis haurakiensis* (North Island little shearwater) has been assumed.

6 *Coprotheres pomarinus* is the scientific name for Pomarine skua within Robertson *et al*., 2017; however, this bird is also referred to as the Pomarine jaeger (*Stercorarius pomarinus*).

* Species that have been identified within the PRCP for Taranaki as regionally significant on account of their coastal indigenous biodiversity values

APPENDIX F

Cultural Impact Assessment

CULTURAL IMPACT

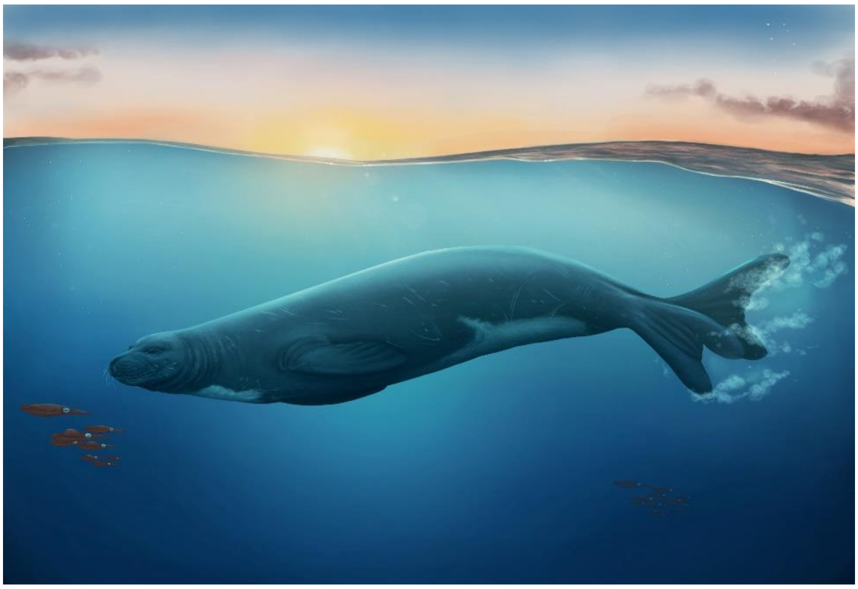
ASSESSEMENT

Ngāruahine me Ngāti Ruanui

Beach Energy Resources

Kupe Phase 2 Development Drilling

Programme 2021



Contents

2. Introduction of Ngāti Ruanui

Ko Aotea te waka

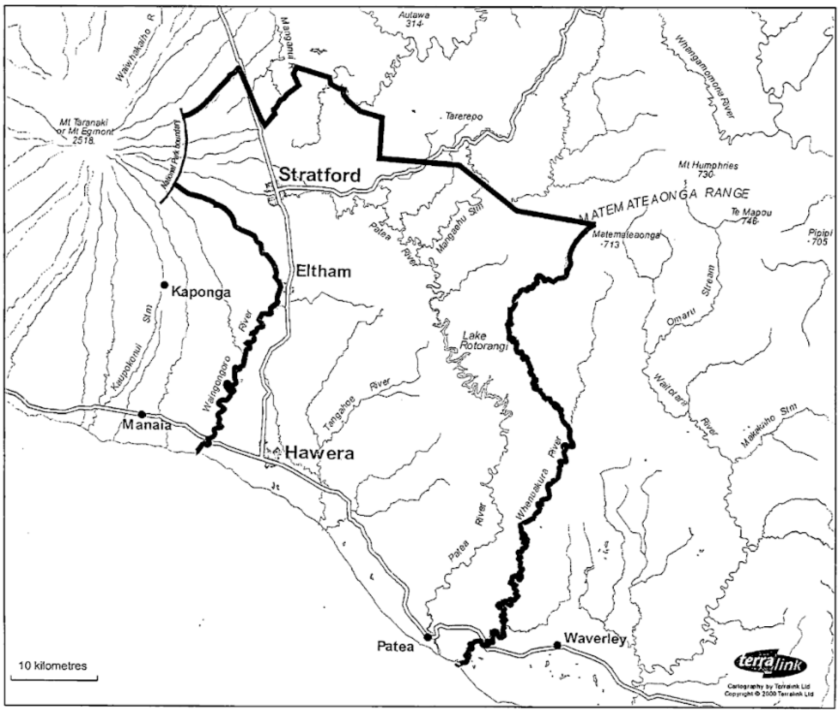
Ko Turi te tangata ki runga

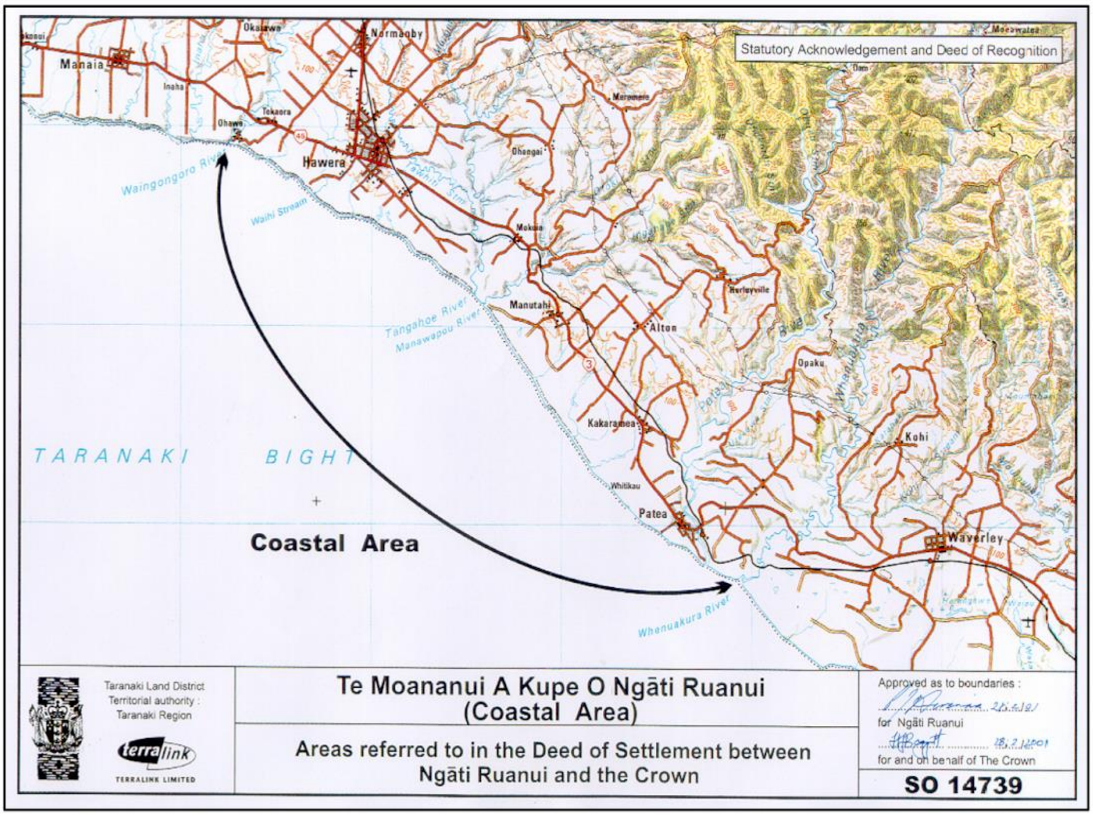
Ko Taranaki te maunga

Ko Patea te awa

Ko Ngāti Ruanui te iwi

The ro'e of Ngāti Ruanui begins at the Whenuakura River, south of the Patea River. From the Whenuakura River, the ro'e reaches inland to Whakaahurangi and back to the coast to wa'apū o te awa o Waingongoro (mouth of the Waingongoro River). The coastline interests of Ngāti Ruanui extend from the mouth of the Whenuakura River north to the Waingongoro River and beyond to the Tasman Sea (refer maps included below of Area of Interest, Statutory Acknowledgement Area Te Moananui A Kupe O Ngāti Ruanui, and the iwi Takutai Moana Claim area of interest).





Kilometers
0 3.75 7.5 15

Scale: 1:320,000

Te Rūnanga o Ngāti Ruanui Trust

Determination-Customary Marine Title and Protected Customary Rights

Map: Individual Map Active Areas V16
Date: 6/12/2016

2.1 Ngā Hapū o Ngāti Ruanui:

- Araukūku
- Kōtuku
- Ngāti Ringi
- Ngāti Tūpito
- A'ita'i
- Ngā Ariki
- Ngāti Takou
- Rangitaaw'i
- 'amua
- Ngāti 'awe
- Ngāti Tanewai
- Tuata'i
- 'apotiki
- Ngāti 'ine
- Ngāti Tūpaea
- Tūw'akae'ū

2.2 Ngā Marae:

- Manuta'i
- W'enuakura
- Wai-o-turi
- Pariroa Pa
- Ngaatiki
- Meremere
- Whakaa'urangi
- Taiporo'enui
- W'arepuni
- Ketemarae

2.3 Te Rūnanga o Ngāti Ruanui Trust

Te Runanga o Ngāti Ruanui Trust is the mandated voice of Ngāti Ruanui and comprised of a representative of the 16 ʻapū that form Ngāti Ruanui.

In 2003, the Ngāti Ruanui Claims Settlement Act was legislated and is now the empowering legislation of Ngāti Ruanui.

In May 2001, the Crown signed a Deed of Settlement with Ngāti Ruanui at the Pariroa Pa recognising and acknowledging the wrong that had been done to them by the settler and succeeding governments to the present day. In 2003, the Ngāti Ruanui Claims Settlement Act was passed. The Ngāti Ruanui Claims Settlement Act 2003 (Treaty claims) is made up of a package that includes; an apology from the Crown, cultural and commercial redress. Our Treaty claims also includes recognition of areas of interest (including taonga species, culturally significant sites, and statutory acknowledged areas), commercial and cultural redress and Deed of covenant. The Ngāti Ruanui Treaty claims commit the decision-maker to recognise implications of the proposed exploration permit on our special traditional relationship with taonga species referred to in Appendix 1. This is in accordance with Section 4 of the Crown Minerals Act 1991. Taonga species with abundant distributions within the South Taranaki Bight (STB) known to Ngāti Ruanui and local fishers (that coincide with the proposed exploration area) include (but not limited to) lemon sole, octopus, crabs, shrimps, and flatfish (flounder).

Ngāti Ruanui recognises the mandate, jurisdiction and responsibilities of the Taranaki Regional Council to protect the coastal environment out to the 12 nm territorial limit, and of the Environmental Protection Authority (EPA) in protecting the marine and coastal environment to the 200nm EEZ and ECS. Ngāti Ruanui specifically endorses the Exclusive Economic Zone and Extended Continental Shelf (Environmental Effects) legislation including greater environmental control by the Environmental Protection Agency.

2.4 Ngāti Ruanui History

In the twelfth century, the people of the Aotea Waka arrived in the area of Patea after leaving the Pacific island of Rangiātea. The Arikinui of the waka was Turi who travelled with his wife Rongorongo. The waka originally made landfall at Kāwhia whereby Turi and his people travelled over land until they came to Patea where they settled on the south bank of the Patea River. Taneroroa, the daughter of Turi married Uenuku-Puanake of the Takatimu waka. The descendants of Ruanui are named after their son, Ruanui. Ruanui was also the name given to an ancestor who resided in Rangiātea. Within a few generations, the descendants of Ruanui formed the main tribe in South Taranaki.

As acknowledged in the Ngāti Ruanui Claims Settlement Act (2003) in the Pre-1860 period (1840s and 1850s) Ngāti Ruanui were prosperous and economically successful. The iwi traded extensively with European settlements and overseas traders. Following the signing of the Treaty of Waitangi, Ngāti Ruanui consistently opposed the sale of Maori land in Taranaki. By the mid-1860s, Ngāti Ruanui and other iwi of Taranaki and elsewhere had entered into a compact to oppose further land sales. By 1860, no Ngāti Ruanui land had been sold to the Crown.

However, the Taranaki wars during the 1860s and the defence of ancestral lands resulted in a huge loss, of both life and property. And after the New Zealand Settlements Act 1863 was enacted to affect the confiscation of lands of Maori whom the Crown assessed to have been engaged in "rebellion" against the authority of the Queen, in 1865, the Governor of New Zealand confiscated much of the land of Ngāti Ruanui. The confiscation proclamation of 2 September 1865 declared all of southern Taranaki an "eligible site", liable to be used for the purposes of European settlement. During 1865, some 1.2 million acres of Taranaki land was proclaimed 'confiscated' under the Act. This included almost all of the coastal lands of Ngāti Ruanui.

Customary use of coastal waters and the wider oceans are evident in Ngāti Ruanui traditional songs and stories. For example, near Patea is Parara ki Te Uru, Patea Beach, a well-known site (recorded in the song 'No Runga') where ancestors Turi and Rongorongo sustained their hapu by growing gardens and gathering seafood including pupu in the mudflats. Further up the coast is Whitikau (a fishing village) where Turi and Rongorongo daughter Taneroroa lived sustaining the next generation of the hapu. Manawapou, further along the coast is a significant waahi tapu where the Wharenui Manawapou was built to host the meeting of the Rangātira from where the w'akatauaki 'Te Tangata Too Mua, Te W'enua Too Muri' was derived.

Post confiscation, many Ngāti Ruanui 'apū were moved beyond the 10-mile confiscation line and were forced to settle inland thereby limiting access to the coastal areas, coastal resources (including petroleum and minerals) and the food basket provided by the oceans.

3. Special Associations (Ngāti Ruanui Claims Settlement Act 2003)

Statutory Acknowledgement of the Cultural, spiritual, historical, and traditional association of Ngāti Ruanui with Te Moananui A Kupe O Ngāti Ruanui

The resources found within Te Moananui A Kupe have, since time immemorial, provided the people of Ngāti Ruanui with a constant supply of food resources. The hidden reefs provided koura, paua, kina, pupu, papaka, pipi, tuatua, and many other species of reef inhabitants. 'apuka, moki, kanae, mako, and patiki swim freely between the many reefs that can be found stretching out into the spiritual waters of Te Moananui A Kupe and along the Ngāti Ruanui coastline.

Names such as Rangatapu, Ohawe Tokotoko, Waihi, Waokena, Tangahoe, Manawapou, Tauma'a, Manuta'i, Pipiri, Kaikura, W'itikau, Kenepuru, Te Pou a Turi, Rangitaaw'i, and W'enuakura depict the whereabouts of either a fishing ground or fishing reef.

All along the shoreline from Rangatapu to W'enuakura food can be gathered, depending on the tides, weather, and time of year.

Tragedies of the sea are also linked to these reefs. Ngāti Ruanui oral history records the sinking off Tangahoe of a Chinese trade ship that had just been loaded with a cargo of flax. When the bodies were recovered and brought to shore, none of them had any eyes.

The people of Ngāti 'ine believe that they did something wrong and in turn were punished by the Ngāti Ruanui taniwha named Toi, kaitiaki (guardian) of the fishing reefs and grounds, who is renowned to this day to eat the eyes of his victims.

Statement by Ngāti Ruanui of cultural, spiritual, historical, and traditional association of Ngāti Ruanui with Nga Taonga a Tane raua ko Tangaroa

The w'aikorero (oral history) of our tupuna of old, and now honoured by each generation, thereafter, places the utmost importance on the role of Ngāti Ruanui as kaitiaki (guardians) for all the life forms of the environment. Ngāti Ruanui have always believed that the environment, including all indigenous species of fish, flora, and fauna, are interrelated through whakapapa and are all precious to Ngāti Ruanui. All species are important, and all play their role within the environment. The integration of all species in the environment is woven within the holistic pattern of life itself. Ngāti Ruanui as a people are part and parcel of the environment itself.

Ngāti Ruanui recognise that any negative effects on one species may cause ill effects for other species. Ngāti Ruanui continue to maintain a kaitiaki (guardian) role to look after all species within our environment.

The mauri (life force) of all species is important to Ngāti Ruanui, the essence that binds the physical and spiritual elements of all things together, generating and upholding all life. All species of the natural environment possess a life force, and all forms of life are related.

4 Overview of Ngāti Ruanui history and associations relevant to Petroleum Mining

As outlined, Ngāti Ruanui has a traumatic history of land confiscations, alienation from its ro'e moana and resources including offshore petroleum and minerals (including but not limited to the Kupe gas project), exploitation by others of its petroleum and mineral resources (and subsequent impacts on wider resources including taonga fish and marine mammal species), and disregard and disrespect of Ngāti Ruanui rangātiratanga and mana motuhake.

Coastal areas including offshore areas are now captured by oil rigs, production wells, production stations, that are owned by other parties, all impacting upon Ngāti Ruanui access of the marine and coastal resources (petroleum, minerals, kaimoana etc.) within its rohe moana and tribal authority. As shown in the maps of Ngāti Ruanui coastal ownership and interests above, the Petroleum Mining Licence No.38146 is located within the Ngāti Ruanui Ro'e Moana;

Ongoing exploration and permitting is a contemporary form of confiscation from Ngāti Ruanui. Associated activities have subsequent impacts on customary areas, its cultural landscape, and taonga species (among other impacts). Therefore, as Treaty partner, the iwi seeks to exercise its rangātiratanga and protect its rights and interests.

"Mineral exploration and permitting has the potential impact of further confiscation to Ngāti Ruanui and we will continue to exercise our right as Treaty Partners to protect those rights"

Under Part 5 of the Ngāti Ruanui settlement, the Ministers of Energy, Conservation, Fisheries, and Arts, Culture and Heritage were to establish protocols with the iwi. (*Note - The extent of the current protocol with the Minister of Energy, and its significance for this consent application is unknown and should be followed up with Ngāti Ruanui).

5. Introduction of Ngāruahine

Introduction of Ngāruahine

Mai Tangaroa ki Tawhiti pamaomao, Hawaiki pamaomao

Tawhitiroa, Hawaikiroa, Tawhitinui, Hawaikinui, ki Aotearoa

E tu, e tu ki uta

E tu, e tu ki tai

Tae noa ki te ngutu awa o Waingongoro ki Taungatara

Piki ake ki te tihi o Maunga Taranaki

Huri noa ki te Tonga

Haere tonu ki te Awa o Waingongoro, o Ngāruahine, Ngāruahinerangi

E pai, te pononga pai

E kotiti, te pononga pai

Haumi e! Hui e! Taiki e

The rohe of Ngāruahine begins from te tihi o te maunga. From there it moves through the Waingongoro river and Taungatara stream to their respective coastal mouths. From there it extends to Hawaikinui, Tawhitinui, Hawaikiroa, Tawhitiroa, Hawaiki pamaomao, Tawhiti pamaomao.

5.1 Ngā Hapū me Ngā Marae o Ngāruahine

The Hapū of Ngāruahine are mana whenua mana moana within their takiwā. They have held, and continue to hold, ahikāroa (long occupation) since the original inhabitants first settled the land.

Hapū	Marae
Kanihi-Umutahi	• Kanihi-Mawhitiwhiti & Rangatapu
Ōkahu-Inuawai	• Aotearoa & Rangatapu
Ngāti Manuhiakai	• Te Aroha o Tītokowaru
Ngāti Tū	• Waiokura
Ngāti Hāua Piko	• Tawhitinui & Okare ki Uta
Tamaahuroa-Tītahi	• Oeo

5.2 Ngāruahine History

The Hapū of Ngāruahine claim lineage to a host of ancestral vessels that settled this coast including Te Wakaringaringa, captained by Mawakeroa, Te Rangiuamutu, captained by Tamatea Rōkai and Aotea Utanganui captained by Turi Arikinui. It was Turi who re-named many of the places along the west coast as he travelled from Kāwhia Moana to settle in the location of the present town of Pātea.

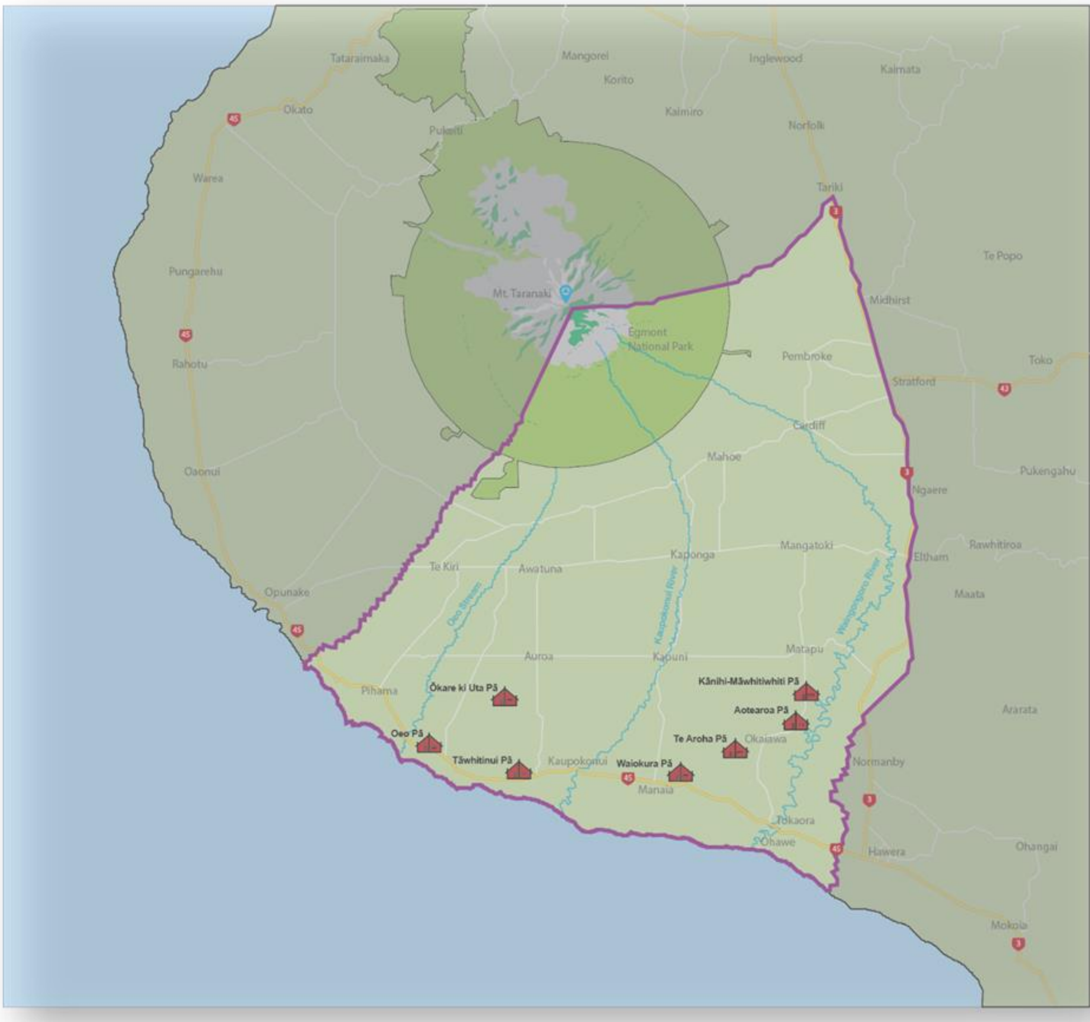
The Ngāruahine worldview is shaped by religious beliefs, cultural values and kinship ties to the environment. It has also been shaped by personal and collective experiences of dipossession, marginalisation, and cultural oppression. Ngāruahine were an economically successful and prosperous people prior to 1860, in full possession of our lands, seas and resources. These resources were not a commodity, but were the means of sustenance, heritage and continuity. Tenure was exercised by those who had both the skill and whakapapa needed. Resource management systems ranged from crop production to gathering mahinga kai at the appropriate times of the year.

As with other Iwi and Hapū throughout Aotearoa, Ngāruahine has been subject to economic underdevelopment and non-development for over 160 years. Our rights, resources and aspriations for self-determination have been subsumed by a state created without our meaningful input. The effects of colonisation have been as constant as they have been destructive. Well-known Crown acts and omissions of the 19th and 20th centuries have negatively impacted many areas of Ngāruahine life.

Multiple generations of Ngāruahine have suffered from the effects of resource dispossession which manifest as circumstances of poverty, poor housing, and degraded physical and spiritual health.

While the area concered (PML 38146) is delimited within a spatial context, the entire sea is considered as a connection to our past, our tūpuna and to the ongoing relationship to our whanaunga in the pacific. These waters were historically navigated by our ancestors as they travelled the oceans to Te Wai Pounamu and the pacific. Ngāruahine share close whakapapa links with neighbouring Iwi Taranaki Tūturu and Ngāti Ruanui.

5.3 Map of Ngāruahine



5.4 Kanihi-Umutahi Hapū

According to Kanihi tribal history, the people of Kanihi-Umutahi are the descendants of the tangata whenua tribes who landed at Te Rangatapu on the Te Rangiuamutu waka, captained by Tamatea-Rokai. The descendants of Kanihi-Umutahi also claim ancestry from the Aotea Utanganui waka which was captained by Turi-te-Ariki-nui.

Kanihi-Umutahi has a very close relationship with the people of Okahu-Inuawai, not only because of the physical proximity to one another, but because of their shared inter-Hapū ancestry.

The Kanihi-Umutahi people have historically resided on both the western and eastern banks of the Waingongoro River. The ancient pa, Kanihi takes its name from the tribe's people and is located on the eastern bank of the Waingongoro River on a block of land known as Te Rua o te Moko.

In addition to having its own mana motuhake, Kanihi Umutahi is also a Hapū of Ngaruahine and has whakapapa relationships with other Hapū of Ngaruahine.

The awa within the takiwā of Kanihi-Umutahi Hapū were once abundant with fish species resources, including tunaheke, piharau, kahawai, inanga, pakotea and kokopu.

The continued drilling activity within the Ngāruahine rohe has seen the slow decline of these natural resources and has an overarching impact on our mana, our whenua and our kaitiaki cultural values as a people.

The people of Kanihi-Umutahi are guided by these values and we expect Beach Energy to understand and protect these values including but not limited to, maunga, urupa, wāhi tapu, awa, moana, taonga, kohatu, coastlines and seabed. All the while upholding the tikanga o Kanihi-Umutahi Hapū and the interets held by whanaunga Hapū o Ngāruahine.

Mana Motuhake: the right of Hapū to determine their own future and govern their own development and affairs,

Whanaungatanga: Recognise that the Hapu has close and historical links with all other Hapū within Ngāruahine, and historical links with other Iwi.

Tikanga – the Tikanga of the Hapū is to be upheld.

Kotahitanga: the Hapū supports the value of unity and pursuing common opbjectives with their whanaunga Hapū o Ngāruahine.

Allen Webb - Kanihi-Umutahi Hapū Chair

5.5 Te Korowai o Ngāruahine Trust

Efforts by earlier generations to survive and overcome the injustices of the late 1800's achieved momentum through the work of organisations such as the Taranaki Māori Trust Board, Ngāruahine Iwi Authority, Ngāruahine Muru me te Raupatu, and Ngā Hapū of Ngāruahine.

Te Korowai o Ngāruahine Trust (Te Korowai) was established in 2013 and subsequently mandated as the post settlement governance entity for Ngāruahine Iwi under the Ngāruahine Claims Settlement Act 2016.

Besides giving effect to the Ngāruahine Settlement Legislation, the trustees of Te Korowai also have a responsibility to:

- foster spiritual values, unity, support and co-operation amongst uri of Ngāruahine.
- advance the cultural, physical, social, and economic wellbeing of Ngāruahine Iwi members.
- hold and apply the treaty settlement in accordance with the provisions of the Trust Deed.
- be the voice and representative body for Ngāruahine Iwi.
- perfom the functions of a mandated iwi organisation and iwi aquaculture organisation in accordance with the Māori Fisheries Act 2004 and Māori Commercial Aquaculture Claims Settlement Act 2004 respectively.

As part of implementing its Deed of Settlement, Te Korowai has produced Te Uru Taiao o Ngāruahine (Ngāruahine Kaitiaki Plan). This plan sets out the environmental issues of significance to Ngāruahine and our preferred outcomes for the environment. This plan stipulates, as a general principle, that where the effects of an activity are not fully understood or quantifiable, a precautionary approach is used as the default.

6 Special Associations (Ngāruahine Claims Settlement Act 2016)

In its apology the Crown acknowledged that the lands and other resources confiscated from Ngāruahine have made a significant contribution to the wealth and development of New Zealand. The Crown also acknowledged that envionmental degradation of Ngāruahine lands, waterways and coastal waters, including deforestation, freshwater and marine pollution, and the diplacement of indigenous plants and animals from the effects of the dairy industry, resource extractive industries and other causes is a source of great distress for Ngāruahine.

7 Overview of Ngāruahine history and associations relevant to Petroleum Mining

In 1937, Parliament passed the Petroleum Act to nationalise all petroleum resources in New Zealand and exclude land owners from recieving any royalties from commercial oil fields. Māori leaders and opposition politicians objected at the time that nationalisation of petroleum deprived Māori of the ability to earn royalties from the petroleum beneath their lands and was contrary to the principles of the Treaty of Waitangi.

In June 1999, the Waitangi Tribunal granted urgency to hear a claim lodged on behalf of Ngā Hapū o Ngāruahine including petoleum resources, natural gas and condensate located within their rohe (Waitangi Tribunal, 2003). Within these boundaries were two major gas condensate fields – the onshore Kapuni field and the offshore Kupe field. The Tribunal found that a treaty interest was created in favour of Māori for the loss of legal title by:

a) the alienation of land prior to 1937 by means that breached the Treaty principles, including by pre-Treaty land transactions, Crown purchases pre-1865, raupatu, Native Land Court processes, public work takings and takings for survey liens; and
b) expropriation of petroleum under the Petroleum Act 1937 without payment of compensation to landowners and without provision being made for the ongoin payment of royalties to them.

The Tribunal concluded that to exclude petroleum assets from settlements would be a further breach of the principles of the Treaty of Waitangi and recommended that the Crown withhold from sale the Kupe petroleum mining licence until either Māori interests were safeguarded or the petroleum claims were settled.

In November 2003, following consideration of the Tribunal's findings in the Petroleum Report, the Crown proceeded with the transfer of its 11 percent share in the Kupe field to Genesis Energy, with the Government stating that it did not agree with Tribunal's findings and recommendations.

The natural resources of South Taranaki make it one of the prosperous regions in New Zealand. Ngāruahine feel however that their ability to take advantage of these resources has been severely limited by historic Crown actions. Many Ngāruahine feel aggrieved about living in poverty while their rich lands and seas generate propsperity and economic growth.

This application is ocean based and therefore affects all Ngāruahine Hapū and our whanaunga Iwi Ngāti Ruanui. The comments made in regard to this application do not prevent Ngāruahine Hapū from providing their own cultural assessment nor do they attempt to undermine the mana of Ngāti Ruanui and their Hapū.

It is expected that Ngāruahine Hapū will have differing views and concerns about the proposal. This CIA does not purport to supplant the rights of those Hapū as mana whenua and mana moana of their respective rohe.

8 Summary of the Application

Beach Energy Resources NZ (Kupe) Limited (**Beach**) is proposing to undertake the Kupe Phase 2 Development Drilling Programme within Petroleum Mining Licence 38146 (**PML 38146**). PML 38146 is located in the South Taranaki Bight (STB), offshore and to the south of Manaia (refer Appendix 1).

Ngāti Ruanui hold mana moana over this area (refer **Fig. 1 and 2**).

Beach requires a marine consent and a marine discharge consent from the Environmental Protection Authority (EPA) under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act) to undertake various activities associated with the drilling programme.

Beach is preparing the consent application and the Impact Assessment. This Cultural Impact Assessment (CIA) is being prepared in parallel with this work and will need to assess the Impact Assessment also once it is completed.

The Kupe Phase 2 Development Drilling Programme is proposed to be undertaken in summer 2022/2023 when weather conditions in the South Taranaki Bight are most favourable and will involve several activities for which marine consent and marine discharge consents are required.

The drilling will be undertaken using a mobile offshore drilling unit (MODU). Beach has not yet contracted a specific MODU to undertake the drilling programme, however a jack up MODU is comprised of a buoyant hull that holds all the drilling equipment which is fitted with three to four moveable legs that are jacked down into the seabed to raise the hull out of the water.

The development well will be drilling through existing empty conductors on the Kupe WHP, meaning that direct drilling on the seafloor at this location is not required. The depth of the Kupe Phase 2 Development Drilling wells will be drilled down to approximately 3,370m True Vertical Depth Subsea (TVDSS).

All the drill cuttings, ground-up rock produced during the drilling of the development wells will be released from the jack up MODU deck into the sea where they will sink and settle on the seabed away from the Kupe WHP. The volume of cuttings produced during the drilling of the well depends on the diameter and lengths of well sections. Dispersal patterns for released drill cuttings will be influenced by a number of different factors, including water depth, release point, current speed and direction, and weather conditions at the time of the discharge. In order to determine an indication of the dispersal and deposition of the drill cuttings, Beach has commissioned Ocean Limited to model the dispersal and depositions of the drill cuttings from development wells. Various other supporting activities will be required during the Drilling Programme, including pre-drill works, (such as seabed surveys and geotechnical coring), formation evaluation techniques, use of supporting vessels and remotely operated vehicles and the subsequent environmental monitoring around the WHP.

In addition, various discharge streams will occur during the drilling operations, including the discharge of a small portion of drilling muds, cement, and other operational discharges (such as during completion operations). There will be a number of ‘harmful substances’ (those that are deemed to be ecotoxic to the aquatic environment) that will be discharged as part of the drilling operations, In addition, a marine discharge consent is required to discharge ‘deck drainage’ water which may contain residual amounts of harmful substances from the jack-up MODU to sea – this would only occur if there was a spill on the deck and the amount discharged would be very small (just the residual amounts left on the deck following the clean-up of a spill).

9 Cultural Impacts of the Proposed Application

9.1 Ngāti Ruanui Rights, Values, and Interests

Ngāti Ruanui rights, values and interests which form the basis in assessing and understanding culturally significant and sensitive ecosystem include:

- Tikanga - customary practice, values, protocols
- W'akapapa - ancestral lineage, genealogical connections, relationships, links to ecosystems
- Tino rangātiratanga - self-determination
- Mana w'enua - authority over land and resources
- Kaitiakitanga - environmental guardianship
- W'akakota'itanga - consensus, respect for individual differences and participatory inclusion for decision-making
- Mātauranga Māori – holistic world view, traditional knowledge
- Mauri - internal energy or life force
- Ki uta ki tai - interconnected resources and ecosystems from the mountains to the sea
- Taonga tuku I'o - intergenerational protection of highly valued taonga

9.2 Te Moana Uriuri Tangaroa Takapou W'ariki i Papatuanuku e Takoto Nei – Coastal and Marine Environment

Te Moana uriuri	The depths of the water including all the sea life
Tangaroa Takapou W'ariki	The mat of the ocean and everything on the seabed
I Papatuanuku E takoto nei	To the mother that embraces everything else

Ngāti Ruanui believe you only take from the sea what you need to live off.

The coastal and marine environment is a vital component of the plan as it encompasses a diverse and changeable range of ecosystems. The coastal and marine environment includes coastal wetlands, estuaries, and sand dunes, encompassing the foreshore and seabed extending to the 200 nautical mile Exclusive Economic Zone (EEZ) and Extended Continental Shelf (ECS).

Ngāti Ruanui has a longstanding association with the coastal and marine environment and the life forms found within it. The protection of fisheries, marine birds and marine mammals is important to Ngāti Ruanui in its role as kaitiaki. The coastal and marine area continues to provide a multitude of food resources to Ngāti Ruanui. The impact of the human habitation is longstanding and in recent times, the sceptre of mining of the oil and mineral industry in the coastal and marine areas has become more and more visible with potential long-term implications. Any new structures, occupations and developments within the foreshore and seabed areas will be carefully evaluated[1].

The objectives of Ngāti Ruanui for the coastal and marine environments include the duty to

- Minimise negative impacts on the coastal and marine environments.
- Minimise negative impacts on aquatic life forms, marine birds, and mammals.
- Traditional knowledge systems are acknowledged and protected.
- Protection of customary fisheries.
- Acknowledgement of mahinga kai through local planning documents.

9.3 Mahinga Kai

The ability of uri of Ngāti Ruanui to access its ma'inga kai sites must be protected both formally and informally. The ability to have a close relationship with tāonga species, not only through the understanding of their whakapapa and life cycles through mātauranga Māori, but also through the ability to uphold manaakitanga in the rohe of the iwi. The value of these species extends beyond a means for sustenance but also as indicators for interpreting the natural and spiritual world. The mana of an iwi or hapū can be directly correlated to the foods laid at collective gatherings. The 'special' kai of Ngāti Ruanui have been outlined earlier in this report, and the ability of Ngāti Ruanui to provide that kai is a symbol of their mana, their prowess, and their ability to uphold their responsibilities as mana whenua in their own rohe. These practices are not taken lightly in the Māori world. There are few insults that hit harder than not being able to provide a feast for manuhiri.

As a result of these relationships, which are described further when talking about the applications impact on whakapapa, having a drilling operation which can negatively impact the life cycle of benthic communities, water quality and pelagic species, marine animals, seabirds, and marine traffic is culturally abhorrent for Ngāti Ruanui.

[1] Ngāti Ruanui Environmental Management Plan 2012

The customary rights of Ngāti Ruanui are enshrined in legislation. The rights to access those sites will be severely diminished if they are not protected from pollution and poaching. Clear acknowledgement of these rights through local planning documents provides a practical outcome to the intent of the Crown[2]. These rights will be negatively impacted by any activities in the EEZ which will impact the mauri and wellbeing of our tāonga species.

Taonga species with abundant distributions within the South Taranaki Bight (STB) known to Ngāti Ruanui and local fishers (that coincide with the proposed exploration area) include (but not limited to) lemon sole, octopus, crabs, shrimps, and flatfish (flounder). Large cockles, Tucetona laticostata, a taonga shellfish which played an important role in customary fishing (also biogenic reef forming specie) are locally known to live buried in the sediments within the proposed exploration area. Exploration activities could result to fragmentation and dispersal of valves of cockles, damaging live or dead shells. Dead shells create biogenic habitats for myriad smaller invertebrates and juvenile fish[3]. The areas "in and around" the Patea Shoals is also called as Rolling grounds because of its undulating seafloor. The areas are known to Ngāti Ruanui and local fishers as nursery grounds (seafloor) with abundant juvenile fish (presence of biogenic habitats). There are a range of sensitive areas that are important both from a western biodiversity point of view, but also through the whakapapa of Ngāti Ruanui directly to these tāonga species. It is essential that the whakapapa of these tāonga species are protected and enabled to thrive without being disrupted by the discharges and activities proposed in the application.

Taonga fish species that migrate between fresh and salt water, particularly in the STB as a necessary part of their life cycle include longfin eel (at-risk, declining specie), piharau/kanakana, īnanga, kōaro, kanae, and smelt. The Ministry for the Primary Industries' catch data from 2005 to 2016 (refer to Appendix 2) confirms that the STB are migration routes for taonga species. Besides this, taonga species also include indigenous birds, flora, and fauna of special cultural importance to Ngāti Ruanui.

Tuna is one of the largest eels in the world and it is found only in the rivers and lakes of New Zealand. The ideal way to protect and enhance the state of the tuna population is to ensure that the number of breeding adults successfully make their way out to the Pacific Ocean (15-30 years for shortfins, 25 years for longfins, and sometimes up to 80 years) to breed and die; and the number of young eels that have swum up into estuaries or coastal rivers to find suitable habitat and to replace breeding adults[4].

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[2] Ngāti Ruanui Environmental Management Plan 2012
[3] Submission on Exploration Permit Application 60510.01 19 November 2019
[4] Submission on Exploration Permit Application 60510.01 19 November 2019

i. Sensitive Habitats

Ngāti Ruanui and local fishers have developed detailed knowledge of our fishing grounds, often built up over many years. Local traditional knowledge about the environment and fish catch confirms that corals (including bryozoans), live and dead scallop and cockle beds, orange and brown 'sponge weeds or algae, kelp forests, tube worm fields, and horse mussels are found within the STB.

The areas described by Ngāti Ruanui fishers as shell hash, cockle and scallop beds roughly coincided with Glycymeris, Scalpomactra, and Tucetona. The sponge and coral areas coincide with bryozoan, Talochlamys, and Tucetona. Gillespie & Nelson (1996) further described surficial sediment facies, the bulk of which was described as being fresh and originating from bryozoans and bivalves.

The Cawthron's research work (2016) on sensitive habitats, prepared on half of the applicant, indicated the presence of five threatened invertebrate species and four threatened coral Madrepora oculata within the proposed exploration area and surrounds. The Taranaki Regional Council (2016) has identified 66 sensitive sites along the Taranaki coast. Many of these and other sensitive or potentially sensitive habitats, and various bryozoan rubble and bivalve beds to the east and southeast of the applicant's existing marine consent and marine discharge consent (currently at the Court of Appeal) and adjoining proposed exploration area.

There are grave concerns for the well being of these species as a result of the drilling and specifically the impact of the deposition of the drill cuttings, the impact of contaminants on these species and the overall impact of the activities on the mauri of these species and their environment (which will be further discussed later in this report). In particular, the proposed activities and the damage associated with drilling on benthic habitats includes direct contact, overturning stones to which they are attached, mixing of epifauna into sediment and smothering. Hence, likely to impact on our customary practice and loss of taonga species. Currently, there is no conservation strategies (such as Ministry of Fisheries Quota Management System) for seabed communities including shellfish. Therefore, a precautionary approach should be adopted by excluding known habitats from exploration activities[5].

ii. Endangered or Critically Endangered Species

Most of our marine bird species are threatened with or at risk of extinction, including species of albatrosses, penguins, and herons. More than one-quarter of our marine mammal species are threatened with extinction, including the New Zealand sea lion and species of dolphins and whales. These animals have important roles in marine ecosystems and are tāonga (treasures) to Ngāti Ruanui. Their fragile state is due to multiple historic and present-day pressures, such as seabed mining and

[5] Submission on Exploration Permit Application 60510.01 19 November 2019

associated exploration activities. Endangered or critically endangered species have been identified within the STB: blue whales, humpback whales, killer whales, sperm whales, maui dolphins and blue penguins.

As we have not been privy to the design and development of the research that SLR has undertaken the IA for this application for Beach in particular for impacts on marine animals and seabirds we are taking a highly conservative approach and note our concerns that drilling, and discharges will have a physical and cultural impact on our taonga species. In particular the drilling will negatively impact the mauri of the moana in the STB area and as such will impact on the mauri of the marine community.

We also note that as part of our 2019 research we have identified the following taonga species in the STB and who use these waters as migration routes;

- Tohora; Blue Whales, Humpback Whales, Killer Whales, Sperm Whales,
- Aihe; Maui Dolphin
- Kororā; Blue Penguin

Ngāti Ruanui, will need to peer review all data being gathered on these assessments commissioned by Beach Energy, so further work will be required once those assessments are shared with the iwi.

It is essential that any impact assessments should have been completed in partnership with Ngāti Ruanui, ideally setting joint scope, peer review and a joint committee for the overseeing of the work. This work should include mauri as an indicator of marine health and should have been a core part of the environmental assessment, in addition to the work of this CIA.

iii. Customary Rights

Many demersal fish (bottom associated) species support Ngāti Ruanui customary fishing rights. Demersal fish such as leatherjackets (20-50 metres along the whole South Taranaki Bight), golden mackerel, eagle rays and blue cod are known to Ngāti Ruanui and customary fishers to occur within the proposed exploration area and sandy habitats. Baracoutta, carpet sharks, gurnard, school shark, spiny dogfish, anchovy, snapper, rig, trevally, and tarakihi are commonly caught through the whole STB.

Rock lobsters (Jasus edwardsii) spend most of the year associated with subtidal reefs. However, according to Ngāti Ruanui traditional knowledge, in winter and summer larger (>1.5 kg) rock lobsters move offshore to depths more than 25 metres to feed on shellfish such as cockles or Tucetona species (refer to discussion under the Ngāti Ruanui Claims Settlement Act 2003), scallops (Pectin novaezealandiae) and horse mussels (Atrina zelandica). Customary fishing targets rock lobsters on these shellfish beds during winter and summer seasons.

The proposed application could impact on our customary fishers and subsequent loss of customary practices through fish displacement: First, displaced fishing effort will shift into other areas, which may increase the risk of localised depletion, potentially increasing risks to stock sustainability. Second, our local fishers may need to purchase a new vessel to fish in grounds that are further away, additional fuel costs, and less efficient fishing grounds. Ngāti Ruanui continues to exercise customary ownership and rights over the affected marine and coastal environment. Our application for customary marine title and customary rights under the Marine and Coastal (Takutai Moana) Act 2011 are currently in the High Court and Crown engagement processes.

10 Mauri, Whakapapa, Kaitiakitanga

As outlined in the statement of association with Nga Taonga a Tane raua ko Tangaroa above and other iwi documents and submissions that were reviewed for this CIA, mauri, whakapapa and kaitiakitanga are particularly important values for Ngāti Ruanui .

10.1 Mauri

Ngāti Ruanui considers the moana itself as a living entity which has a mauri or life force that is itself a taonga. The Māori worldview of the term mauri is interwoven with Māori values, principles, ethics, such as whakapapa, and the spiritual interconnected qualities of tapu, mana, mauri, and wairua. It forms an important basis for the practice and responsibility of kaitiakitanga. Mauri is an integral concept which includes the opportunity for cultural and environmental monitoring, but not exclusively so. It depicts how Māori observe, experience, and interpret the world and its changes. Mauri is commonly described as the essential essence or internal element, a life principle, which permeates through all living and non-living things and sustains all forms of life. Everything has mauri proportions of spiritual and physical state and therefore resources can be damaged physically and spiritually.[6]

The moana is rich with other marine taonga, including:

- hydrocarbon deposits which have provided the basis for Taranaki's oil and gas industry; substantial iron sand deposits formed by the erosion of volcanic material from Mt Taranaki and concentrated by sea currents and tides; a habitat for fish exploited by large commercial fishing companies;
- a seafood resource used by tangata whenua and by recreational fishers; and a habitat for marine flora and fauna, ranging from simple bottom dwelling organisms (benthic biota) and phytoplankton, through plants like sponges and seaweed, up to 13 different cetacean species, including internationally endangered blue whale and nationally critical or endangered Southern right whale, killer whale, and Maui's dolphin.

It is found by Ngāti Ruanui, that based on the activities of the application; i.e., drilling, the producing and release of drill cuttings, discharging waste to the sea of muds and cements and other operational discharges and the risk of harmful substances being released, that the mauri of the moana and its whānau through whakapapa will be negatively impacted. This is unacceptable to Ngāti Ruanui.

[6] Mauri: He Ariā Tiketike Hei Aroturuki Te Taiao: Garth Harmsworth and Shaun Awatere

10.2 Whakapapa

Whakapapa is the foundation of the Ngāti Ruanui approach to environmental management. This is determined by the shared descent from Papatuanuku and Ranginui (through Tane Mahuta) and the genealogical connection between people, plants, birds, and insects.

Whakapapa connections exist between Ngāti Ruanui and all of the environment, but particularly taonga species. These relationships must be acknowledged and protected from potential adverse effects. The reciprocal relationship between the moana itself and mana whenua mana moana must also be acknowledged and ensured. Ngāti Ruanui must be able to fulfil its kaitiaki obligations for the moana.

The impacts of the activities on our taonga species risk killing a range and large scale of whanau members within the complex web of whakapapa between the atua and through to the people of Ngāti Ruanui. Some of the taonga species in the STB are already critically endangered and so the impact on our whakapapa of this application being approved could be the ending of whakapapa lines completely for some species. For others the ending of particular lines of whakapapa specific to the waters of Ngāti Ruanui and its taonga could occur due to the impact of drilling. A further impact on the whakapapa of taonga species, specific to Ngāti Ruanui is the effect of avoidance of the area due to the drilling, sending taonga species elsewhere, disconnecting their breeding opportunities and having the effect of reducing taonga specie numbers in Ngāti Ruanui and consequently reducing the relationship that is held between the iwi and its cousins, the moana based community. This in turn has an effect on the use and practice of mātauranga Māori and the transmission of te reo Maori as customary practices decline in the gathering and preparation of kai for our ability to provide manaaki to our manuhiri.

The cultural impacts are wide and connected across multiple cultural values.

10.3 Kaitiakitanga

Kaitiakitanga is an inherited responsibility of those who hold **mana whenua** to ensure that the **mauri** of the natural resources of their takiwā is healthy and strong, and the life-supporting capacity of these ecosystems is preserved. Kaitiakitanga is central to the protection of the natural environment and is fundamental to on-going existence of Ngāti Ruanui. Furthermore, Ngāti Ruanui as kaitiaki must protect and preserve the natural environment for future generations. In practice, it is preferred that our ability to oppose is given weight in the assessment of the application. We should in fact be the decision maker on these matters and that will continue to be an aspiration for Ngāti Ruanui. As kaitiaki we have an obligation to protect the moana.

11 RaNgātiratanga, Tikanga, Mātauranga o Ngāti Ruanui

After a history of confiscation, alienation and being locked out of potential mining and socio-economic benefits of mineral exploitation by colonising processes and ongoing effects of colonisation the raNgātiratanga of Ngāti Ruanui and its customary ownership rights and authority must be recognised.

Being alienated from meaningful participation in the control and exploitation of the natural gas-based minerals that reside in its takiwa, the naming of oil and gas fields within their our rohe moana, including Kupe, are synonymous to both Ngāti Ruanui and the oil and gas industry.

"The vexed issue of nationalised minerals means that Ngāti Ruanui are alienated from meaningful participation in the control and exploitation of the petroleum-based minerals that reside in its takiwa. The naming of oil and gas fields within their takiwa are synonymous to both Ngāti Ruanui and the oil and gas industry, including Te Maari and Kupe. Adding a further potential cultural impact (through the use of Ngāti Ruanui names) to the exploitation of the resource itself"

Ngāti Ruanui seek meaningful involvement in governance and management of activities that have potential adverse effects on cultural values. The iwi seeks to ensure best practice use and protection of its resources, particularly taonga species. For example, in relation to a similar application the Impact Assessment included a review of previous submissions and presented the following finding based on an iwi submission and evidence.

"The submission presented concerns over the operation and potential effects from the activity. The concerns in the submission were general in nature only two specific areas were identified those being the North & South Traps and the Patea River Mouth area. The concerns with those sites were the loss of customary kaimoana species and the ability to manage and restore those sites under tikanga Maori principles. Other areas that were mentioned were spawning areas yet there was no site-specific information contained in the submission. Eels and marine mammals were specifically mentioned as a species of concern."

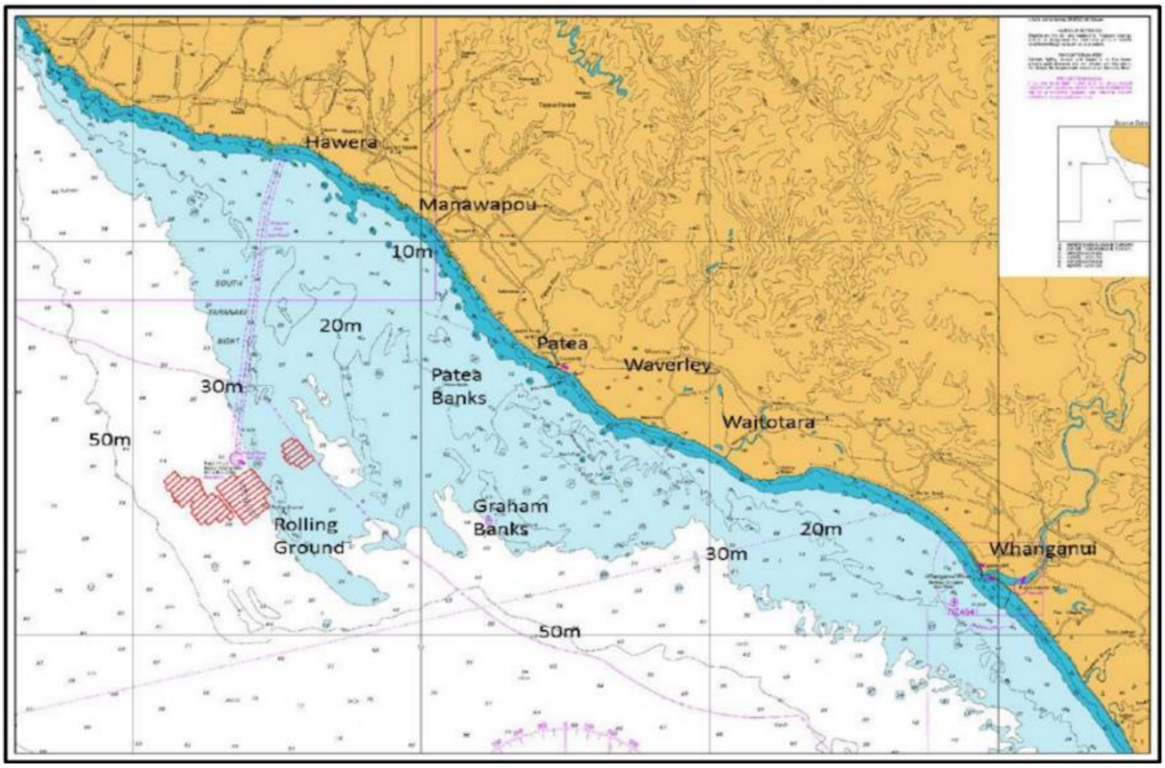
Another example that demonstrates the significance of protecting taonga species and exercising raNgātiratanga, enabling kaitiakitanga and the use of tikanga and mātauranga is the Ngāti Ruanui Wai W'āngote 'Ae'ae Rautaki (Marine Mammal Stranding Strategy). Marine mammals have particular significance in terms of whakapapa and kaitiakitanga values to Ngāti Ruanui, which is illustrated by the tribe's strategy "Mate Wai W'āngote" (August 2021). The strategy outlines their tikanga related to whale stranding's. The tribe's efforts to develop best practice management and cultural recovery convey the importance of marine mammals to the iwi. Potential adverse effects on marine mammals from the proposed activities and subsequent impacts on Ngāti Ruanui should be considered.

Decision making (and any potential management if activities are permitted) must be in accordance with Ngāti Ruanui tikanga and mātauranga. The practice of kaitiakitanga, as defined by Ngāti Ruanui, must be empowered in this consenting process (and potential management and monitoring if consent is approved). Another iwi submission is referred to below, which emphasises this point in the context of consenting resource exploitation (SUBMISSION108983.xml)

"The submission from Ngāti Ruanui is very comprehensive and identifies some key cultural principles and practises that should be applied for ongoing management. The submission also highlights some Ngāti Ruanui and indigenous rights that should be examined in future applications…

…It is important to note that a number of times reference was made to matauranga Maori and other values that should be incorporated into ongoing monitoring and management of the operation and associated activities."

Figure 1: The Patea Shoals and sand extraction site proposed for the Exploration Permit Application



60510.01. Source: Land Information New Zealand chart NZ45 (http://charts.linz.govt.nz/tifs/nz45.tif)

The references above from the TTR Impact Assessment Appendices-to-Impact-Assessment-23-August-2016.pdf (epa.govt.nz) are included because of the relevance of that minerals mining context to the

Kupe one, both in location (the Kupe gas platform and pipeline are the purple features located approximately 1.2km north of TTR's iron sand mining project) and activity. There are a number of petroleum and minerals mining projects within the STB (refer appendix 4) which, from a holistic view, should be considered for this application in terms of the potential cumulative impact of activities on Ngāti Ruanui values, particularly on the mauri of the moana, taonga species, and the iwi. Hence the mātauranga and other knowledge and evidence in that submission is a good source to cross-reference when considering whether or not to approve the Beach Energy applications.

iv. Rights and Interests (Supreme Court Decision Sept 2021)

Ngāti Ruanui have implicit rights as indigenous peoples and mana whenua mana moana which are recognised by a number of international and national provisions (including the United Nations Declaration on the Rights of Indigenous Peoples, and Te Tiriti o Waitangi and subsequent Ngāti Ruanui Claims Settlement Act). Beach Energy has an obligation to have meaningful engagement with Ngāti Ruanui on these applications, and they will accept nothing less.

Iwi rights were recently made more explicit by the Supreme Court decision for TRANS-TASMAN RESOURCES LIMITED v TARANAKI-WHANGANUI CONSERVATION BOARD, [2021] NZSC 127 [30 September 2021] 2021-NZSC-127.pdf (courtsofnz.govt.nz). The Court upheld the previous High Court and Court of Appeal decisions quashing Trans-Tasman Resources Ltd.'s consents. TTR lost its bid to overturn a decision preventing it from mining millions of tonnes of iron sands off the coast of South Taranaki (adjacent to PML 38146). The Decision is precedent-setting and has implications for the consent application by Beach Energy Resources Ltd, process and decision.

The judgment deals with a number of issues concerning the proper interpretation and application of the EEZ Act, including the approach to be taken to section 12 of the Act, which states, *inter alia*, that the marine consent authority (the EPA) is required to take into account the effects of activities on existing interests in order to recognise and respect the Crown's responsibility to give effect to the principles of the Treaty of Waitangi (for the purposes of the EEZ Act). The Court held that a "broad and generous construction" was required and that section 12(c) of the EEZ Act provides a strong direction that **the decision maker on an application for marine consent must take into account the effects of a proposed activity on existing interests in a way that recognises the Crown's obligation to give effect to the Treaty principles**. The Court found that **existing interests include tikanga-based customary rights and interests, including kaitiakitanga**. The Court was also agreed that **tikanga as law had to be taken into account** by the decision maker as "other applicable law" under the decision-making criteria outlined in section 59 of the EEZ Act where its recognition and application is appropriate to the particular circumstances of the application at hand.

Ngāti Ruanui was one of seven groups to lodge an appeal against the EPA's decision in 2017 to grant TTR consents to extract and process seabed material containing iron ore and to discharge processed material into the sea. They were heard by the High Court in 2018.

The evidence and findings of this case should be carefully considered by the applicants (Beach Energy) and decision maker (EPA) in relation to the Kupe Development and Drilling Programme (Phase 2) and these particular marine consents and marine discharge consent applications.

Below are pertinent examples from the hearing.

NZHC 2217 (28 August 2018): Did the DMC properly assess the effects on existing interests correctly?

At para [195] the High Court found that, *On behalf of Ngāti Ruanui and Ngā Rauru Kītahi, it was submitted that their customary and commercial interests were not recognised and respected, and that the activities for which consent was sought, offended against their mana whenua.*

Further, at para [197] there is reference to the conclusion of the minority which states that…*Tangata whenua will be particularly affected by adverse effects on their existing customary rights. Māori have statutory acknowledgement over the coastal marine area that will be directly and indirectly affected by the sediment plume. This will significantly impact the ability of tangata whenua to exercise kaitiakitanga over their rohe and marine resources and will in their view adversely affect the mauri of the marine environment. We accept that fish may avoid the sediment plume and move elsewhere. However, Ngāti Ruanui and Ngā Rauru Kītahi cannot move their rohe.*

12 RaNgātiratanga, Tikanga, Mātauranga o Ngāruahine

The coastline provided Ngāruahine with many vitally important resources including fish and shellfish, edible plants, traditional medicines and items used for artistic and ceremonial purposes. Tangaroa-i-te-Ruapetu is the spiritual guradian of the moana and other water bodies and all that live within them. This guardian was central to the lives of Hapū tūpuna and remains culturally significant to the Hapū whānau living today. Tangaroa has provided for them materially, acted as a highway for travel, a source of rongoā, aided their wellbeing and provided for their spiritual sustenance.

Hapū are mana moana in the coastal marine area and exclusive economic zone. Mana moana practices include but are not limited to:

- Karakia;
- Protecting and harvesting mātaitai;
- Resource management and conservation (rāhui and kaitiakitanga);
- Use of tauranga waka and navigation of ancestral waters;
- Providing gifts to manuhiri;
- Whakawhanaungatanga.

The Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 is an example of the assumed legal authority maintained by the New Zealand state. Te Korowai notes our past engagement with the Environmental Protection Agency (EPA) has been both ineffective and frustrating. We consider our cultural, economic and spiritual interests to be historical and inalienable – regardless of what the legislation states. We tautoko the statement from Ngāti Ruanui regarding Kaitiakitanga and that the mana moana obligation to protect the moana should be matched by a corresponding role as a decision maker. This would be the fitting role for a treaty partner rather than the symbolic inclusion practices that are currently undertaken by the EPA (Newton, Osborne & Sibley, 2018).

12.1 Rangatiratanga

Taonga species

Contemporary use of the term 'taonga species' is a construct designed to coerce Māori into the compartmentalisation approach of a western world view. For Ngāruahine, taonga is a term used to describe anything considered to be of value. It includes culturally or socially valuable objects, resources, ideas, phenomenon, and techniques. This broad definition indicates the importance of context and the need to differentiate between what is valued, why, and by whom. All plant, animal and fish species are taonga tuku iho to Ngāruahine.

It is difficult to assess the impacts of this activity on taonga tuku iho as we have recieved only fleeting information as regards to the physical, ecological and socio-economic effects. Assessments for these parameters should ideally be provided to Iwi before completing a comprehensive CIA. We will likely see these assessments at the same time as the EPA, if at all. We are particularly concerned at the potential impacts of the activity on the migration of tuna and piharau.

13 Conclusion

Ngāti Ruanui and Ngāruahine oppose the Beach Energy Application to the EPA based on the nature and significant scale of cultural impacts on the moana and the people of the iwi. While Ngāruahine and Ngāti Ruanui recognise the openness of the company to provide information and other explanations and supplementary material the environmental impacts have not been clearly addressed or explained. The time constraints in preparation of the application have not allowed the Impact Assessment to be co-designed to ensure a partnership on scope, and on the independence of the assessment."

13.1 Conclusion/Recommendations from Ngāti Ruanui

- The proposed drilling and discharge application and its proposed area where it will operate, and surrounds have high cultural significance to Ngāti Ruanui and are habitats of taonga species including indigenous flora and fauna.
- There are cultural impacts on whakapapa, tikanga, mātauranga and kaitiakitanga that are significant and cannot be avoided or remedied.
- Ngāti Ruanui traditional knowledge of the affected local marine environment confirms the presence of sensitive benthic habitats, threatened marine seabirds and mammals within the proposed exploration area and surrounds.
- The Ngāti Ruanui Claims Settlement Act 2003, (subpart 7, clause 109) acknowledges the cultural, spiritual, historical, and traditional association of Ngāti Ruanui with Nga Taonga a Tane raua ko Tangaroa, being the indigenous species; and the species of fish and other aquatic life found within the fisheries protocol area and managed by the Ministry of Fisheries under the fisheries legislation.
- There is inadequate information on the state of the marine environment on the proposed drilling and discharge area and surrounds leading to uncertainty. A lack of data does not provide a firm well-informed decision-making therefore precautionary principles should be favoured.

If the application was to go ahead in spite of our **strong** opposition, we would require the following recommendations to be addressed to our satisfaction;

- That identified culturally significant areas, habitats of taonga species, indigenous flora and fauna, sensitive benthic habitats, nursery grounds of juvenile fish, migratory and foraging grounds of marine seabirds and mammals be protected and excluded from the proposed drilling and discharge affected area.
- That the decision-maker requires the applicant to provide a sampling programme and programme of analyses of the bulk samples prepared in partnership with Ngāti Ruanui, prior to commencing drilling work.
- The sampling programme and programme of analyses shall, as a minimum, include:
    - Photos of the sample sites before and after sampling;
    - Sampling exclusion where photos of sample sites show evidence of culturally significant sites, habitats of taonga species, sensitive habitats, indigenous flora, and fauna.
    - Sample description (including geological descriptions, photographic documentation, sample weights); 3.4 Size fraction separation (8mm) and description of major constituents (nodules, carbonate, erratic, shell material);
    - Geochemistry of major elements;
    - Petrology and grain size descriptions;
    - Geotechnical testing (including abrasion and point load testing, and in situ density readings);
    - Environmental testing, including sediment chemistry and elutriate testing.
- That the decision-maker requires the applicant to provide the outcome of the bulk samples' analyses prepared alongside Ngāti Ruanui, prior to commencing drilling work.
- Ngāti Ruanui will be resourced to design a cultural health monitoring framework (CHMF) based on mātauranga Māori that will be implemented in parallel to a western science-based model. This monitoring will be part of compliance of any consent and is required to be a consent condition with clear review triggers if the CHMF results identify any deterioration in the mauri of the moana and its whānau.
- Ngāti Ruanui will be resourced to co-lead this monitoring framework of both western science and mātauranga Māori methods.
- That the decision-maker requires the applicant to provide an Environmental Monitoring Plan (EMP) prepared alongside Ngāti Ruanui, prior to commencing exploration work. The EMP shall be prepared in accordance with the permit conditions, and shall (as a minimum) include details in respect of:
    - The acquisition of environment baseline information and cultural indicators;

  - The implementation, timing, and resourcing of the CHMF and all monitoring that must include Ngāti Ruanui;
  - The gathering of information that assists in assessing the adverse effects of the permit holder's activities on the affected marine environment;
  - The triggers and agreed process with Ngāti Ruanui for any 'stop work' directives as a result of adverse effects being detected in the monitoring framework;
  - The key contacts for all parties involved in the monitoring.
- That a Ngāti Ruanui Kaitiaki Group be established and that the consent holder shall, convene, and fund an inclusive hui of Ngāti Ruanui for the purpose of facilitating the establishment of a Ngāti Ruanui Kaitiaki Group (NRKG) of no more than 5 and no fewer than 3 representatives of Ngāti Ruanui. Any casual vacancies on the NRKG shall be filled by the entity who has a vacancy through their own appointment processes.
- Twice each year, the consent holder will convene a meeting with members of the NRKG to discuss and obtain feedback on any cultural and environmental effects arising from the monitoring reports that should be presented at each hui.
- The meetings shall be conducted in good faith and have the following objectives:
  - Facilitating information flow between the consent holder and Ngāti Ruanui regarding the operation and environmental effects of the consent holder's activities associated with the STB (including new information, results of monitoring and any studies relevant to such effects);
  - Identifying any issues of concern that have arisen during the previous year and to discuss appropriate measures to address issues raised;
  - Providing Ngāti Ruanui with a work plan for works each year including the EMP; and
  - Making recommendations for the consent holder and the Peer Review Panel to consider in relation to any issues identified in terms of (b) above. (please see the establishment of the peer review panel further in these recommendations).
  - the consent holder shall meet with the NRKG to discuss proposed changes to the workplan and to seek input from the NRKG on any cultural effects and implications of those changes.

- There should be established a Peer Review Panel that independently reviews monitoring reports provided on the activities of Beach Energy. This panel should include two appointments made by Ngāti Ruanui.

- The consent holder shall assist the Ngāti Ruanui Peer Review Panel Representative and NRKG to fulfil its objectives by, among other things:
    - Arranging an appropriate venue in the local area for the meetings;
    - Ensuring its senior environmental and operational advisors attend the formal meetings; and
    - Providing summary information on the workplan and EMP for the members.
- The consent holder shall provide reasonable administrative and logistical support to facilitate the functions of the NRKG, and provision of a contribution towards attendance at the meetings, any special meetings convened, and attendance at any hui required for reporting back to Ngāti Ruanui.
- These meetings are to occur for the full length of the consent and are to be drafted as a consent condition.
- A mitigation package to be negotiated with Ngāti Ruanui and Beach Energy regarding cultural and environmental impacts that cannot be avoided or mitigated.

13.2 Conclusion/Recommendations from Ngāruahine

Ngāruahine oppose the Beach Energy application in its current form based on the lack of quality baseline information for the current state of the existing marine environment. The Environmental Risk Assessment is based on a mixture of mostly secondary data in a comprehensive literature review. Some of this literature is up to 70 years old. Beach Energy has not undertaken any testing of water quality, instead providing a number of assumptions based on the work completed by Trans-Tasman Resources Limited and used in their applications to mine iron ore sands close to the Kupe WHP.

When taken together, these issues require that a precautionary approach is used as identified in Te Uru Taiao o Ngāruahine.

In the absence of quality baseline information we require that the applicant establish and maintain a monitoring programme which involves both Ngāruahine and Ngāti Ruanui. Such a programme will identify baseline data prior to the commencement of works for:

- Pelagic Fish;
- Diadromous Native Fish;
- Marine mammals;
- Seabirds (both migratory and non-migratory);
- Sea water quality;
- Benthic ecosystems to a range of 2kms of the proposed drilling site(s).

The monitoring programme will integrate both western science and mātauranga Māori methods.

Ongoing monitoring will measure changes to the baseline overtime and be reviewed by the Kaitiaki Group. This Kaitiaki Group will contain equal representation from Ngāti Ruanui, Ngāruahine and the applicant. The Kaitaiki Group will have the power to stop any drilling activities contained in this application based on their review of monitoring information.

The applicant will ensure that there is:

- adequate information provided to Ngāruahine Hapū on monitoring results; and
- actively seek their feedback on those results.

Decommissioning Plan

Te Korowai advocates for the normalisation of mitigation plans which are co-designed with mana moana under general objective 6 of Te Uru Taiao o Ngāruahine. In the case of hydrocarbon exploration and extraction activities this means a decommissioning plan as per policy 3.7(c). We encourage Beach Energy to undertake the development of a decommissioning plan with all Hapū of Ngāruahine or to amend any existing plan to incorporate their perspectives and aspirations for decommissioning.

Cost/Benefit Analysis

Regional economic benefits are estimated at $43m (26%) of a total spend of $168m, the majority of which will go to mining support services. How much of the economic benefit will be retained in South Taranaki is not identified in the assessment. Economic benefit analysis invariably overestimates the economic returns and underestimates the environmental costs. Those costs are socialised or spread across society.

Mitigation Measures Offered

The assessment classifies impacts into those on the pelagic (open sea water column) and benthic (lowest level of a water body) environs and provides measures to avoid, remedy or mitigate those effects. The mitigation measures offered are basically what Beach Energy is required to do anyway under the EPA regulations or standard best practice for the industry. There is nothing particularly benevolent about them and calling them mitigation measures is probably a bit generous.

Hazardous Substances

There is no information on the types and quantities of hazardous substances to be used. This is because this information will be specific to the MODU that Beach eventually contracts to undertake the drilling operations.

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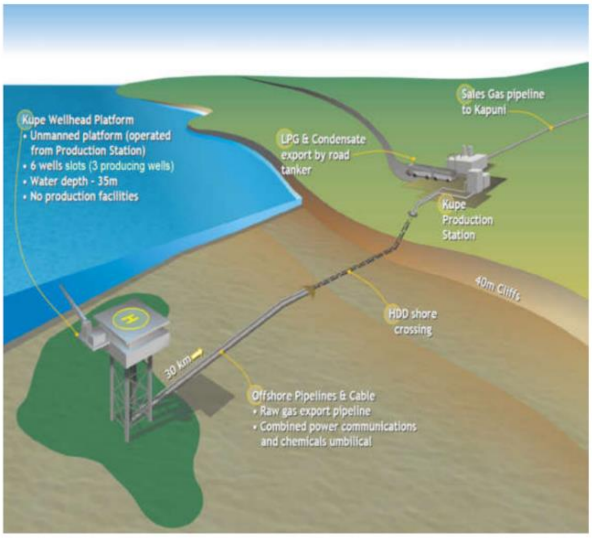
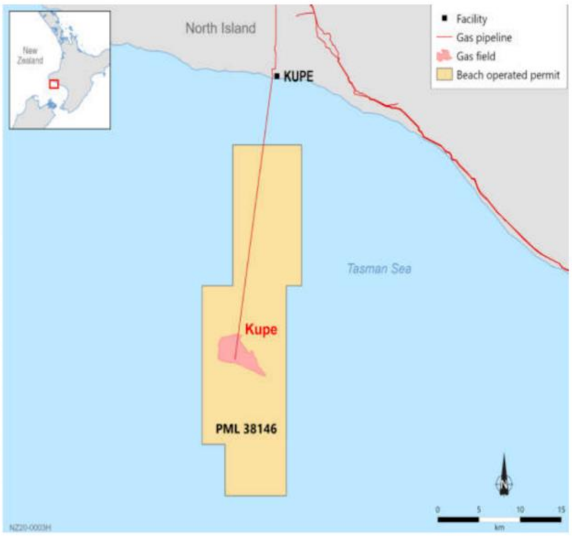
Appendix 1: Components of the current and proposed Kupe Gas Project, and area of Consent Application (PML 38146)

Source:https://www.beachenergy.com.au/wp-content/uploads/2021/10/Kupe-Phase-2-Development-Drilling-Program.pdf





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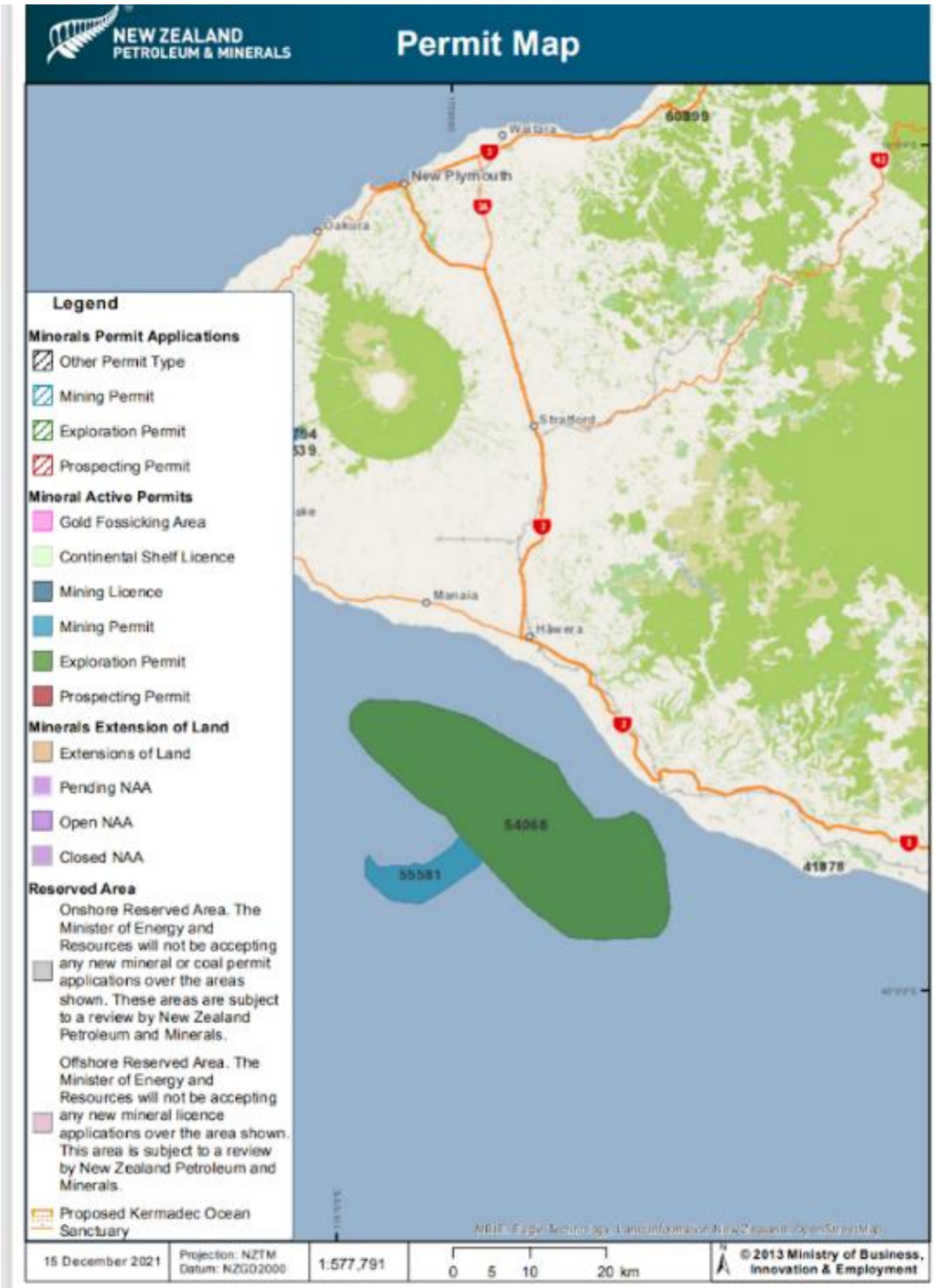
Appendix 2: Ngāti Ruanui Taonga species (Source: Submission TTR Exploration Permit Application 60510.01 VFinal19-3-2019.pdf)

SHELLFISH		
Kina	Sea urchin	Evechinus chloroticus
Kuku / Kutae	Green lipped mussel	Perna canaliculus/mytilus edulis
Kuku / Kutae	Blue lipped mussel	Perna canaliculus/mytilus edulis
Paua	Paua – black foot (Abalone)	Haliotis iris
Paua	Paua – yellow foot	Haliotis australis
Pipi /kakahi	Pipi	Paphies austral
Pupu	Pupu	Turbo smaragdus/zediloma spps
Purimu	Surf clam	Dosinia anus et al.
Rori	Sea snail	Scutus breviculus
Tuangi	Cockle	Austrovenus stutchburgi
Tuatua	Tuatua	Paphies subtriangulata, paphies donacina
Waharoa	Horse mussel	Atrina zelandica
Waikaka	Mud snail	Amphibola crenata, Turbo smaragus, Zedilom spp.
Tio, Karauria, ngahiki, repe	Rock Oyster	Crassostrea glomerata
Tupa, kuakua, pure, tipa, tipai, kopa	Scallop	Pecten novazelandiae

Koiro, ngoiro, totoke, hao, ngoio, ngoingoi, putu	Conger Eel	Conger verreauxi
Koura	Crayfish	Jasus edwardsii
Kaunga	Hermit Crab	Pagurus novaeseelandiae
Papaka parupatu	Mud Crab	Helice sp.
Papaka	Paddlecrab	Ovalipes catharus
Kotere, humenga	Sea anemoe	Cnidaria group
Rore, rori	Sea cucumber / sea snail	Stichopus mollis
Patangatanga, patangaroa, pekapeka	Starfish	Echinoderms

Appendix 3: Active Permit Maps in the South Taranaki Region



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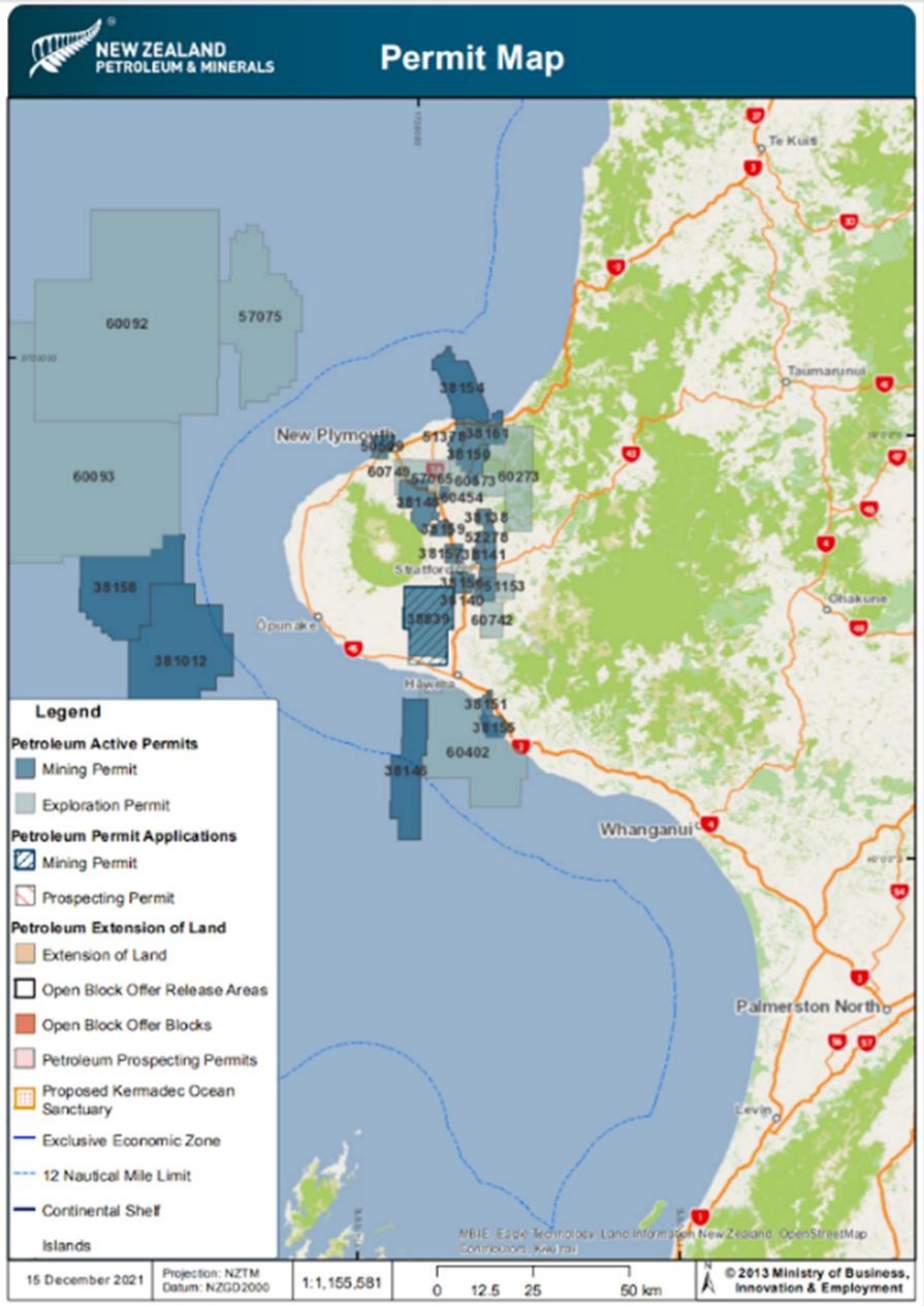
NEW ZEALAND
PETROLEUM & MINERALS
Permit Map
Te Kuiti
Taumarunui
Ohakune
New Plymouth
Stratford
Opunake
Hawera
Whanganui
Palmerston North
Levin
60092
57075
60093
38154
38158
381012
38839
60742
60402
38146
38151
38155
60273
Legend
Petroleum Active Permits
Mining Permit
Exploration Permit
Petroleum Permit Applications
Mining Permit
Prospecting Permit
Petroleum Extension of Land
Extension of Land
Open Block Offer Release Areas
Open Block Offer Blocks
Petroleum Prospecting Permits
Proposed Kermadec Ocean Sanctuary
Exclusive Economic Zone
12 Nautical Mile Limit
Continental Shelf
Islands
15 December 2021
Projection: NZTM
Datum: NZGD2000
1:1,155,581
0 12.5 25 50 km
© 2013 Ministry of Business, Innovation & Employment

He Whakamārama – Kupe Phase 2 Development Drilling Programme.

Prepared for: Beach Energy. Attention: Adam Wood and Vicki Meijer

Prepared by: Ngāti Manuhiakai

Date: 5 April 2022

Quality Assurance			
Date	Version	Change	Comment
27 February 2022	A	Initial draft.	
13 March 2022	B	Updated following hapū wānanga	
24 March 2022	C	Updated following hui with Beach Energy	
27 March 2022	D	Updated following hapū wānanga	
5 April	1	Final CIA document	Updated following korero with Beach regarding proffered conditions, and Te Korowai o Ngāruahine regarding respective roles.

1.0 He Kupu Whakataki/Introduction

Introduction & Purpose

Ngāti Manuhiakai exercise mana whenua and mana moana over the ancestral lands, waters, taonga species, wāhi tapu and wāhi taonga within the takiwa which extends from the tip of Maunga Taranaki into Te Moana O Tangaroa (including out into the outermost extent of the Exclusive Economic Zone) taking in Te Rere o Kapuni and Inaha Rivers. From east to west, the boundary extends from the western banks of the Waingongoro River to the eastern banks of the Raoa Stream. These interests are recognised in the Ngāruahine Claims Settlement Act 2016.

Ngateko on the Kapuni stream is one of the original landing places of the Wakaringaringa waka, captained by Mawakeroa, the other being Kaupokonui. Many of the people on that waka took up settlement here. The Kapuni stream marks the boundary between the takiwa of Ngāti Manuhiakai and Ngati Tu Hapū.

Ngāti Manuhiakai also claim ancestry from the Aotea Utanganui waka which was captained by Turi-te-Ariki-nui. During the fourteenth century, Turi, with his wife Rongorongo and their people, travelled south along the coast naming many places as they went.

Ko Aotea te Waka

Taranaki te Maunga

Te Rere O Kapuni me Inaha nga Awa

Te Aroha O Titokowaru Ki Toona Marae

Ngāti Manuhiakai te hapū

Ngaruahine-Rangi te Iwi

Inaha te Tauranga-waka.

Aotea is our waka

Taranaki our mountain

Te Rere O Kapuni and Inaha our Rivers

Te Aroha O Titokowaru Ki Toona our marae

Ngati Manuhiakai our sub-tribe

Ngaruahine-Rangi our Tribe

Inaha our Tauranga-waka.

The various awa that are located within the takiwa of Ngāti Manuhiakai have great spiritual importance, they are, "the blood and veins of the takutaimoana, each of them with a story to tell." The wai that flows through these awa symbolises the link between the past and the present. Each awa has its own mauri and wairua which connect the hapū with the river and the spiritual world. They are significant taonga that provide both physical and spiritual sustenance.

The domain of Tangaroa extends from the source of these awa "te piki ake o Maunga Taranaki" to the moana. Each awa is linked and together form an entity that includes its source, and the moana. As a result the relationship the hapū have with these awa relates to the entire catchment. The tangible linkages between these awa provide the hapū with a system of ara, or pathways throughout their respective takiwa, allowing access inland. River travel was important to hapū for both economic and social reasons.

Despite the wrongful legal confiscation of our traditional lands and waters in 1865, Ngāti Manuhiakai have always maintained a living relationship with our moana and our whenua and maintained strong historical, cultural, traditional and spiritual connections with our rohe. In the context of the marine environment this relationship is guaranteed in the Treaty of Waitangi. Within the context of Te Tiriti o Waitangi, the marine environment can be conceptualised as a taonga as well as the principles, values and tikanga associated with it.

According to our worldview, the environment is a fundamental part of who Ngāti Manuhiakai are as tangata whenua. The environment itself is our atua system. In our view the environment existing long before us and will exist long into the future, with or without people; the environment is able to survive without our influence.

This flows forward into the Ngāti Manuhiakai application of Kaitiakitanga. Kaitiakitanga is not man looking after the environment, it is the environment that looks after man. It is the environment that allows us to live and to exist. We rely on the environment for us to exist. We co-exist with our environment, and this co-existence has developed over a long period of time.

In today's context, Ngāti Manuhiakai in their expression/application of their kaitiakitanga extend this to individuals and entities that come into our rohe to ensure that those people understand the context in which they operate, and their obligations within this area.

To this end Ngāti Manuhiakai has engaged with Beach Energy and its predecessors through the development of the Kupe field. Ngāti Manuhiakai considers that a working relationship has been developed with these companies over that time, to a point where there is comfort in sharing information and discussing issues. As the field enters its final stages of productive life, Ngāti Manuhiakai are now considering how to prepare and inform ourselves for the re-use or restoration of the Kupe field as a transition from fossil fuel dependency to other forms of energy occurs in our rohe, and more broadly across the world over the coming decades.

The purpose of this Cultural Impact Assessment (CIA)[1] is to assess the actual and potential effects on the environment, and the existing interests of Ngāti Manuhiakai to inform the overall Beach programme of works, including the requisite Marine Consent and Marine Discharge Consents.

Authors & Te Ao Māori

Ngāti Manuhiakai have prepared this CIA to assess the effects of the proposal. Only tangata whenua who *whakapapa* have the mandate to carry out CIAs, and only tangata whenua can determine the issues that affect their relationship, existing interests and their natural and physical resources and to

[1] Appendix 1 sets out general context around what a CIA does, and what matters they generally address.

what extent these may be. Experienced resource management practitioners[2] provided technical science and planning input to compliment the cultural expertise of mana whenua.

Ngāti Manuhiakai have a holistic view of the environment based around whakapapa (genealogy) and whanaungatanga (relationships), connecting us and all physical and spiritual things in the world. Our relationship with the environment stems from our whakapapa to Papatūānuku (Earth Mother) and Ranginui (Sky Father) who gave rise to many children, also known as the Atua (guardians) of the domains of the natural world. Therefore, it is important to understand that potential impacts of any proposed activity would be conceptualised holistically.

Over the last 200 years the prominence of the Māori worldview has been eroded across the political landscape of Aotearoa/New Zealand. This began with the denigration of Rangi, Papa and the other Atua with the arrival of the early Christian missionaries. This continued with the gradual loss of control by tangata whenua over land and other resources. The strengthening of the Western Worldview's focus over this time on the individual and his material needs, has further eroded the values inherent in the Māori Worldview. It is of no coincidence that over this time, the condition of natural and physical resources has degraded and the amount available for use has diminished. The reversal of this trend both in the condition of natural resources and the relevance of Te Ao Māori is stressed by tangata whenua and must be reflected into the resource consents and other permissions which enable the activities which occur in our taiao.

The values that this application is assessed against in this CIA are informed by this Worldview.

Methodology

For the purposes of this CIA, Ngāti Manuhiakai describe the impacts associated with the proposal on our cultural values in terms of mauri[3]. Whilst the difficulty in quantifying cultural impacts is acknowledged, where the impacts are tangible both the sensitivity and magnitude of the impacts should be described. Other impacts wholly cultural in nature need to be articulated in such a way that the concepts are understood and mitigation measures, if any, are applied.

The following were the key steps taken to inform the development of this CIA:

1 Engagement with Beach Energy on the proposal since July 2021.
2 Review of the application (draft), documentation and oral histories held by hapū kuia, kaumatua and pūkenga regarding the development history of the Kupe Field and the area.
3 Utilised the mōhiotanga of uri familiar with the industry.
4 Meetings with Beach Energy to understand aspects of the project and associated application including proffered conditions.

[2] Sera Gibson (MSc (Marine Biology)(Hons), PGDip (Biological Science), BSc (Zoology/Animal Biology)), and Sean Zieltjes (MLS (Environment Law)(Hons), BREP (Ecology)(Hons), MNZPI).

[3] Mauri is the active life-giving principal or physical life-principle. Mauri was created through the union of Ranginui (sky father) and Papatūānuku (earth mother) and became ora (active or life-giving) when Tāne Mahuta separated them, giving rise to many children each becoming the atua (deities) of respective domains of the environment, including Tangaroa who became the deity of the sea. Mauri radiates outwards from the environment to the species for which it was intended. Mauri is unable to protect itself against unnatural changes to the environment, though it does have the ability to mend and heal, given appropriate time and conditions. Our role as kaitiaki is to ensure the mauri of the ecosystem and environment is protected and enhanced.

5 Confirmation of the findings of this CIA by Ngāti Manuhiakai.

Presentation of the findings of this CIA to Beach Energy will be scheduled following these dates.

2.0 Activity description and proffered conditions

The proposal is described at length in section 2 of the application. Ngāti Manuhiakai understand that this project is to fully develop and maximise the prodcuction of the Kupe field for around 10 years after which all oil and gas resources will have been exploited.

Key attributes of the project as Ngāti Manuhiakai understand it includes:

- Drilling of two development wells from the existing unmanned Kupe Wellhead Platform (WHP) using a mobile offshore drilling unit (MODU). It is expected that a jack up MODU will be used given the relatively shallow water depth.
- Drilling through existing conductors' slots at the Kupe WHP, meaning that direct drilling on the seafloor at this location is not required. The depth of the wells will be drilled down to approximately 3,370 m True Vertical Depth Subsea.
- Release of all drill cuttings (ground-up rock) produced during the drilling will be released from the jack-up MODU deck into the sea and will settle on the seabed away from the Kupe WHP.
- Various other supporting activities will be required during the drilling programme, including pre-drill works (such as seabed surveys and geotechnical coring), formation evaluation techniques, use of supporting vessels and remotely operated vehicles and the subsequent environmental monitoring around the WHP.
- Various discharge streams will occur during the drilling operations, including the discharge of a small portion of drilling muds, cement and other operational discharges (such as during completion operations).
- Contingency measures will include side-tracking if the original wellbore misses the proposed geological target or is compromised; re-spudding if either of the proposed wells have to be abandoned before they reach their targets; the use of explosives (such as directional charges) to sever and recover the drill string or to perforate a casing to allow the placement of remedial cement if the cement behind the casing is lost; and the ability to dump faulty cement batches if required, however based on recent campaigns of a similar nature this is considered unlikely.
- A number of 'harmful substances' (those that are deemed to be ecotoxic to the aquatic environment) will be discharged as part of the drilling operations including 'deck drainage' water which may contain residual amounts of harmful substances from the jack up MODU to the sea.
- The development of an Environmental Monitoring Plan (EMP) that will utilise best available bio-physical information from the field to assess the potential environmental effects of the drilling activities and to track the recovery of benthic communities and sediment quality over time. The EMP will implement the Offshore Taranaki Environmental Monitoring Protocol (OTEMP), recognised as industry best practise. Additional base-line data to inform this plan may be collected ahead of this monitoring plan (as a permitted activity). This EMP will also specify the timing and activities when a Marine Mammal Observer is to be on-board any vessel associated with the drilling programme.
- The Drilling Programme is proposed to be undertaken in summer 2022/23 when weather conditions in the South Taranaki Bight are most favourable.

Beach requires a marine consent from the Environmental Protection Authority (EPA) under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act) to undertake various activities associated with the drilling programme. In addition, Beach Energy also requires a marine discharge consent to discharge 'deck drainage' water from the jack-up MODU to the sea from the EPA under the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015 (D&D Regulations).

If Beach Energy decides they want to undertake forms of seismic survey – checkshot survey and vertical seismic profiling and these triggers the requirements of a Level 1 or Level 2 seismic survey as defined in the Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations (Code of Conduct) a Marine Mammal Impact Assessment will need to be submitted for approval to the Department of Conservation.

A number of proffered conditions also form a part of the application. Ngāti Manuhiakai understand that the purpose of these conditions is to deal with adverse effects of the activity authorised by the consents on the environment or existing interests. The application at section 9.2 sets out what the applicant is recommending the EPA adopt as a set of conditions to achieve this. The description of what the marine consent conditions look to achieve is:

> *Proffered condition 2 of the marine consent seeks an expiry date of 31 December 2028, which takes into account the post-drill environmental monitoring which the marine consent requires and authorises. Beach intends to drill the first development well during the 2022/23 summer period and if the second development well is drilled it may be drilled during the 2023/24 summer or later. Proffered condition 13 requires Beach to undertake three rounds of post-drill benthic monitoring, each round being approximately 12 months apart. Therefore, the final post-drill monitoring would occur during the 2026/27 summer period if the second development well is drilled. Beach considers it appropriate to provide some flexibility in terms of the timeframes to drill the development wells to provide for unforeseen circumstances and potential delays (e.g., restrictions associated with the Covid19 pandemic), and therefore an expiry of 31 December 2028 for the marine consent is sought and considered appropriate.*
>
> *Proffered condition 8 limits the number of development wells that can be drilled under the marine consent to the two described in this consent application. It is worth noting that a 'well' constitutes a single well drilled into the seabed, except where that well is required to be re-spudded, in which case the initial well and the subsequent re-spudded well are together deemed to be a single well.*
>
> *Proffered conditions 9 to 12 requires Beach to submit an EMP to the EPA for certification prior to drilling activities taking place. The EMP outlines the proposed monitoring approach that will be undertaken after the drilling. The EMP needs to be consistent with OTEMP, being a protocol, which was developed through consultation with industry regulators, MNZ, and the EPA. Advice Note 1 explains that the drilling of the first development well (KS-9) may commence as soon as the EMP has been submitted to the EPA for certification as the pre-drill monitoring will have already been completed under Permitted Activities Regulations.*
>
> *Proffered conditions 13 requires Beach to undertake monitoring in accordance with the certified EMP. This monitoring includes the requirement for post-drill benthic monitoring to enable comparisons to be made with the pre-drill monitoring and to monitor for the recovery of the benthic environment after drilling activities have ceased. This monitoring is in line with previous marine consents for drilling activities in New Zealand's EEZ. It should be noted that no specific pre-drill monitoring is necessary for the second development well (if it is drilled) because the*

first post-drill monitoring for the initial development well will essentially act as the pre-drill monitoring for the second development well due to the timing between the drilling operations.

Proffered condition 14 limits the volume of in-situ material (strata) removed from each of the two development wells to 534m^3, except where a well is required to be side-tracked or re-spudded, in which case the total volume removed can be increased to 1,068m^3. These are the anticipated maximum volumes of material to be removed from any one well, and on which the drill cutting dispersal modelling has been based.

Proffered conditions 15 to 21 relate to mitigating potential impacts to seabirds and marine mammals in accordance with similar conditions on existing marine consents as a result of recommendations by DOC.

Proffered condition 22 requires Beach to provide up-to-date information to all persons with existing interests identified in Section 5.2.

Proffered conditions 23 and 24 relate to the requirement for notification to the EPA as soon as practicable of the occurrence of an "environmental incident". This term means an incident arising out of, or in connection with, a well which would be declared to be a notifiable incident under the HSWPEE Regulations and which Beach reasonably considers may result in an adverse environmental effect.

Proffered condition 25 requires Beach to notify the EPA as soon as reasonably practicable upon becoming aware of any adverse effects on the environment or existing interests that were not anticipated or are of a scale or intensity not anticipated when the consent application was granted to enable the EPA to undertake a review of the marine consent under section 76(1)(c) of the EEZ Act.

Proffered condition 26 requires Beach to notify the EPA, in writing, when the MODU is positioned on site and the date of departure of the MODU. This condition will provide the EPA with sufficient time to allow organisation of any compliance monitoring that is required under other conditions.

Proffered condition 27 requires Beach to maintain a log for each well drilled and be made available to the EPA upon request. This log will record various parameters specific to each well and can be utilised for compliance monitoring in relation to those parameters recorded.

Proffered conditions 28 and 29 require Beach to provide logs and reports to the EPA at certain stages after the completion of drilling of each well.

Proffered conditions 30 to 32 requires Beach to provide a Compliance Report for each well which includes a description, analysis, evaluation and discussion on all of the environmental monitoring results (including a copy of the raw data obtained during the monitoring activities) and logs of any seabird collisions and marine mammal sightings. In addition, this Compliance Report is also required to assess compliance with the conditions of the marine consent. A timeframe of nine months following the final post-drill monitoring requirements has been included within these conditions to allow adequate time to compile the environmental monitoring results and undertaken an analysis of compliance with the consent conditions.

Advice Note 3 outlines the EPA's ability to review the duration and/or conditions of the marine consent under section 76 and 77 of the EEZ Act. The ability to review the duration and/or *conditions do not need to be imposed as formal conditions as the ability to instigate such reviews are codified in the EEZ Act and is not a condition that a consent holder can or must comply with.*

A set of General Advice Notes is included which reminds Beach of its obligations under other MMRs, including the requirement for an ESRP under the D&D Regulations, its obligations under the Biosecurity Act 1993 (for ballast water and biofouling on vessels), Marine Mammals Protection Act 1978 (for marine mammals), and the Wildlife Act 1953 (for seabirds and marine mammals)[4]

Similarly for the discharge consent, the application includes the following description of what the proffered conditions look to achieve:

Proffered conditions 1 to 6 are administrative conditions which are routinely imposed on other marine discharge consents granted by the EPA.

Proffered condition 7 requires Beach to not store or handle any harmful substances in non-hazard areas which drain directly to the sea.

Proffered condition 8 requires Beach to manage the storage of harmful substances within a secondary containment system. This would mean that any escape of those harmful substances will be contained within the area where they are used and those substances may be recovered, subject to residual amounts remaining.

This condition has been proffered to reduce the potential for harmful substances to enter the deck drains and their subsequent discharge to the marine environment; thereby reducing the potential for adverse effects on the environment and persons with existing interests.

Proffered condition 9 requires Beach to ensure that the minimum design requirements stated in the condition are onboard the MODU(s) which is utilised during the drilling. This condition has been developed to reduce the potential uncertainty associated with this marine consent application.

Proffered conditions 10 to 12 are similar in nature to the requirements of the ESRP in that they require Beach to notify the EPA in the event of a spill of any harmful substances, seek advice regarding the monitoring of that spill and provide the results of any monitoring undertaken to the EPA. This would be in addition to undertaking activities in accordance with an ESRP.

Proffered condition 13 seeks an expiry date of 31 December 2026. Beach intends to drill the first development well during the 2022/23 summer period and the second development well (if drilled) may be drilled during the 2023/24 summer or later. While this is the anticipated timetable for the drilling, Beach considers it appropriate to allow some additional time to provide for unforeseen circumstances and potential delays, and therefore an expiry of 31 December 2026 for the marine discharge consent is sought and considered appropriate. The expiry of the marine discharge consent is earlier than the marine consent because the latter authorises activities associated with post-drill monitoring which is required to be undertaken for a three-year period after the drilling is completed.

[4] 740.30012.00000-R01-v0.1-Kupe Phase 2 Development Drilling Programme Consent Application - 20220128.docx, Section 9.

An Advice Note is included which outlines the EPA's ability to review the duration and/or conditions of the marine discharge consent under section 76 and 77 of the EEZ Act. The ability to review the duration and/or conditions do not need to be imposed as formal conditions as the ability to instigate such reviews are codified in the EEZ Act and is not a condition that a consent holder can or must comply with[5].

[5] Ibid

3.0 The existing interests of Ngāti Manuhiakai

Introduction

Ngāti Manuhiakai expect that the full range of customary rights and interests that make up their existing interests in the both the petroleum resource itself, and the area within which the Beach Energy Kupe project and supporting infrastructure are located are taken into account.

As introductory comments regarding the existing interest of Ngāti Manuhiakai; resource management and practises are not new endeavours for us. Ngāti Manuhiakai have practised our own management and planning in this area according to our own customs, methods and lores since first settling this rohe. Despite the impacts of colonisation these customs, methods and lore remain. They have whakapapa to people and places. They are embodied in practises, rights, responsibilities and obligations that form a part of the identity of Ngāti Manuhiakai.

To be clear these 'existing interests' pre-date the Treaty of Waitangi; and as such existing interests cannot be limited to those principles articulated within the Treaty. It is the broader customs and lore upon which Ngāti Manuhiakai interpret and hold relationships with people and place which must be engaged with directly through this process, alongside those Treaty interests which also exist.

Ngāti Manuhiakai customs and lore

The Ngāti Manuhiakai principles of the foundation of our environment begin in the nothingness before anything was created, we know this as Te Kore. Growth, movement, and thought began to stir in Te Kore. This was the start of existence, from where Ranginui emerged in his intangible form. The desire grew within Ranginui, the desire to take a physical form. That desire brought forth the first physical form we know as Papatūānuku. Our foundation principles were now a reality, the reality of existence.

The desire for growth within these two principles brought forth the offspring of Ranginui and Papatūānuku. These offspring populated the intangible of Ranginui and the tangible of Papatūānuku. These offspring form the beginning of our environment.

The need to reproduce was performed at Kurawaka, where Tāne took the clay from Papatūānuku and moulded a form, and one by one the offspring of Ranginui and Papatūānuku gave a part of themselves until Tāne breathed life into the nostrils of the form and the existence of female was a reality, she is known as Hineahuone, the woman who descended from the clay of Papatūānuku.

From here we understand that we were created by the environment and it is the environment that allows us to exist.

When Tāne breathed life into the nostrils of Hineahuone she let out a sneeze, Tihei, and woman now existed and man is a reality.

Mauri is existence. Mauri ora is a healthy existence and mauri mate is an unwell existence. Mauri is the reality of existence, all things that exist possess mauri. In terms of this proposal, the current state of mauri of the environmental features and/or species, as interpreted by Ngāti Manukiakai, is assessed against the residual impacts associated with the proposed activities (as assessed in the Environmental Risk Assesment process).

Mana or the right to exist was also given to Hineahuone by the offspring of Ranginui and Papatūānuku. This is where mana became a reality, mana whakaheke is the mana that has been passed down from Ranginui and Papatūānuku and their offspring and on to Ngāti Manuhiakai of today.

Ngāti Manuhiakai mana exists from the mouth of Inaha, follows the river to the peak of Taranaki Maunga and back down Kapuni river to the sea, to Hawaikinui Tawhitinui, Hawaiki roa Tawhiti roa, Hawaiki Pāmaomao tawhiti pāmaomao, our relationship to the environment is through mana whenua, mana moana, mana awa, mana rangi, mana tangata.

Through generations, Ngāti Manuhiakai has learned to exist within our environment, and have an obligation to welcome and teach manuhiri how to also exist in our environment. This is the **manaakitanga** of Ngāti Manuhiakai, to aki or akiaki " ka whakatō i te wairua kaha ki tētehi atu" to implant strength into others mana. Our environment gives manaaki to Ngāti Manuhiakai and Ngāti Manuhiakai gives manaaki to manuhiri**. Kaitiakitanga** is the expression of manaakitanga.

Tino rangatira is a concept introduced in the Treaty of Waitangi to express total control in the same way the Queen had total control of her people and lands. Ngāti Manuhiakai has many Rangatira which means everyone has a right to their view. Ngāti Manuhiakai **Rangatiratanga** is when we are in agreeance, these are Ngāti Manuhiakai Tikanga upheld by our Rangatira.

Treaty of Waitangi Interests

Regarding the Treaty of Waitangi specifically, and how this relates to the ownership, use and exploitation of petroleum resources Ngāti Manuhiakai, along with ngā hapū o Ngāruahine brought a claim to the Waitangi Tribunal in 1999 with respect to Taungatara-Tariki-Araukuku (petroleum, natural gas and minerals)[6].

Kupe, and the sale of the crown interests in the field were of direct relevance to that claim. In short, the Tribunal found that *"…the Government's policy to expropriate petroleum ownership in 1937 was reasonably necessary in all the circumstances. Those circumstances did not, however, justify the associated policy by which the Crown also took to itself the royalties paid by petroleum producers. With its adverse impact on all prior owners of the petroleum resource, both Māori and non-Māori, the royalty policy required independent sound reasons for its imposition. And if good reasons were lacking, as we have found they were, Māori could protest that their fundamental property rights, promised to be protected by article 2 of the Treaty of Waitangi, had been breached. Further, in the circumstances, neither the Crown's article 1 right to govern nor the article 3 guarantee of equality between Māori and non-Māori could justify the royalty policy"*[7]. The Tribunal went further outlining that "*where Māori legal rights to petroleum were extinguished in breach of the Treaty, a new interest arose"*[8]. This was termed a 'Treaty Interest', and that specific redress was required to address breaches of those Treaty interests.

In summary the Tribunal made the following findings:

- *Prior to 1937, Māori had legal title to the petroleum in their land.*
- *A Treaty interest was created in favour of Māori for the loss of legal title to petroleum by:*
  - *the alienation of land prior to 1937 by means that breached Treaty principles; and*
  - *expropriation under the Petroleum Act 1937, without payment of compensation to landowners and without provision being made for the ongoing payment of royalties to them.*
- *Whenever that Treaty interest arises, there will be a right to a remedy and a corresponding obligation on the Crown to negotiate redress for the wrongful loss of the petroleum.*

[6] Wai 796, 2003
[7] Wai 796, 2003 pg 64
[8] Wai 796, 2003 pg 65

- *The redress to be provided is in addition to any other entitlement to redress.*
- *It is in breach of Treaty principle for the Crown to exclude petroleum-based remedies from settlements.*
- *Therefore, the Crown's royalty entitlements, and its remaining interest in the Kupe petroleum mining licence, ought to be available for inclusion in settlements with affected claimants[9].*

These recommendations have never been enacted.

The Ngāruahine Claims Settlement Act 2016 provided for these recommendations to a limited degree, with the final legislation including a number of acknowledgements that are directly relevant to this application as follows:

- (11) The Crown acknowledges that the lands and other resources confiscated from Ngāruahine have made a significant contribution to the wealth and development of New Zealand[10].
- (12) The Crown acknowledges that its nationalisation of petroleum resources in New Zealand in 1937 caused a great sense of grievance within Ngāruahine that is still held today[11].
- (13) The Crown acknowledges that environmental degradation of Ngāruahine lands, waterways, and coastal waters, including deforestation, freshwater and marine pollution, and the displacement of indigenous plants and animals from the effects of the dairy industry, resource extractive industries, and other causes, is a source of great distress for Ngāruahine[12].
- (16) The Crown acknowledges that its breaches of the Treaty of Waitangi and its principles during the 19th and 20th centuries have together significantly undermined the traditional systems of authority and economic capacity of the Ngāruahine iwi, and the physical, cultural, and spiritual well-being of its people. The Crown acknowledges that it has failed to protect the rangatiratanga of Ngāruahine, in breach of its obligations under Article Two of the Treaty of Waitangi[13].

This Settlement legislation also provides for Ngāruahine to enter into relationship agreements with the Ministry for the Environment (MfE) and the Ministry of Business, Innovation and Employment (MBIE). The relationship agreement with the MBIE covers minerals and petroleum and recognises the unique kaitiaki (caretaker) role of the iwi of Taranaki regarding petroleum and minerals. The agreement provides for early engagement on petroleum block offers. This enhanced agreement is unique to the Taranaki area as it recognises Taranaki is the only petroleum-producing basin in New Zealand.

These obligations extend to Ngāti Manuhiakai via the Post Settlement Governance Entity (PSGE) for ngā hapū o Ngāruahine.

It is important to note that this settlement legislation does not preclude Ngāti Manuhiakai, and Ngāruahine more generally from pursuing further claims against the Crown to address other breaches of the Treaty which occur later than 21 September 1992[14].

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[9] Wai 796, 2003, pg 79
[10] Ngāruahine Claims Settlement Act 2016, section 9
[11] Ibid
[12] Ibid
[13] Ibid
[14] https://www.govt.nz/browse/history-culture-and-heritage/treaty-settlements/find-a-treaty-settlement/ngaruahine/ngaruahine-deed-of-settlement-summary/

Summary

As the Kupe field enters what we understand to be the final decade or so of productive life a fundamental expectation is that this project and associated application will create space and confirm the importance of the methods by which Ngāti Manuhiakai exercise their customs and lore regarding the use and development of petroleum resources.

This project and associated application are the first to be made for the Kupe field following the promulgation of Settlement legislation. Ngāti Manuhiakai expect that no further breaches of the Treaty acknowledged as such in the 2016 legislation will result from this project.

The next section of this impact assessment considers the project, and the impact assessment work completed to date within the context of the existing interests of Ngāti Manuhiakai articulated above and makes recommendations to Beach Energy (as the applicant), and the Environmental Protection Agency (EPA) as the Crown agency responsible for the consideration, and subsequent monitoring or performance of the permissions applied for.

4.0 Ngā Take/Actual and Potential Environmental Effects – Kupe Phase 2 Development Drilling Programme.

Table 1 below sets out an impact assessment for the activity within the existing environment as understood by Ngāti Manuhiakai. Attributes of this environment are included in the ngā whakaaro/rationale column. Recommendations for how potential effects on the existing interests of Ngāti Manuhiakai are then made within this context.

To assist the EPA in considering the application, this CIA has been aligned to *He Whetū Mārama*, the framework that guides the EPA in the undertaking of its statutory and other obligations to Māori. This is outlined in Table 1:

Ngā Mātāpono (Principles)	Ngā Whakamāramatanga (explanations)	**Ngā Whakaaro** (rationale)	Ngā Take me Ngā Tohutohu (assessment and recommendations)
WAKA HOURUA / PARTNERSHIP	The principle of PARTNERSHIP requires that the EPA acts reasonably, honourably, and in good faith to ensure the making of informed decisions on matters affecting the interests of Māori.	***Ngāti Manuhiakai Custom and Lore interests.*** Article 2 of the Treaty contains an unqualified guarantee to the rangatira and hapū of New Zealand of "rangatiratanga" (in te reo Māori) and "full exclusive and undisturbed possession" (in English) in relation to their lands, estates, forests, fisheries and "taonga katoa". The exercise of those guaranteed rights and interests is a lawfully established existing activity for the purposes of the EEZ Act. The exercise of these rights and interests can be described as the most long-standing lawfully established existing class of activities in New Zealand. Those rights were not affected by the acquisition of sovereignty by the British Crown in 1840. Article 2 of the Treaty recognises the continued existence of these rights and interests[15]. This coastal marine area is subject to statutory acknowledgement afforded under the Ngāruahine Claims Settlement Act 2016, as well as Te Korowai o Ngāruahine Trust application (CIV-2017-485-000243) and claim for Customary Marine Title and Protected Customary Rights under the Marine and Coastal Act 2011. These amplify the basis for the existing mana whenua mana moana interests of Ngāti Manuhiakai in the Kupe field. Kaitiakitanga[16,] is recognised as an aspect of the existing interest of Ngāti Manuhiakai. Hapū experts advise that it is important to note that kaitiakitanga includes the practise of use, development, restoration and protection of resources and relationships[17], not just the stewardship of resources as commonly misconceived[18]. As outlined above, for Ngāti Manuhiakai kaitiakitanga is an expression of manaakitanga; a method through which Ngāti Manuhiakai undertake their obligations to uplift the mana of people and entities who conduct business within the rohe of Ngāti Manuhiakai. It is also necessary to understand the inextricably linked concepts of whanaungatanga and kaitiakitanga; a system that enabled human exploitation of the environment, but through the kinship value (known in Te Ao Māori as whanaungatanga) they also emphasised human responsibility to nurture and care for it (known in Te Ao Māori as kaitiakitanga)[19]. These give context to the existing interest that Ngāti Manuhiakai has in the Kupe field and supporting infrastructure, and the lands, estates, forests, fisheries and "taonga katoa" therein. Previous approvals that have facilitated the exploitation of resources from the Kupe field have largely excluded Ngāti Manuhiakai from exercising their rangatiratanga or kaitiakitanga. Instead, Ngāti Manuhiakai has relied on their relationships with one or two key people within the operators through which they have been able to exercise their kaitiakitanga and manaakitanga interests. Ngāti Manuhiakai consider that those individuals have driven Beach to be a culturally competent company. Moving forward a reliance on informal processes is considered risky, and as operators change or should those individuals leave the ability for Ngāti Manuhiakai to exercise those interests may be severed. For this reason, a more formalised forum, underpinned through a condition of both consents is recommended. Suggested wording for this is included in the column adjacent. In large projects such as the proposal it is common that iterative changes in delivery to respond to changes in context will be made. Conditions which require the on-going engagement of Ngāti Manuhiakai in those changes and certifying the management plans which are proposed to avoid, remedy and/or mitigate the	***Kaitiakitanga interests of Ngāti Manuhiakai*** To take into account the existing interests of Ngāti Manuhiakai with respect to this proposal structuring whanaungatanga and kaitiakitanga into the project are recommended. It is important to note that this is interrelated with the mauri assessment undertaken below. The intervention of kaitiaki and cultural tools to address impacts on mauri are fundamental in taking into account the principle of waka hourua/partnership. The relationship between Beach and Ngāti Manuhiakai, and engaging a CIA to inform the regulatory process is a positive example of this. However, it is recommended that the applicant goes further and develops a partnership agreement with Ngāti Manuhiakai and considers how the ongoing role of kaitiaki is implemented through procurement and structured into the project. Similarly, conditions of consent that provide assurance that whanaungatanga and kaitiakitanga will continue to play a role in the management of the effects of the proposed activities on the existing interests of Ngāti Manuhiakai is recommended. A Kaitiakitanga Forum type process is one method of providing that. A condition that achieves this could be as follows: Recommended condition – *The Consent Holder shall convene and resource a Kaitiaki Forum. This Forum shall commence prior to commencement of works on site for the duration of the project.* *The function and purpose of the Kaitiaki Forum shall be formally agreed by the Consent Holder and Ngāti Manuhiakai and formally documented in a Forum Collaboration Agreement. This Agreement shall include, but not be limited to:* *a) reference to the Cultural Impact Assessment Kupe Phase 2 Development Drilling Programme; dated March 2022; prepared by Ngāti Manuhiakai* *b) the entities to be represented on the forum, and number of representatives;* *c) the frequency at which the forum will meet;* *d) the decision-making process to be utilised in the forum; and* *e) a dispute resolution clause.* *Advice Note: Given the scale of the development it is anticipated that a number of changes will be made through the construction phase and beyond. A Kaitiaki Forum enables the Consent Holder to obtain the necessary cultural expertise to inform those decisions, as well as providing for the role of Mana Whenua as Kaitiaki in managing, avoiding, remedying and mitigating the effects of the consented development.*

[15] Trans-Tasman Resources Ltd v Taranaki-Whanganui Conservation Board and others [2020] NZCA 86 CA573/2018
[16] kaitiakitanga is both an expression and affirmation of rangatiratanga" and explains that "rangatiratanga is the authority for kaitiakitanga to be exercised – Kawharu, M., Kaitiakitanga: A Maori anthropological perspective of the Maori socioenvironmental ethic of resource management. Journal of Polynesian Society, 2000. 109(4): p.349-370
[17] http://www.environmentguide.org.nz/issues/marine/kaitiakitanga/what-is-kaitiakitanga/
[18] Trans-Tasman Resources Ltd v Taranaki-Whanganui Conservation Board and others [2020] NZCA 86 CA573/2018
[19] Waitangi Tribunal Ko Aotearoa Tēnei: A Report into Claims Concerning New Zealand Law and Policy Affecting Māori Culture and Identity (Wai 262, 2011)

		adverse effects of the operation. As articulated in the assessment below with respect to mauri, there are a number of potential adverse effects which require management across the implementation of this consent. For this reason, a Kaitiaki Forum (or similar) that enables the consent holder to access cultural expertise in making operational decisions which affect those aspects of mauri is recommended. This application is for what will be the final stages of productive life in the Kupe field. In respect to the resource protection or management aspects of kaitiakitanga it is considered that specific conditions are required to ensure that Ngāti Manuhiakai are able to exercise that interest through the implementation of the programme of works. Fundamental to kaitiakitanga are requirements on tangata whenua to nurture relationships between people, and people and place. At a practical level this requires access into a kaupapa, to information, and to an area. It requires opportunities for Tangata Whenua to contribute to the decisions towards better health and well-being (cultural, social, economic and environmental). It is a continuous and ongoing process. It is reliant on a willingness of all parties to engage in that process and relationship to be successful. *Ngāti Manuhiakai Treaty of Waitangi Interests* As outlined above, and as articulated in Wai 796 Ngāti Manuhiakai also hold Treaty Interests that remain unresolved regarding the ownership of petroleum resources within our rohe. In determining this application, the EPA are required to consider the economic benefit of the project to New Zealand[20]. Whilst the project through the generation of work, and royalties continuing to be paid to the Crown undoubtedly generate economic benefit, there are limited demonstrable positive impacts on the social or cultural well-being of Ngāti Manuhiakai resulting from the exploitation of resources in the Kupe field since operations began in 1986. Those factors which improve social and cultural wellbeing such as education, employment or the maintenance/development of cultural infrastructure such as marae/pā, whare wānanga and the like have not benefitted from the exploitation of the Kupe field as would be expected if the existing rangatira interests of Ngāti Manuhiakai[21] taken into account, or if the Crown applied the Treaty principle of Partnership to any degree. The cumulative adverse effects on Ngāti Manuhiakai resulting from this is significant, ongoing and as noted in the apology from the Crown to the broader Iwi o Ngā Ruahine remains a source of grievance[22].	*Treaty of Waitangi Interests of Ngāti Manuhiakai* Ngāti Manuhiakai acknowledge that addressing these interests is primarily the responsibility of the Crown. The recommendations of Wai 796 remain the recommendations of Ngāti Manuhiakai with respect to our Treaty interests in this resource. Notwithstanding this, Ngāti Manuhiakai encourage Beach as a partner now that it is aware of these existing interests, to consider how through the delivery of this project is able to take these into account. Ultimately Ngāti Manuhiakai yearn for their mokopuna to come home. To have education and employment opportunities in their own rohe. And to have the opportunity to lead peaceful, secure lives acting in roles for their hapū where they are equipped to continue to manaaki all people who operate in the rohe of Ngāti Manuhiakai.
WHAI WĀHI / PARTICIPATION	The principle of PARTICIPATION informs the development of EPA strategy, policy, and process that enables the effective engagement and input of Māori.	This lack of participation and effective engagement of cultural expertise to inform operations within the Kupe field over the past 36 years has resulted in a number of adverse effects on the existing interests of Ngāti Manuhiakai these include the following: • This exclusion of mātauranga Māori and tikanga Māori including the kaitiaki role of Māori and the protection and enhancement of the mauri and mana of the Kupe field and surrounds. This results in significant adverse effect on cultural identity and the relationship Ngāti Manuhiakai are able to have with this area and project. • This exclusion from participation adversely affected the ongoing rights of Ngāti Manuhiakai to realise economic potential and generate economic benefit, or enhance their cultural, social, spiritual, and physical health through the development and exploitation of the Kupe field traversed above. It is important to note that the cumulative adverse effects in successive campaigns since 1986 that result from this lack of participation is significant.	It is considered that to avoid the continuation of the lack of participation and the resulting adverse effects on mana whenua that specific conditions are required for both the Marine Consent and Marine Discharge Consent are required that set structures in place that provide for the existing interests of Ngāti Manuhiakai with this area. A Kaitiaki Forum, and co-development of any monitoring programme being two key mitigations in that respect. Ngāti Manuhiakai recognise that whilst whakapapa is the fundamental difference between the Te Ao Māori perspective and western science, both views need to be utilised to inform the use and management of natural resources to achieve the common objective of environmental sustainability.

[20] Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, section 59(2)(f).

[21] This is outlined at length in the findings of the Waitangi Tribunal Petroleum Report, 2000 (Wai 796). The report recorded that Māori had legal title to petroleum in their land prior to 1937, and that the petroleum assets should be included in the Treaty negotiations. The Crown failed to honour the findings of the Tribunal. A further report was issued in 2011 highlighting how the petroleum regime was in breach of the Treaty of Waitangi. The Tribunal found flaws in the management regime including the lack of protection given to Māori rights and lands.

[22] This position is consistent with the information shared by ngā iwi o Taranaki to MBIE through successive block offer processes regarding the positive economic benefits of the oil and gas industry in the Taranaki Region. Māori in our region remain disproportionately represented in all depravation statistics. MBIE note there is concern among a range of submitters that oil and gas activity has not and therefore will not bring any benefits to iwi, hapū and whānau, or to the region in which the activity is occurring. The suggested jobs and wealth created by the activity is viewed sceptically by these groups who outline a level of poverty for their people despite claims that the royalties derived from the industry contributes greatly to the economy.

<table>
<tr>
<td>PITO MATA / POTENTIAL</td>
<td>The principle of POTENTIAL recognises that EPA decision-making and activities have impacts on the direction for future growth and development in a Māori cultural and economic setting.</td>
<td>The Just Transition was announced in early 2018[23]. This is considered an important aspect of the socio-economic environment for the region. As mentioned in the application, Kupe is entering into the final stages of productive life. Other offshore fields including Tui, Pohokura, Māui and Maari will in the coming decades require decommissioning and remediation as they come to the end of their productive life as Aotearoa transitions away from fossil fuels. MBIE in partnership with local government and ngā iwi o Taranaki have developed a Taranaki 2050 Roadmap to guide this transition. Tapuae Roa recognises that tangata whenua are major contributors to and will play an increasingly important role in the future of the Taranaki economy for the well-being of the entire community.

These attributes of the current socio-economic environment are considered important context in which this project sits within. Although decommissioning is not part of this application, it is important to develop the skills, knowledge and techniques of the local Taranaki community (including our Māori communities) to contribute to the restoration of our marine environment as a part of our Just Transition.

Ensuring ngā iwi o Taranaki are not excluded from the opportunity to develop this mātauranga, should they wish to, is fundamental for the applicant to take into account this principle of pito mata/potential.</td>
<td>Potential is realised through the opening of pathways for Ngāti Manuhiakai to contribute to this kaupapa long-term. Ensuring the opportunity for Ngāti Manuhiakai to utilise and develop mātauranga to participate meaningfully in this industry through this project and when the field is decommissioned is recommended.

Opportunities for tikanga, kawa and mātauranga in the avoidance, remediation or mitigation of actual and potential adverse effects that may arise from those activities are considered to only add value in achieving the purpose of the EEZ Act.

Structuring whanaungatanga and kaitiakitanga into projects and securing these through condition of consent are key building blocks in achieving this potential, to improve the ongoing social, cultural, and economic well-being of Ngāti Manuhiakai.</td>
</tr>
<tr>
<td>TIAKITANGA / PROTECTION</td>
<td>The principle of active PROTECTION requires the EPA to take positive steps to ensure that Māori interests, knowledge, and experience are valued in its decision making and activities.</td>
<td>In addition to the existing interests of Ngāti Manuhiakai articulated in section 3 above, the Act requires a description of the current natural environment and its constituent parts against which the impacts of an activity can be considered. In describing the current natural environment from a Te Ao Māori perspective requires the holistic and interconnected nature of that environment to be articulated/considered, including intrinsic responsibilities for Ngāti Manuhiakai such as kaitiakitanga.

The conditions as drafted are silent on the existing interests of Ngāti Manuhiakai, or the process related requirements which enable Ngāti Manuhiakai to perform this role.

To undertake an assessment against mauri it is important to note that the current state of the environment does not exist in a vacuum and that it is a direct result of the development of the Kupe field over time. The proposed activities are occurring in this context where the natural environment is already heavily impacted from a cultural perspective, and the role of kaitiakitanga in the general management of those resources reduced significantly as outlined above. This must be reflected in any description of the current state of the existing environment.

In undertaking this assessment, it is understood that in many cases impacts on the mauri of environmental features or species overlaps with the values derived from western science and those that have already been described in the Impact Assessment; nevertheless, these cultural impacts need to be articulated. The cultural values of specific concern to Ngāti Manuhiakai are set out in the Ngā Kaupapa column below. A fuller description is contained in Appendix 2.

The modified criteria for determining residual impacts on mauri are outlined in Table 1b as follows.
<table>
<tr><th>Activities</th><th>Ngā Kaupapa</th><th>Impact or interaction / Env. features and/or species</th><th>Current State of Mauri of Env. feature and/or Species Interpreted by Mana Whenua</th><th>Predicted Magnitude of Env. Impact from the IA in the application</th><th>Residual Impact on Mauri under current proposal (n.b. following confirmation of conditions some of these levels may be reduced)</th></tr>
<tr><td colspan="6">Planned Activities</td></tr>
</table>
</td>
<td>The Impact Assessment set out in the application has been completed in the absence of an assessment against the current state of mauri. For mauri to be accurately assessed against the impacts of the proposal a baseline or current state of mauri must be determined for each of the receptors or environmental features and/or species of cultural significance to Ngāti Manuhiakai. This determination can only be made by tangata whenua and is a determination of the mauri that will prevail in the absence of the project or in this case prior to the development of the Kupe field. The current state of mauri also describes the historical trends for resources that have contributed to this state.

As mentioned, this determination was absent in the initial scoping process for this proposal and was not undertaken as a part of previous approvals. As a result, the negative effects, proposed mitigation measures and the assessment of the residual impacts have been identified without this baseline state of mauri.

In lieu of that scoping process, Ngāti Manuhiakai has determined the current state of mauri for each of the receptors or environmental features and/or species of cultural significance through hui (refer to Table 1b). These determinations were then assessed against the predicted magnitude of environmental impact of the project as articulated throughout section 7 and summarised in Table 33 in the application (where the natural environment is already heavily impacted from a cultural perspective) (refer to Tables 2-5). This resulted in a residual impact on mauri (in the absence of cultural mitigations measures) (refer to Table 6).

Where the level of residual impact is <u>low</u> it is assumed that generic control measures are already in place in the design process but require continuous monitoring and improvement. Where the level of residual impact is <u>moderate or above</u> it requires additional control measures to move the risk to lower the residual impact on mauri. This informs the basis of the recommendations made below.</td>
</tr>
</table>

[23] https://www.mbie.govt.nz/business-and-employment/economic-development/just-transition/

		Pre-drill works	Ngā Taonga Koiora (native flora and fauna)	Effects on the pelagic environment	Minor degradation	Negligible	Very low
				Effects on benthic environment	Minor degradation	Negligible	Very low
		Installation and removal of MODU	Ngā Moana (offshore waters)	Reduction in water quality	Minor degradation	Negligible	Very low
			Ngā Taonga Koiora (native flora and fauna)	Collision and entanglement of marine mammal	Severe degradation	Negligible	Low
				Collision or disorientation of seabirds	Severe degradation	Negligible	Low
			Ngā Taonga Tuku Iho (valued flora and fauna)	Aggregation effects on fish	Minor degradation	Negligible	Very low
			Ngā Taonga Koiora (native flora and fauna)	Effects on benthic environment	Minor degradation	Negligible	Very low
		Drilling operations	Ngā Taonga Koiora (native flora and fauna)	Behavioural and masking effects of marine mammals	Severe degradation	Less than minor	Moderate*
				Effect on seabirds	Severe degradation	Negligible	Low
			Ngā Taonga Tuku Iho (valued flora and fauna)	Noise and vibrational effects on fish	Moderate degradation	Negligible	Very low
				Noise and vibrational effects on cephalopods	Moderate degradation	Negligible	Very low
			Ngā Taonga Tuku Iho (valued flora and fauna)	Drilling on benthic environment	Minor degradation	Negligible	Very low
		Discharge and deposition of drill cuttings	Ngā Taonga Koiora (native flora and fauna)	Effects on primary productivity from increased turbidity	Minor degradation	Negligible	Very low
				Effects on fish, fish larvae and zooplankton from increased turbidity	Moderate degradation	Negligible	Very low
				Effects on marine mammals due to turbidity effects	Severe degradation	Less than minor	Moderate*
				Effects on benthic communities due to deposition of cuttings	Major degradation	Minor	High**
		ROV Works	Ngā Taonga Koiora (native flora and fauna)	Effects on pelagic environments	Minor degradation	Negligible	Very low
				Effects on benthic environments	Minor degradation	Negligible	Very low
		Formation Evaluation	Ngā Taonga Koiora (native flora and fauna)	Effects of flaring on seabirds	Severe degradation	Less than minor	Moderate*
		Supporting activities	Ngā Taonga Koiora (native flora and fauna)	Behavioural effects on marine mammals	Severe degradation	Less than minor	Moderate*

Aspects of the proposal go some way to lessening the impact on mauri. Ngāti Manuhiakai consider the resourcing of hapū members, suitably qualified and experienced to monitoring impacts on mauri, to undertake the role of Marine Mammal and Seabird Observer. Ngāti Manuhiakai consider this a positive example (*).

Other recommendations for the operation to better take into account our kaitiakitanga includes restricting the use of explosives and the discharge of further material (e.g faulty cement and deck drainage) and disposing of this on-shore, acknowledging the extremely low likelihood of this being required (*).

It is recommended that the applicant considers further mitigation through the co-development and implementation of an Environmental Management Plan (EMP) with Ngāti Manuhiakai. As shown in the matrix higher impact outcomes are generally related to the inability to exercise rangatiratanga/mana moana, kaitiakitanga and undertake associated tikanga to protect and enhance mauri and mana. The following recommendations are made noting that reducing impacts on mauri are not able to be achieved without mana whenua.

Environmental Monitoring Plan (**)

It is understood that monitoring programmes generally rely on methodologies set out in the Offshore Taranaki Environmental Monitoring Protocol (OTEMP), recognised as industry best practise with consistent use generating a data set that is replicable and comparable across multiple areas of the marine environment. The importance of this is not questioned, however it is expected that both western science and mātauranga Māori will be utilised in demonstrating performance of this consent and the overall health of the natural environment subject to this proposal.

The EMP is the primary tool and opportunity to reduced residual impacts on mauri (as stated under the current proposal) to a position of no net loss or net gain. The EMP should summarise the residual impacts from the Impact Assessment and provide an explanation of how a position of no net loss or net gain will be achieved via a series of practical management actions and associated timescales for their implementation. The time it will take to achieve a position of no net loss or net gain from a state of impacted mauri is unknown.

The Plan is proposed to define how the actual impacts of the project will be monitored and assessed, how the implementation of the management actions will be verified, and how the effectiveness of the management actions will be measured. Again, these must be done so in a way that will inform the state of impacted mauri.

The Plan should also include the projects adaptive co-management strategy including when adaptive co-management is warranted (ie trigger points for additional management) and how it will be implemented. Adaptive co-management is critical to achieving long-term biodiversity commitments and goals. It is also well suited to traditional ecological knowledge and arguably

				Behavioural effects on seabirds	Severe degradation	Less than minor	Moderate*
		Environmental Monitoring	Ngā Taonga Koiora (native flora and fauna)	Reduction in water quality on pelagic environment	Minor degradation	Negligible	Very low
				Physical disturbance on benthic environment	Minor degradation	Negligible	Very low
		Contingent Activities					
		Effects of explosives	Ngā Taonga Koiora (native flora and fauna)	Underwater noise on pelagic environment	Minor degradation	Less than minor	Low
				Behavioural effects on benthic environment	Moderate degradation	Almost negligible	Low
		Excess Cement Disposal	Ngā Taonga Koiora (native flora and fauna)	Increased turbidity on pelagic environment	Minor degradation	Negligible	Very low
				Smothering effect on benthic environment	Minor degradation	Negligible	Very low
		Deck Drainage	Ngā Taonga Koiora (native flora and fauna)	Harmful effects on plankton and primary productivity	Minor degradation	Negligible	Very low
				Harmful effects on benthic invertebrates	Minor degradation	Minor degradation	Very low
				Harmful effects on pelagic invertebrates	Minor degradation	Minor degradation	Very low
				Harmful effects on seabirds	Severe degradation	Minor degradation	High**
			Whaioranga (economic development and sustainability)	Effects on recreational fishing	Moderate degradation	Minor degradation	Moderate*
				Effects on commercial fishing	Moderate degradation	Minor degradation	Moderate*
		Other Activities					
		Effects on Human Health	Ngā Tangata (people) - Taha wairua, Taha whānau, Taha hinengaro, Taha tinana	Effects on hauora	Major degradation	Negligible	Low
		Effects outside the EEZ	Ngā Moana (offshore waters)	Effects on water quality	Minor degradation	Negligible	Very low
		Cumulative Effects from Planned Activities					
		Cumulative Effects	Ngā Taonga Koiora (native flora and fauna)	Effects of deposition of cuttings on benthic communities	Minor degradation	Minor	Low
				Noise and vibration effects on marine mammals	Severe degradation	Less than minor	Moderate**
				Noise and vibration effects on seabirds	Severe degradation	Less than minor	Moderate**

kaitiakitanga, indigenous knowledge and mātauranga due to the dynamic nature of the processes of traditional ecological knowledge.

Finally, the Plan should also include Key Performance Indicators (KPI's) and cultural indicators which will determine the project's success in meeting a position of no net loss or net gain with respect to mauri.

A condition that achieves this could be as follows:

Recommended condition –
The Consent Holder shall co-design and implement the Environmental Management Plan which includes an adaptive co-management strategy with Ngāti Manuhiakai to provide an opportunity for mātauranga to inform the Plan and its implementation.

The proffered conditions include a consultation feedback loop in the initial development of the EMP which goes some way towards these outcomes. The proffered conditions also outline who is considered a suitably qualified and experienced person to draft the EMP[24]. This definition is problematic in it does not recognise mātauranga Māori as expertise and could have a limiting factor on taking into account kaitiakitanga. Overall, this approach falls short of co-development and adaptive co-management as articulated above, and associated remediation on mauri that approach works towards. This is interrelated with other measures (i.e., the use of marine mammal observers and the like) which work together to reduce impacts on mauri overall.

Ngāti Manuhiakai Hapū recognise that other parties have existing interests in the application area and therefore the ability to invite other parties into the co-development process if required should be accommodated within the processes to design monitoring plans. Ngāti Manuhiakai are mana whenua and hold a longstanding relationship with the consent holder that, in part, enables the hapū to exercise their existing interests articulated above within the operations of Beach Energy. Should the conditions of these consents elevate the role of parties that are not mana whenua this has the potential to generate adverse effects on the existing interests of Ngāti Manuhiakai.

As outlined above, Ngāti Manuhiakai express and implement their kaitiakitanga and manaakitanga obligations in manner which uplifts and improves the connection between any entity operating in our rohe.
This same rationale extends to the formation of any consultative group through conditions that may be imposed.

Similarly, Ngāti Manuhiakai recommends the inclusion of a condition that requires the resourcing of a hapū member, suitably qualified and experienced to monitoring impacts on mauri, to undertake the role of Marine Mammal and Seabird Observer including monitoring contingent activities (e.g the use of explosives and the discharge of faulty cement and deck drainage). This should

[24] *Suitably qualified and experienced person means a person who:*
(a) holds a degree qualification in the relevant subject matter, or holds relevant professional certification from a relevant professional body; and
(b) has at least eight years' relevant experience.

				Explosives on pelagic environment	Minor degradation	Less than minor	Low
				Maritime traffic - Harmful substance discharges	Minor degradation	Negligible	Very low
				Maritime traffic - noise and vibration	Minor degradation	Negligible	Very low
		Unplanned Activities					
		Loss of Well Control	Ngā Taonga Koiora (native flora and fauna)	Effects on marine mammals	Severe degradation	Minor	High**
				Effects on seabirds	Severe degradation	Minor	High**
				Effects on fish	Moderate degradation	Less than minor	Moderate*
				Effects on plankton and primary production	Minor degradation	Almost negligible	Very low
				Effects on benthic environments	Minor degradation	Minor	Low
		Fuel spill from refuelling operations	Ngā Taonga Koiora (native flora and fauna)	Effects on biological environment	Minor degradation	Less than minor	Low
			Whaioranga (economic development and sustainability)	Effects on fisheries	Moderate degradation	Negligible	Very low
		Vessel Collision	Ngā Taonga Koiora (native flora and fauna)	Effects on pelagic environment	Minor degradation	Less than minor	Low
				Effects on benthic environment	Minor degradation	Almost negligible	Very low
			Whaioranga (economic development and sustainability)	Effects on socio-economic environment	Severe degradation	Less than minor	Moderate*
		Biosecurity Incursion	Ngā Taonga Koiora (native flora and fauna)	Effects on benthic environment	Minor degradation	Less than minor	Low
			Whaioranga (economic development and sustainability)	Effects on socio-economic environment	Severe degradation	Less than minor	Moderate*

be specified explicitly, as opposed to being contained within the EMP more generally.

Longer term exclusion of activities which impact negatively on mauri (**)

Ngāti Manuhiakai understand from the application is that time is the primary tool that will enable the seabed and biodiversity to return to a more natural state post drilling. Success of this is determined through the EMP process. The application considers that this should occur in a relatively short timeframe and has based the length of consent (out to 2028) to conservatively provide for that. Ngāti Manuhiakai support this approach.

In the instance that this is not achieved, and a longer time period is required (depending on what the EMP considered 'success' to include) understanding the mechanisms available to extend that timeframe or consider other offsets or environmental compensation may be available in line with an adaptive co-management approach are recommended. Ngāti Manuhiakai continue to advocate for this area to be excluded from commercial fisheries and other extractive industries until such time as that is achieved.

Table 1a: Cultural impact assessment table

Consequence level	Scale	Duration and Recovery	Populations and Protected Species	Habitat and Ecosystem Function	Socio-Economic
0 – Negligible	Highly localised effect (<1 km2).	Temporary duration (days-weeks). No recovery period necessary	No predicted adverse effects to populations. Almost no protected species impacted.	Undetectable, affecting <1% of original habitat area. Ecosystem function unaffected outside of natural variation.	No disruptions to normal
1 – Minor	Localised effect (1-5 km2).	Short term duration (weeks-months). Rapid recovery would occur once activity stops (within weeks)	Possible adverse effect to populations, but not sufficient to be detectable. Some individuals of protected species may be impacted but no impact on their population.	Measurable but localised, affecting 1-5% of original habitat area. Minor changes to ecosystem function.	Short term disruptions to normal activities (weeks to months)
2 – Moderate	Medium scale effect (5-100 km2).	Medium term duration (months). Short term recovery period required once activity stops (within months).	Detectable impacts to populations. Could affect seasonal recruitment but does not threaten long-term viability. Some population level effects may become apparent for protected species.	Potential impacts more widespread, affecting 5-20% or original habitat area. Moderate changes to ecosystem function.	Medium term disruptions to normal activities (months).
3 – Severe	Large scale effect (100-500 km2).	Long term duration (years). Substantial recovery period required once activity stops (within years).	Impacts to populations are clearly detectable and may limit capacity for population increase. Population level impacts are clearly detectable for protected species.	Widespread impacts, affecting 20-60% of original habitat area. Severe changes to ecosystem function.	Long term disruptions to normal activities (years).
4 – Major	Very large-scale effect (500-1,000 km2).	Extensive duration (years-decades). Substantial recovery period required once activity stops (years to decades).	Long-term viability of populations is clearly affected. Local extinctions are a real possibility if activity continues. Serious conservation concerns for protected species.	Activity may result in major changes to ecosystem or region, affecting 60-90% of original habitat area. Major changes to ecosystem function.	Extensive disruptions to normal activities (years-decades).
5 – Catastrophic	Regional effect (>1,000 km2).	Very extensive duration (decades). Extremely long recovery period (> decades) or no recovery predicted.	Local extinctions are expected in the short-term. Very serious conservation concerns for protected species	Activity will result in critical changes to ecosystem or region, affecting virtually all original habitat. Total collapse of ecosystem.	Very extensive disruptions to normal activities (decades).

Table 2: Criteria for assessing potential consequence levels

Level/score	Description	Likelihood of exposure
1	Remote	Extremely unlikely but theoretically possible.
2	Rare	May occur, but only in exceptional circumstances.
3	Unlikely	Not likely to occur in normal circumstances.
4	Possible	Could occur at some time.
5	Likely	Will probably occur in normal circumstances.
6	Certain	Is expected to occur in most circumstances and has a history of occurrence.

Table 3: Criteria for assessing consequence likelihood

		Consequence levels					
		0 Negligible	1 Minor	2 Moderate	3 Severe	4 Major	5 Catastrophic
Likelihood of Conse	1 – Remote	Negligible	Very low	Very low	Low	Low	Low

quenc e	2 – Rare	Negligible	Very low	Low	Moderate	Moderate	Moderate
	3 – Unlikely	Negligible	Low	Moderate	Moderate	High	High
	4 - Possible	Negligible	Low	Moderate	High	High	Extreme
	5 - Likely	Negligible	Low	Moderate	High	Extreme	Extreme
	6 - Certain	Negligible	Moderate	High	Extreme	Extreme	Extreme

Table 4: Overall risk of residual impact

Risk Ranking		Potential Impact	Predicted Magnitude of Environmental Risk
	Extreme	**Extreme Risk** – _unacceptable for project to continue under existing circumstances. Requires immediate action._ Equipment could be destroyed with large environmental impact as a result of the activity.	Very significant
	High	**High Risk (intolerable risk)** – _where the level of risk is not acceptable and control measures are required to move the risk to lower the risk categories._ Medium environmental impact from the activity.	Significant
	Moderate	**Moderate Risk** – _requires additional control measures where possible or management/communication to maintain risk at less than significant levels._ Small environmental impact from the activity. Where risk cannot be reduced to 'Low' control measures must be applied to reduce the risk as far as reasonably practicable. Requires continued tracking and recorded action plans.	Minor
	Low	**Low Risk** – where the level of risk is broadly acceptable and _generic control measures are already assumed in the design process but require continuous monitoring and improvement._	Less than minor
	Very Low	**Very Low Risk** – where the level of risk is acceptable and _no_ specific control measures are required.	Almost negligible
	Negligible	**Negligible Risk** – _no_ intervention or further monitoring is required. Negligible (at worst) environmental impact.	Negligible

Table 5: Risk ranking description

	Current State of Mauri of Environmental Feature and/or Species					
	Pristine / undisturbed	Minor degradation	Moderate degradation	Severe degradation	Major degradation	Catastrophic degradation
Predicted Magnitude of Environmental Impact	The mauri of the environmental features and/or species is pristine and undisturbed. The concerns of kaitiaki are negligible.	Minor degradation on the mauri of the environmental features and/or species. The concerns of kaitiaki are low.	Moderate degradation on the mauri of the environmental features and/or species. The concerns of kaitiaki are moderate.	Severe degradation on the mauri of the environmental features and/or species. The concerns of kaitiaki are moderate to high.	Major degradation on the mauri of the environmental features. The concerns of kaitiaki are very high.	Catastrophic degradation on the mauri of the environmental features and/or species. The concerns of kaitiaki are major.

Negligible	Negligible	Very low	Very low	Low	Low	Low
Almost Negligible	Negligible	Very low	Low	Moderate	Moderate	Moderate
Less than minor	Negligible	Low	Moderate	Moderate	High	High
Minor	Negligible	Low	Moderate	High	High	Major
Significant	Negligible	Low	Moderate	High	Major	Major
Very significant	Negligible	Moderate	High	Major	Major	Major

Table 6: Predicted magnitude assessed against the current state of mauri of environmental features and/or species as interpreted by mana whenua

5.0 Ngā Kupu Whakatepe me Ngā Tohutohu/Conclusions and Recommendations

Ngāti Manuhiakai have prepared this CIA to assess the effects of the Kupe Phase 2 Development Drilling Programme. The assessment has been articulated to *He Whetū Mārama* outlining how the cultural values of Taranaki Iwi are able to be expressed through the project. The existing interests of Ngāti Manuhiakai are articulated in Section 3 above. A description of key customs and lore of Ngāti Manuhiakai are described, with several conditions of consent recommend to take into account those interests.

Similarly, the existing Treaty interests of Ngāti Manuhiakai are also summarised, noting that a full description of those interests is contained in Wai 796 and not repeated in this document. This CIA echo's and reaffirms the recommendations of Wai 796 with respect to the Treaty interests that must be taken into account through this process.

Ngāti Manuhiakai has considered and articulated the environmental effects of the project in the context of mauri. As shown in table 1 above, there are several aspects of the project which interfere with the mauri of this location to such a degree that additional consent conditions are recommended in order to reduce the magnitude of those interferences occurring.

It is noted that due to the nature of the project that an interference to mauri will result irrespective of the conditions of consent; and in this instance offsets are required.

To summarise the recommendations:

1. Update the Existing Interests section of the application to provide the greater depth regarding all of the existing interests of Ngāti Manuhiakai.
2. Update the Existing Environment section of the application to ensure the description of the current natural environment notes the interconnection between those elements described and tangata whenua through whakapapa.
3. Take into account those existing rangatira and kaitiaki interests by structuring whanaungatanga and kaitiakitanga into the programme of works by:
    a. Resourcing engagement with Ngāti Manuhiakai.
    b. Engaging cultural expertise to develop the proposal (ACTIONED AND ONGOING) through engagement of this CIA and adoption of outcomes for the project.
    c. Require that any sub-contractor to the project (including current contractors) are operating to the values of Beach as a culturally competent company, noting that Ngāti Manuhiakai can assist in this. This may require cultural induction of contractors to understand the world view of Ngāti Manuhiakai. Securing this requirement through condition of consent or relationship agreement is recommended.
4. Take into account those existing rangatira and kaitiaki interests through the Impact Assessment/proffered conditions by:
    a. Implementing a Kaitiaki Forum secured by way of condition of consent.
    b. Committing to the co-development of Environmental Monitoring Plan(s) (EMP) for the project with Ngāti Manuhiakai, ensuring our mātauranga has the opportunity to inform the data relied upon for the performance of the Consent Holder. Secure this requirement by way of condition of consent, noting that previous advice to operators similar to this have not eventuated despite best intentions of those operators.

c. Consider the length of time consent is applied for to ensure sufficient time is available for the area to re-balance with respect to mauri, this being informed by the EMP, and an adaptive co-management approach.
d. Ensuring Marine Mammal Observers are utilised through periods of the project which have the potential to disrupt marine mammals.

These recommendations are designed to recognise existing interests of Ngāti Manuhiakai to both the environment and area through whakapapa; and the practice of tikanga and kawa, and the application of mātauranga Māori by our kaitiaki, to ensure the mauri of the ecosystem and environment. Reducing these requirements to conditions of consent, or similar agreement provides assurance that the role of kaitiaki within the project.

Appendix 1 – Statutory Context for this CIA

Te Tiriti o Waitangi

The purpose of CIAs is to ensure that the spiritual and physical well-being of a resource, area or site is maintained and that the kaitiaki obligations of tangata whenua are upheld. These roles and responsibilities apply to the ocean, rivers, lakes, forests, fisheries and wildlife as they do to all natural and physical resources.

These resources were guaranteed to tangata whenua under Article 2 of the Treaty of Waitangi and Te Tiriti o Waitangi (the Māori language version) for as long as tangata whenua so desired. Tangata whenua have not relinquished these rights and responsibilities. Below is a transcript of the Second Article of Te Tiriti o Waitangi followed by the translation into English (Professor IH Kawharu) and the first part of "Article the Second" of the Treaty of Waitangi.

> *"Ko te Kuini o Ingarani ka wakarite ka wakaae ki nga Rangatira ki nga Hapū, ki nga tangata katoa o Nu Tirani te tino rangatiratanga o ratou wenua o ratu kainga me o ratou taonga katoa. Otiia ko nga Rangatira o te wakaminenga me nga Rangatira katoa atu ka tuku ki te Kuini te hokonga o era wāhi wenua e pai ai te tangata nona te Wenua - ki te ritenga o te utu e wakaritea ai e ratou ko te kai hoko e meatia nei e te Kuini hei kai hoko mona."*

> *"The Second The Queen of England agrees to protect the Chiefs, the subtribes and all the people of New Zealand in the unqualified exercise of their chieftainship over their lands, villages and all their treasures. But on the other hand the Chiefs of the Confederation and all the Chiefs will sell land to the Queen at a price agreed to by the person owning it and by the person buying it (the latter being) appointed by the Queen as her purchase agent." (trans. IH Kawharu)*

> *"Her Majesty the Queen of England confirms and guarantees to the Chiefs and Tribes of New Zealand and to the respective families and individuals thereof the full and exclusive and undisturbed possession of their land and Estates, Forests, Fisheries and other properties which they may collectively or individually possess so long as it is their wish and desire to retain the same in their possession....."*

Since the signing of the Treaty of Waitangi in 1840, land and other natural and physical resources have been gradually alienated from tangata whenua. This has diminished the authority of iwi, hapū and whanau over ngā taonga tuku iho for which kaitiaki responsibilities were previously held. Despite this loss, the tikanga, rights and responsibilities over natural and physical resources by mana whenua iwi, hapū and whanau still remain strong.

Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012

The purpose of this Act is to promote the sustainable management of the natural resources of the Exclusive Economic Zone and the Continental Shelf.

Indirectly, the Act will generate a wealth of research to be undertaken in this area, where very little is currently known. This information, along with current knowledge, could contribute to robust environmental impact reporting as well as identifying appropriate mitigation measures. Relevant provisions include:

Section 12 and 18: In order to recognise the Crown's responsibility to give effect to the principles of the Treaty of Waitangi for the purposes of this Act,—(a)… provides for the Māori Advisory Committee to advise the Environmental Protection Authority so that decisions made under this Act may be informed by a Māori perspective.

Section 33 and 59: Requires the Minister, in respect of regulations, and the EPA in respect of marine consents, to take into account the effects on existing interests, which may include Māori who have existing interests as defined in the Act.

Section 45: Requires the EPA to notify iwi authorities, customary marine title groups, and protected customary rights groups directly of consent applications that may affect them[25].

Summary

The Treaty of Waitangi/Te Tiriti o Waitangi 1840, particularly Article two, conferred on tangata whenua a right in respect of full exclusive and undisturbed possession of their lands and estates, forests, fisheries and other properties/taonga. The EEZ, and tangata whenua management plans, are amongst the legislation, policies and statements that affirm the mana whenua status of tangata whenua. The role of kaitiaki in regard to the management and monitoring is affirmed as is the relevance and practice of kaitiakitanga. Some of the mōhiotanga of Ngāti Manuhiakai is articulated into a CIA to provide the applicant with the local context within which the choose to undertake their activities.

[25] EPA (2016) Incorporating Māori Perspectives Into Decision Making. https://www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/293bdc5edc/EPA-Maori-Perspectives.pdf. Accessed June 2021.

Appendix 2 – Expansion of cultural values utilised in the assessment of the impact the proposal has on mauri

The cultural values of specific concern to Ngāti Manuhiakai are as follows:

a) Ngā Tangata (people) - In te ao Māori, the inclusion of the wairua (spiritual health), the role of the whānau (family) and the balance of the hinengaro (mind) are as important as the physical manifestations (body). Should one of the four dimensions be missing or in some way damaged, a person, or a collective may become 'unbalanced' and subsequently unwell. These four dimensions are:
   - Taha wairua (spiritual health) - spiritual health and well-being obtained through the maintenance of a balance with nature and the protection of mauri.
   - Taha whānau (family health) - the responsibility and capacity to belong, care for and share in the collective, including relationships and social cohesion;
   - Taha hinengaro (mental health) – mental health and well-being and the capacity to communicate, think and feel;
   - Taha tinana (physical health) – physical health and well-being.

b) Ngā taonga koiora (native and important fauna) - degradation of the mauri of these taonga species, those being marine mammals, fish and benthic species;

c) Ngā taonga tuku iho (valued flora and fauna) - the degradation of the mauri of species valued by tangata whenua in Fisheries Management Area 8 (FMA8) including snapper, kahawai, blue cod, flatfish, small sharks, eels kina, mussels, toheroa, pipi, cockles and tuatua; and the inability to fish these species due to fishing exclusions in the Tui Field;

d) Ngā moana (coastal and offshore waters) - the degradation of the mauri of this element;

e) Parumoana (seabed) - the degradation of the mauri of this element;

f) Te Hau (air) - the degradation of the mauri of this element and its ability (or not) to sustain all forms of life;

g) Ngā taonga tuku iho (traditional Māori values and practices) - the inability to undertake kaitiakitanga to sustain ourselves and our tikanga;

h) Whaioranga (economic development and sustainability) - The complete disregard for tangata whenua's ownership of minerals and resulting royalties, restrictions to commercial fishing rights has limited our ability to be economically sustainable.

APPENDIX G

Stakeholder Engagement Register

Ngāti Manuhiakai Hapū = NMH

Te Korowai o Ngāruahine Trust = TKoNT

Te Rūnanga o Ngāti Ruanui Trust = TRoNRT

Te Kaahui o Rauru = TKoR

Month	Date	Organisation	Method	Communication Detail
May 2021	06-05-2021	Barbara Kuriger - Taranaki Based MP	Email	Beach extended invitation to Barbara Kuriger to visit the Kupe Production Station. Discussion about the Kupe inlet compressor installation and when the business will bring it online. Conveyed that the new compressor has been designed by Beach and Worley teams and installed, connected and commissioned by New Zealanders. Further discussion about the Kupe Wellhead Platform undertaken and a brief update about Beach's next steps post compressor start up this being the Kupe Phase 2 drilling subject to obtaining relevant approvals. Beach reiterated the importance of stable policy making and the importance of the project both for Beach and New Zealand and how we navigate the transition. Barbara Kuriger accepted invitation to visit the Kupe Production Station. Date and time confirmed for visit in August 2021. Provided a letter dated 22 August 2021 post visit to thank Beach.
	12-07-2021	Ngāti Manuhiakai Hapū	Phone	Explained to NMH that Beach was in the early stages of advising iwi and hapū of the business intentions to apply for a marine consent to support Kupe Phase 2 Development Drilling Programme. This will involve considerable engagement with iwi and hapū stakeholders and advised that we are committed to keeping you informed throughout the process. MR pleased we had reached out early.
July 2021	16-07-2021	Ngāti Manuhiakai Hapū	Phone	Discussed upcoming Kupe Phase 2 Development Drilling Programme. Explained that Beach was planning further development of the Kupe offshore natural gas reserves within our existing mining licence as phase 2 of the Kupe development. Conveyed that Introductory slides would be provided to further explain how the project would be undertaken.
	28-07-2021	Te Korowai o Ngāruahine Trust	Phone	Discussion re date for Kupe Phase 2 Development Drilling Programme.
	29-07-2021	Te Korowai o Ngāruahine Trust	Text	General exchange regarding upcoming meeting.
	30-07-2021	Te Korowai o Ngāruahine Trust	Text	General exchange regarding upcoming meeting.
	29-07-2022	Ngāti Manuhiakai Hapū	Face to face meeting	Beach provided further information to NMH about the application for marine consent and what the process would involve.
August 2021	12-08-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Request to introduce Beach's environmental advisor and provide an update on Beach project activity.
	20-08-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Request to meet to ensure Ngāti Ruanui are informed of Beach's proposed activity.
	20-08-2021	Te Kaahui o Rauru	Email	Notification of Marine survey, advisement that Beach has commenced planning for conducting a marine survey in the offshore South Taranaki Bight. Attached a letter that provided additional information of the proposed survey. Conveyed Beach is keen to consult with TKoR to ensure they have an opportunity to ask any questions and seek further information.
	20-08-2021	Environmental Protection Authority	Meeting (Teams)	Project overview / introduction provided. Regulator meetings and calls prior to the application being lodged.
	24-08-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Confirmation from TRoNRT that they will attend a Teams meeting about the project.
	31-08-2021	Project Reef	Email	Project Reef interest in the pre-activity notice filed with EPA relating to Beach's baseline survey. Project Reef seeking to understand if any data or footage taken as part of Beach's survey work might be shared with Project Reef. Project Reef appreciated that the habitat where Beach's survey is to be undertaken is very different from habitats and substrate that exist in the Patea shoal but felt nevertheless it would be interesting. Advised that TRC coastal plan has been updated since 2019 and now includes Project Reef as an area of outstanding value.
September 2021	03-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Advisement that project slides will be sent by close of business today. Checking on meeting time for any questions for early the following week and understanding who TRoNRT might like to be involved in the meeting. TRoNRT agreed to meet Thursday 9th of September at 9:30pm.
	03-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	06-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Confirmation that slide pack had been emailed through.
	08-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Meeting (Teams)	General exchange regarding upcoming meeting.
	08-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.

Month	Date	Organisation	Method	Communication Detail
	08-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Meeting (Teams)	Overview of the Kupe Phase 2 Development Drilling Programme was provided. Review of introductory slides reviewed and response to questions arising from the meeting.
	14-09-2021	Ngāti Manuhiakai Hapū	Text	NMH conveyed that they have spoken to TKoNT. TRoNRT advised NMH that TRoNRT and TKoNT were in discussion about a potential collaborative CIA. NMH was concerned that NMH's voice may not be heard throughout the process. Discussion about the cultural protocols that would need to be observed.
	14-09-2021	Te Kaahui o Rauru	Email	Beach followed up on the email sent on the 20th of August notifying TKoR of Beach's planned marine survey within permit PML38146. Beach reinforced sentiments expressed in earlier email re questions or feedback, which were needed by 15th of Sept to allow time to inform the planning of this survey and for Beach to share with EPA as standard part of the permitted activity process.
	14-09-2021	Maritime New Zealand	Various	Overview of proposed future activities in the Kupe Field provided, along with discussion around the current and future revisions of the Offshore Spill Response Plan. Emailed project update 1/12/21.
	16-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach advised that business about to submit its initial environmental assessment and sensitive environments contingency plan to EPA (Form 3) in advance of marine survey commencement. Beach advised that it would like to share the document.
	16-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach highlighted that it had been trying to contact TRoNRT. Noted as requested on 9th of Sept for sharing information ahead of work being undertaken. Beach shared initial environmental baseline assessment and sensitive environments contingency for the upcoming marine baseline survey. Advised marine survey date which was weather dependent was 25th of Sept and intention to submit to EPA 10th of Sept to meet EPA regulatory requirements. Highlighted reference to publicly available report completed by NIWA independent of TTRL that can be used to inform our current survey, and application regarding sensitive environments and sediment distribution across areas to the South of the mining licence area and beyond the extent our baseline survey area.
	16-09-2021	Te Korowai o Ngāruahine Trust	Email	Beach provided copy of the Kupe Phase 2 Development Drilling Programme slides that outlined additional information on the project.
	17-09-2021	Ngāti Manuhiakai Hapū	Text	General exchange regarding upcoming meeting.
	17-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Email from TRoNRT advising that it did not have time to review the EPA form document and the earliest this could be achieved would be by the following week.
	17-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach apologised for the short timeframe to review the EPA form and conveyed sentiment would be conveyed to the Beach team. Advised that Beach had to submit the notice to EPA today to meet deadlines for the survey and Beach wanted to be transparent about the content in advance of doing so. Beach emailed Form 3. TRoNRT advised it was not possible to review the document in the timeframe required. Beach emailed TRoNRT to clarify that the document was shared for awareness and transparency as requested and it was not Beach's expectation that it be reviewed as such, apologised for the confusion.
	21-09-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Discussion about TRoNRT CIA template as outlined in TRoNRT Best Practise Guidelines.
	23-09-2021	Ngāti Manuhiakai Hapū	Email	Beach provided copy of TRoNRT Best practise guidelines to NMH chairperson as requested.
	23-09-2021	Department of Conservation	Email and Meeting	Overview of proposed future activities in the Kupe Field provided, along with discussion around the current and future revisions of the Offshore Spill Response Plan. Emailed Project update 1/12/21.
	27-09-2021	Te Korowai o Ngāruahine Trust	Email	TKoNT advised they had met with TRoNRT regarding the development of a CIA relevant to Beach proposed Kupe Phase 2 Development Drilling Programme activities. TKoNT requested additional information about the southeast appraisal well and about engagement with TKoR. TKoNT requested full description of the proposal to assist with the required scope, content, and timeframes of the CIA.
	29-09-2021	Te Kāhui o Taranaki Trust	Email	Project Notification email and Kupe Phase 2 Development Drilling Programme Information Sheet.
	29-09-2021	Te Kaahui o Rauru	Email	
	29-09-2021	Te Kaahui o Rauru	Email	
	29-09-2021	Te Kaahui o Rauru	Email	
	29-09-2021	Te Kāhui o Taranaki Trust	Email	
	29-09-2021	Te Rūnanga o Ngāti Mutunga	Email	
	29-09-2021	Te Rūnanga o Ngāti Tama	Email	
	29-09-2021	Te Rūnanga o Ngāti Maru (Taranaki)	Email	
	29-09-2021	Te Rūnanga o Ngāti Maru (Taranaki)	Email	
	29-09-2021	Te Kotahitanga o Te Atiawa Trust	Email	
	29-09-2021	Te Kotahitanga o Te Atiawa Trust	Email	
	29-09-2021	Te Korowai o Ngāruahine Trust	Text	Follow up with TKoNT

Month	Date	Organisation	Method	Communication Detail
	29-09-2021	Taranaki Regional Council	Face to face meeting	Overview of proposed future activities in the Kupe Field provided, along with discussion around the current and future revisions of the Offshore Spill Response Plan
	30-09-2021	Seafood New Zealand	Email	Project Notification email and Kupe Phase 2 Development Drilling Programme Information Sheet.
	30-09-2021	Sealord Group Limited	Email	
	30-09-2021	Sanford Limited	Email	
	30-09-2021	Talley's Group Limited	Email	
	30-09-2021	Talley's Group Limited	Email	
	30-09-2021	Patea and Districts Boating Club	Email	
	30-09-2021	New Plymouth Sportfishing and Underwater Club	Email	
	30-09-2021	NZ Recreational Fishing Council	Email	
	30-09-2021	Opunake Boat and Underwater Club	Email	
	30-09-2021	Cape Egmont Boat Club	Email	
	30-09-2021	Fluffy Duck Fishing Charters	Email	
	30-09-2021	South Taranaki Fishing Charters	Email	
	30-09-2021	Hy-jinks Fishing Charters	Email	
	30-09-2021	Port Taranaki	Email	
	30-09-2021	Taranaki Harbourmaster	Email	
	30-09-2021	CentrePort Wellington	Email	
	30-09-2021	Wellington Harbourmaster	Email	
	30-09-2021	Deepwater Group	Email	
	30-09-2021	Southern Inshore Fishers	Email	
	30-09-2021	NZ Federation of Commercial Fishers	Email	
	30-09-2021	Egmont Seafoods	Email	
	30-09-2022	Te Ohu Kaimoana	Email	
October 2021	01-10-2021	Taranaki Regional Council	Email	
	02-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	
	03-10-2021	Taranaki Regional Council	Email	
	03-10-2021	Taranaki Regional Council	Email	
	03-10-2021	Marlborough District Council	Email	
	03-10-2021	Marlborough District Council	Email	
	03-10-2021	South Taranaki District Council	Email	
	03-10-2021	New Plymouth District Council	Email	
	03-10-2021	Whanganui District Council	Email	
	03-10-2021	Taranaki/Whanganui Conservation Board	Email	
	04-10-2021	Te Korowai o Ngāruahine Trust	Text	Beach advised pulling together the full description of the proposal as requested and will have this to TKoNT early this week. TKoNT confirmed they had received the proposal and would follow next week when time would allow.
	05-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach sought status update from TRoNRT.

Month	Date	Organisation	Method	Communication Detail
	05-10-2021	Ngāti Manuhiakai Hapū	Email	Beach provided Kupe Phase 2 Development Drilling Programme Information sheet. NMH advised this will be shared with kuia. Discussion about collective CIA with TKoNT and TRoNRT. Shared with NMH that TKoNT would be managing the TKoNT CIA. Advised that Environmental Baseline survey due for completion today. NMH advised they had read the Beach offshore contingency plan and would provide feedback after hapū hui.
	05-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	07-10-2021	Te Korowai o Ngāruahine Trust	Email	Beach provided information pack to assist in the development of TKoNT scope. Beach confirmed that the baseline survey was completed early this week, conveyed that all went well, samples are currently being analysed and we are awaiting the report. Acknowledged capacity concerns raised by iwi, also acknowledged the importance of hearing their voice, understanding their perspectives in respect to the potential effects of our proposed drilling on their cultural values and acknowledge that a CIA is the most appropriate mechanism to understand these. Conveyed tentative timing.
	08-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	08-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	12-10-2021	Ngāti Manuhiakai Hapū	Text	Text sharing policy document to explain how they relate to development of CIAs.
	13-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	13-10-2021	Stuart Nash - Minister of the Crown	Email	Project Notification email and Kupe Phase 2 Development Drilling Programme Information Sheet.
	13-10-2021	Megan Woods - Minister of the Crown	Email	
	13-10-2021	David Parker - Minister of the Crown	Email	
	13-10-2021	Kiritapu Allan - Minister of the Crown	Email	
	13-10-2021	Stephanie Lewis - Taranaki Based MP	Email	
	13-10-2021	Glen Bennett - Taranaki Based MP	Email	
	13-10-2021	Adrian Rurawhe - Taranaki Based MP	Email	
	13-10-2021	Angela Roberts - Taranaki Based MP	Email	
	13-10-2021	Andrew Little - Taranaki Based MP	Email	
	13-10-2021	Barbara Kuriger - Taranaki Based MP	Email	
	13-10-2021	Simon Upton - Parliamentary Commissioner for the Environment	Email	
	14-10-2021	Te Korowai o Ngāruahine Trust	Text	TKoNT advised Beach that TKoNT and TRoNRT would be undertaking a collaborative CIA. Beach requested a meeting to understand what this will mean and how it will be undertaken.
	15-10-2021	Te Korowai o Ngāruahine Trust	Text	Beach requested conversation re collaborative CIA between TRoNRT and TKoNT.
	15-10-2021	Seafood New Zealand	Email	Project Notification email and Kupe Phase 2 Development Drilling Programme Info Sheet.
	19-10-2021	Ngāti Manuhiakai Hapū	Email	Beach advised NMH has further conversations with TKoNT with regard to the CIA. Discussed length of time it was taking to get terms of the collaboration agreed and for them to engage a consultant if they agreed to do so. Pleased TKoNT had agreed to keep NMH informed and engaged in the process.
	19-10-2021	Te Korowai o Ngāruahine Trust	Meeting at TKoNT Office	Discussions about Kupe Phase 2 Development Drilling Project.
	20-10-2021	Ngāti Manuhiakai Hapū	Email	NMH confirmed via email that they have been further informed of the Kupe Phase 2 Development Drilling Programme and are comfortable with the plans to date. NMH also confirmed that kuia and TKoNT reps have received copies of the OSRP plans.
	20-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT thanked Beach for phone call earlier in the day and apologised that they had not been in touch earlier. Email confirmed that they will be doing the CIA in collaboration with TKoNT, and they are currently determining the process for this mahi. TRoNRT conveyed that they will be contact by this Friday with more comprehensive information about our process for your CIA as they treat them all differently. TRoNRT thanked Beach for understanding the delay.

Month	Date	Organisation	Method	Communication Detail
	20-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Acknowledge that some information had not been available at the time we requested your CIA. It is for this reason Beach has paused our application lodgement to EPA, as it is important that we get this right. Please see attached our draft marine consent application to help inform your assessment of potential cultural impacts for the final draft CIA. Note this is a draft, and you will see that some of the sections referenced in the table of contents are not included – this is because they are awaiting input from the CIA(s).
	21-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Email advised TRoNRT at our recent Kupe Phase 2 Development Drilling Programme meeting explained Kupe Offshore spill response plan was being reviewed. Advised KOSRP continues to work well and is considered fit for purpose. Conveyed as part of the three yearly review process we are interested in hearing of any updates to contact details, locations of interest which may be interested in the unlikely event of a spill.
	21-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Email advised TRoNRT that at our recent Kupe Phase 2 Development Drilling Programme meeting we explained that Kupe Offshore spill response plan was being reviewed. The OSRP continues to work well and is considered fit for purpose. As part of the 3 yearly review process, we are interested in hearing of any updates to contact details, locations of interest which may be interested in the unlikely event of a spill.
	27-10-2021	Department of Conservation - National Office	Email	Email from Department of Conservation with a number of questions following their review of the information sheet.
	29-10-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Discussed possibility of TRoNRT engaging a consultant to undertake the CIA report. TRoNRT advised this would need to be ratified by iwi and hapū. Conveyed usually is undertaken in house but they currently had a number of CIAs in process which were taking some time. Discussed value engaging external consultant and iwi expectation pertaining to cost. Probably costs were discussed with the caveat from TRoNRT that each CIA is unique and may require more or less work. Beach has been mindful of any cost of time and resources on iwi/hapū to provide their cultural advice and reached an agreement in advance of the CIA being undertaken.
	29-10-2021	Ngāti Manuhiakai Hapū	Phone	Returned call from NMH. Discussion about the collaborative CIA.
	29-10-2021	Horizons Regional Council	Meeting	Overview of proposed future activities in the Kupe Field provided, along with discussion around the current and future revisions of the Offshore Spill Response Plan. Emailed project update 1/12/21
November 2021	02-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Phone	Discussion with TRoNRT regarding consultation with TKoNT, NMH and TRoNRT collaboration on the CIA agreement. Discussion on the value pertinent to engaging a consultant to prepare the CIA. Understand who would take the lead in the discussions and how engagement would need to be undertaken.
	02-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	02-11-2021	Ngāti Manuhiakai Hapū	Phone	Discussed Kupe Phase 2 Development Drilling Programme in general. Responded to NMH questions. NMH advised that hapū hui date remains uncertain.
	05-11-2021	Ngāti Manuhiakai Hapū	Phone	Advised NMH that the Kupe Phase 2 Development Programme will no longer include the appraisal well. Conveyed that TKoNT and TRoNRT had also been made aware of the change. NMH felt this would be a simpler process for the CIA.
	09-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Meeting postponed due to South Taranaki COVID-19 outbreak. Iwi, hapū focus on whanau health and wellbeing.
	09-11-2021	Te Kaahui o Rauru	Email	General exchange regarding upcoming meeting.
	09-11-2021	Te Kaahui o Rauru	Text	For the 24-hour contact information, we are reluctant to include individuals contact information in the document. I can however confirm that Beach has mobile contact information for personal from each of below listed organisations and propose we add a footnote to the ESRP to that effect. i.e. *for 24 hour contact information refer to the Community Relations Manager or the Emergency Iwi Contact information sheet available in EMQnet. TKoR confirmed receipt of the text.
	10-11-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach conveyed via text is there any chance we can have a quick chat about CIA value and PO.
	11-11-2021	Department of Conservation - National Office	Email	SLR provided the responses for the applicant to the questions that were asked.
	11-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Discussion re iwi/hapū resources required to provide the Beach CIA. Meeting request to discuss PO re koha for CIA.
	11-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Discussion re TRoNRT vendor details required to set up.
	11-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	TRoNRT advised that they were booked up this morning and would call as soon as possible.
	12-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Acknowledged community emphasis on Covid-19 response. Understood that priority at the moment was whanau health and wellbeing. Beach conveyed its sincere regards and our hope that everyone manages to remain well at this very stressful time.
	16-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	General exchange regarding upcoming meeting.
	17-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT sent Beach completed supplier form for PO.
	23-11-2021	Te Korowai o Ngāruahine Trust	Text	Follow up text with regard to status of the collaborative CIA document. Advisement of the December submission date very near.

Month	Date	Organisation	Method	Communication Detail
	24-11-2021	Ngāti Manuhiakai Hapū	Text	NMH advised that there was a still a possibility that there may be two separate CIAs versus one combined. NMH conveyed that this was a very unique position and that not all hapū were convinced this was the correct pathway.
	24-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Email from TRoNRT outlining timelines for CIA first assessment, hapū process, issues disclosure arising from first draft, final draft CIA prior Christmas 2021. Acknowledgement of Beach application date & 7th Dec 2021.
	24-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Referenced discussion with Beach re CIA. TRoNRT confirmed the following key points. Hapū will review this draft and provide further input. They will disclose any significant issues arising from the first draft for you advanced consideration and feedback. Expected the final draft CIA will be completed prior to Christmas 2021. Acknowledged that Beach need to lodge your application to the EPA on the 7th of December 2021. Conveyed while this may be lodged, they expected our application to be fully considered only when the CIA was completed and made available to all parties. Suggested the CIA could then be lodged to supplement the application and be taken into consideration by the EPA. Iwi also noted the final CIA may require Beach to make amendments to the application after lodgement with EPA. Further advising that iwi are happy to adopt a pragmatic approach to this especially where all parties, including the EPA, are working in partnership with Iwi.
	25-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Response to TRoNRT Email 24/11 re CIA confirmation. Clarification of the dates we could expect the draft CIA. Acknowledged TRoNRT and TKoNT further commitment to provide a collaborative CIA. Beach conveyed that our relationship with both iwi groups was extremely important that we committed to ensuring that we followed the correct cultural protocols. Beach advised it was important given that this was a unique process not before undertaken that the business has a clear understanding from a cultural process.
	25-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach acknowledged conversation 24th Nov and TRoNRT follow up email that outlined that CIA that the draft CIA will be provided to Beach within the next two weeks (10 working days) from 24th Nov. Checked that our understanding of dates was correct - expectation it would be 7th Dec? for draft with final draft by 16th of Dec. Explained time will be required review, consult further, take into account any recommendations, and make any changes to the application. We are just very cognisant of Christmas closure dates for the EPA and the relevant completeness checks before our application can be accepted. Beach noted that we sincerely appreciate the commitment to provide CIA to the business for our Kupe Phase 2 Development Drilling Project. Our relationship with both TKoNT and TRoNRT iwi spans ten plus years now and is extremely important to Beach. Conveyed that the relationship with both iwi and hapū has transcended company divestments, and multiple projects, many of which you will recall have been very challenging but undertaken always with trust and respect of each other's views. Appreciate your thoughts re the dates. Confirmed receipt of email on 24th Nov. Conveyed business appreciation for iwi/hapū commitment to providing the CIA to the Kupe Phase 2 Development Drilling Programme. Acknowledged relationship between the business and Beach over time.
	30-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT confirmed that dates are subject to some movement they are unable to be absolutely precise. Aiming for two week turn around on the draft but subject to our cultural advisors release. TRoNRT advised did not anticipate too many issues with a draft of key issues being produced at a minimum. Advised final CIA likely would not be ready until close of business on the 20th or 21st of Dec. Further clarity would be provided mid Dec. TRoNRT conveyed that they did not see too many issues with a draft of the key issues being produced as a minimum with the final draft completed close to close of business on the 20th or 21st of Dec. Advised that TRoNRT should have greater clarity by mid-December. Follow up call from Beach. COVID outbreak impacting local community. TRoNRT health heavily involved in the response. Likely timelines could be impacted.
	30-11-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	November Information sheet and letter sent.
	30-11-2021	Te Kaahui o Rauru	Email	
	30-11-2021	Te Kaahui o Rauru	Email	
	30-11-2021	Te Kaahui o Rauru	Email	
	30-11-2021	Te Korowai o Ngāruahine Trust	Email	
	30-11-2021	Te Korowai o Ngāruahine Trust	Email	
	30-11-2021	Te Rūnanga o Ngāti Tama	Email	
	30-11-2021	Te Rūnanga o Ngāti Maru (Taranaki)	Email	
	30-11-2021	Te Rūnanga o Ngāti Maru (Taranaki)	Email	
	30-11-2021	Te Kotahitanga o Te Atiawa Trust	Email	
	30-11-2021	Te Kotahitanga o Te Atiawa Trust	Email	
	30-11-2021	Te Kāhui o Taranaki Trust	Email	
	30-11-2021	Te Kāhui o Taranaki Trust	Email	
	30-11-2021	Seafood New Zealand	Email	
	30-11-2021	Sealord Group Limited	Email	
	30-11-2021	Sanford Limited	Email	

Month	Date	Organisation	Method	Communication Detail
	30-11-2021	Talley's Group Limited	Email	
	30-11-2021	Talley's Group Limited	Email	
	30-11-2021	Patea and Districts Boating Club	Email	
	30-11-2021	New Plymouth Sportfishing and Underwater Club	Email	
	30-11-2021	NZ Recreational Fishing Council	Email	
	30-11-2021	Opunake Boat and Underwater Club	Email	
	30-11-2021	Fluffy Duck Fishing Charters	Email	
	30-11-2021	South Taranaki Fishing Charters	Email	
	30-11-2021	Hy-jinks Fishing Charters	Email	
	30-11-2021	Port Taranaki	Email	
	30-11-2021	Taranaki Harbourmaster	Email	
	30-11-2021	Wellington Harbourmaster	Email	
	30-11-2021	Taranaki Regional Council	Email	
	30-11-2021	Marlborough District Council	Email	
	30-11-2021	Marlborough District Council	Email	
	30-11-2021	New Plymouth District Council	Email	
	30-11-2021	Whanganui District Council	Email	
	30-11-2021	Taranaki/Whanganui Conservation Board	Email	
December 2021	01-12-2021	Stuart Nash - Minister of the Crown	Email	
	01-12-2021	Megan Woods - Minister of the Crown	Email	
	01-12-2021	David Parker - Minister of the Crown	Email	
	01-12-2021	Stephanie Lewis - Taranaki Based MP	Email	
	01-12-2021	Glen Bennett - Taranaki Based MP	Email	
	01-12-2021	Adrian Rurawhe - Taranaki Based MP	Email	
	01-12-2021	Angela Roberts - Taranaki Based MP	Email	
	01-12-2021	Andrew Little - Taranaki Based MP	Email	
	01-12-2021	Debbie Ngarewa Packer- Taranaki Based MP	Email	
	01-12-2021	Barbara Kuriger - Taranaki Based MP	Email	
	01-12-2021	Simon Upton - Parliamentary Commissioner for the Environment	Email	
	01-12-2021	South Taranaki District Council	Email	
	02-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach conveyed to TRoNRT appreciation for their thoughts on timing which had been shared with team. Suggested it was necessary to have clear understanding on current progress given business position on submitting on 7th Dec. Requested possibility of TRoNRT sharing Table of Contents in advance of the first draft. Requested Teams meeting Friday 3rd Dec 11:30am.

Month	Date	Organisation	Method	Communication Detail
	02-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Phone	TRoNRT responded to Beach email pertaining to timing for CIA delivery (25.11.2021). Advised all dates subject to some movement and they can't be absolutely precise. Aiming for a two week turn around on the draft but this is subject to cultural advisors release. TRoNRT advised that they did not anticipate too many issues with the draft of key issues being produced as a minimum. TRoNRT did not think dates could be met but believed it would be close to the 20th or 21st of December. Advised they would have greater clarity by mid-December.
	06-12-2021	Ngāti Manuhiakai Hapū	Phone	Request for further information sheets.
	06-12-2021	Te Kaahui o Rauru	Meeting (Teams)	Further to our Consultation Summary dated 12.11.21, we met with FS from TKoR on 6.12.2021. At this meeting we provided the overview of the minor ESRP updates. It was confirmed by TKoR that for matters such as this, generally TKoR would take a similar position to that of TRoNRT given it was in their rohe. We advised of our engagement with TRoNRT and that we had received confirmation they had reviewed the OSRP and had no further comments as outlined in our OSRP Summary of Consultation. Additionally, we also conveyed that Horizons Regional Council were consulted and that they had dedicated iwi liaison officers who would in the event of a spill liaise directly with them, but to be assured that we would always be speaking with TRoNRT in the event of a spill directly.
	09-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach followed up with TRoNRT. Advised had called past at 1:30-pm re the CIA as had another meeting in Hawera. TRoNRT advised they were in another hui unable to meet.
	10-12-2021	Te Korowai o Ngāruahine Trust	Phone	Requested a call back in respect to current status of CIA.
	14-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Advised TRoNRT that Beach staff member had called past their office last week after another hapū meeting on the off chance we could meet to advise of a significant change to our application as per texts last week.
	14-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	General exchange regarding upcoming meeting.
	12-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT conveyed that she had wrongfully thought TKoNT had received their version of the draft CIA. This has been received this afternoon by TKoNT. TRoNRT conveyed they will have an updated version of the draft for Beach by Friday.
	15-12-2021	Deepwater Group	Email	Further update on the project including updated information sheet.
	15-12-2021	Southern Inshore Fishers	Email	
	15-12-2021	NZ Federation of Commercial Fishers	Email	
	15-12-2021	Egmont Seafoods	Email	
	15-12-2021	Te Ohu Kaimoana	Email	
	15-12-2021	Department of Conservation - National Office	Email	
	17-12-2021	Muaupoko Iwi	Email	Beach reached out to Muaupoko Iwi to advise them that Beach is planning the Kupe Phase 2 Development Drilling Programme. Also shared two information sheets relevant to the proposed work.
	17-12-2021	Muaupoko Iwi	Email	Beach reached out to Muaupoko Iwi to advise them that Beach is planning the Kupe Phase 2 Development Drilling Programme. Also shared two information sheets relevant to the proposed work.
	17-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach conveyed to TRoNRT that Beach was going to delay our application lodgement. All options were considered but that business preference was to submit the application with the CIA. New submission date would be 19th of January. This would provide more time for iwi to get hapū review of the CIA.
	17-12-2021	Ngāti Manuhiakai Hapū	Text	Advised NMH meeting with TRoNRT earlier this week was postponed due to Covid response. TRoNRT advised that they had yet to receive the draft CIA, although their consultant has been drafting for many weeks. Beach conveyed to NMH that left messages with TRoNRT and TKoNT in this regard. Conveyed the delays were a concern, however the business has been committed to ensuring that we understand the cultural perspective. NMH confirmed a phone meeting at 2:30pm 22/12/21.
	21-12-2021	Ngāti Manuhiakai Hapū	Meeting (Teams)	End of year discussion with NMH. Beach thanked NMH for willingness to consult, their time and knowledge throughout this process. Beach conveyed Christmas wishes to the team at NMH and wished them a safe and enjoyable holiday break.
	21-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email and Phone	TRoNRT confirmed that they were available 11:30am today to chat. TRoNRT emailed confirmation that he had reviewed KOSRP and that they had no further comments. TRoNRT advised that the CIA draft was due today.
	21-12-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach thanked TRoNRT for meeting this morning, good to understand the level of impact on TRoNRT Healthcare as a result of the recent COVID-19 case. Additionally, thanked TRoNRT for confirming that the draft CIA will be sent through today. Beach so very appreciative of this as it will provide time for the business to reflect on the content, understand iwi and hapū perspective, and meet to discuss our response as soon as we can in advance of our submission. It has been extremely important that we follow the correct cultural process, particularly given the report was coming from both TRoNRT and TRoNRT iwi groups.

Month	Date	Organisation	Method	Communication Detail
	21-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach requested a phone meeting today. TRoNRT confirmed conversation for 11:30am.
	21-12-2021	Ngāti Manuhiakai Hapū	Email	Beach additionally, thank you for confirming that the draft CIA will be sent through today. Beach so very appreciative of this as it will provide time for the business to reflect on the content, understand iwi and hapū perspective, and meet to discuss our response as soon as we can in advance of our submission. It has been extremely important that we follow the correct cultural process, particularly given the report was coming from both TKoNT and TRoNRT iwi groups.
	22-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach followed up with TRoNRT on the CIA that we were advised was coming through on 21st Dec but was not received as conveyed.
	22-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	Text from Beach to TRoNRT to check whether the consultant was sending the document or whether to expect this from TRoNRT directly. Asked if the document was receiving some final tweaks hence further delays. Seeking to understand whether we would still receive the CIA within the next day or so.
	22-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT advised Beach that they had expected a draft version yesterday and are yet to receive it, also advising that they will send it through as soon as they receive it. Beach emailed TRoNRT directly to thank for the advisement. Conveyed that we are keenly awaiting the CIA document as it forms a very important part of our submission, and we are mindful that our office closure is looming.
	22-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach email to follow up on CIA promised on the 21st of December. No response.
	22-12-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach conveyed to TRoNRT as per conversation with TRoNRT yesterday we are keenly awaiting the CIA document as it forms a very important part of our submission, and we are mindful that our office closure is looming. No response.
	23-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Text	TRoNRT advised Beach that draft CIA has arrived and was just undergoing review. Beach followed up with TRoNRT. No CIA document shared.
	23-12-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	TRoNRT advised that CIA had been created under a short period of time in an attempt to meet Beach timeframes even with Covid impact on hapū. TRoNRT advised that they needed to give hapū time to comment. Beach advised TRoNRT that I would update the business about the overlays with COVID and how this has impacted timeframes. Beach also advised that we respected the cultural processes that needed to be undertaken.
	24-12-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach thanked TRoNRT for their message. Conveyed that we recognised and acknowledge that hapū need time to provide their thoughts through the correct cultural process. We also acknowledged that this has been further complicated with the CIA being joint and the overlays of COVID-19. We understand the importance of this engagement being undertaken in the correct cultural manner.
	24-12-2021	Te Rūnanga o Ngāti Ruanui Trust	Phone	General discussion on CIA progress.
January 2022	05-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach wished TRoNRT Happy New Year. Reiterated with TRoNRT that timing was quite crucial for our application to be submitted this month and advised Beach would very much appreciate an update on CIA status.
	07-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Asked TRoNRT if they could please advise when the CIA will be sent through. Beach conveyed that the timeframe for submission lodgement is closing up rather fast. 3:44pm TRoNRT advised that they were on annual leave and that they had spoken to other TRoNRT staff who would be picking up the work on the CIA next week. TRoNRT also conveyed that they are reviewing the TRoNRT position this weekend.
	10-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT thanked Beach for email. Conveyed on holiday until 12th Jan. Office closed until Monday 17th of Jan. Will try and contact Beach about 1pm 11th of Jan. Beach thanked TRoNRT for the email and time.
	11-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT suggested a meeting on Wed 12th of Jan at 1:00pm to provide a status update. TRoNRT conveyed office was closed until Monday 17th of Jan, however she did want to contact us tomorrow afternoon at 1pm. Beach accepted proposed date and time to meet.
	11-01-2022	Te Korowai o Ngāruahine Trust	Text	Wished TKoNT Happy New Year. Checking dates that TKoNT was back in the office. Conveyed that TRoNRT advised the draft CIA was received just prior to Xmas which we understood had undergone hapū review. Advised this has taken some time over the break. Advised we delayed our submission lodgement until 19th of January to ensure the CIA could form part of our application
	12-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT apologised for delay. TRoNRT advised had she had wrongfully thought TKoNT had received their version of the draft. TKoNT has received it this only afternoon and is happy with it and will have the updated version for you on Friday morning with the additions from TKoNT. TRoNRT apologised for the delay.
	12-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Meetings dates set and agreed for Friday 4th of Feb 2:30pm – 3:30pm – Meeting with relevant Beach staff, TRoNRT and TKoNT to respond to any questions in advance of sharing additional information with relevant hapū.
	12-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT confirmed workshop dates. 16th of Feb 9:00am – 11:30am – Follow up workshop with Beach staff, TRoNRT and TKoNT to respond to any further questions from the hapū to help inform final draft of CIA. Beach responded to TRoNRT at 3:46pm by return email. Thanking TRoNRT for time and response on the report. Conveyed business appreciation of all the work undertaken to provide the document to Beach.

Month	Date	Organisation	Method	Communication Detail
	12-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	TRoNRT emailed to see if we could move our 1:00pm forward. Discussion held at 10.30am. TRoNRT advised that they had not anticipated the length of time that the consultant would take. Much longer than they had anticipated, she apologised for ongoing delays. TRoNRT advised that the draft CIA presented by consultant was reviewed by TRoNRT and required a number of changes. TRoNRT now happy with content, has been hapū reviewed and shared with TKoNT. TRoNRT advised that TKoNT were happy with the content and were currently adding their comments in advance of sending the document through to Beach on Friday 14th Jan. TRoNRT conveyed that this was this was the first time TRoNRT had agreed to a collaborative CIA with another Iwi group. Beach thanked TRoNRT for the update. Expressed the company's gratitude for the time needed to ensure that the document accurately reflected the position of both TRoNRT and TKoNT.
	12-01-2022	Ngāti Manuhiakai Hapū	Text	Beach advised NMH that TRoNRT has advised that the CIA is with TKoNT for review. We assume this draft will be shared with NMH as committed to by TKoNT. NMH thanked Beach for the update and would look out for the draft document.
	14-01-2022	Trans-Tasman Resources Ltd	Phone	Reached out to Trans-Tasman Resources Ltd office to provide project notification update. No response. Email notification to Trans-Tasman Resources Ltd to follow.
	14-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach enquired as to how the CIA report was progressing.
	14-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT advised that they had been in contact with TKoNT and they will have draft by 3pm, apologised for the delay advising that they will send it through as a draft as soon as I get it and that they understood the urgency.
	14-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT provided without prejudice the first draft of the TRoNRT CIA. This was provided so that Beach can consider we might position our application. TRoNRT conveyed they were aware of the pressure Beach was under and will work with TKoNT to get a final draft to Beach that will take into consideration Beach responses to their recommendations.
	14-01-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT provided contact details of person who will provide vendor information for setting up TKoNT in Beach vendor system for payments to hapū for reviewing Beach marine consent application to inform hapū views for the CIA.
	14-01-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT emailed advanced first draft CIA of TKoNT views. Document was provided without prejudice to give Beach idea of how the business might position our application. TKoNT also advised that this would be integrated into the TRoNRT draft and formatted and structured appropriately. TKoNT also conveyed that they understood time constraints and that a final draft would be provided by TRoNRT early next week.
	17-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT advised that TKoNT and TRoNRT have a hui this morning. With the input from all the hapū of TKoNT we will be doing another draft ready for review end of March 2022.
	17-01-2022	Te Korowai o Ngāruahine Trust	Text	Email to follow up on draft CIA. Conveyed we had anticipated that we would receive the draft report this week based on advisement from TRoNRT advisement it would be provided on 24th of Nov 2021.
	18-01-2022	Te Korowai o Ngāruahine Trust	Text	TKoNT advised they will be sending draft CIA to Ngāruahine hapū.
	18-01-2022	Ngāti Manuhiakai Hapū	Text	NMH advised that they had received the TKoNT CIA.
	20-01-2022	Ngāti Manuhiakai Hapū	Meeting	NMH requested a special meeting to discuss the Beach CIA for the Kupe Phase 2 Development Drilling Programme. Focus of the meeting was for NMH to share the views on the collaborative CIA. NMH conveyed that the views expressed in the TKoNT CIA were not the views of NMH. A special Hapū hui was to take place to discuss the way forward.
	26-01-2022	Ngāti Manuhiakai Hapū	Phone	NMH conveyed that NMH were not comfortable with the content of the TKoNT CIA. NMH were seeking to undertake an independent CIA with the support of an external consultant to guide and facilitate the CIA process. Advised this position on the TKoNT CIA will be taken to a special Hapū hui.
	28-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email and Phone	Beach conveyed to TRoNRT that Beach appreciated their time to discuss process, dates, and times for our upcoming huis regarding the Beach CIA. As agreed, Beach will send out the meeting invitations to these team meetings later this afternoon. Agreed Process, Meeting Dates and Times: -Monday 31st January Beach Country Manager will email TRoNRT and TKoNT representatives about first draft of Beach CIA and share additional marine consent application information. Wednesday 2nd of Feb 9:00am – 9:30am – Preliminary discussion with representatives from Beach and iwi prior to meeting on 4th and 16th of February. Friday 4th of Feb 2:30pm – 3:30pm – Meeting with relevant Beach staff, TRoNRT and TKoNT to respond to any questions in advance of sharing additional information with relevant hapū. 16th of Feb 9:00am – 11:30am – Follow up workshop with Beach staff, TRoNRT and TKoNT to respond to any further questions from the hapū to help inform final draft of CIA.
	28-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TKoNT sent email to acknowledge that that process dates and times specified in the email sent at 2:50pm on the 28th of January were accurate and what was agreed by both parties.

Month	Date	Organisation	Method	Communication Detail
	31-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Thanked iwi representatives for the first draft of CIA. Acknowledged due to Beach developing our marine consent application in parallel with our request for your CIA it was difficult for iwi to assess some of the impacts of our proposed activity on their culture, beliefs and kaitiakitanga which was not our intent. Conveyed many contributing factors that determine when the business commences a consenting application process such as regulatory time frames and rig availability, but equally as important is your cultural perspective. We acknowledged that some information had not been available at the time we requested your CIA. For that reason, business had paused our application lodgement to EPA, as it is important that we get this right. Beach shared out draft marine consent application to help inform iwi assessment of potential cultural impacts for the final draft CIA. Noted this was a draft, and advised some sections referenced in the table of contents are not included – awaiting input from the CIA(s). Reassured iwi that our relationships are important to Beach and we are committed to understanding these better through their CIA.
	31-01-2022	Te Korowai o Ngāruahine Trust	Email	Thanked iwi representatives for the first draft of CIA. Acknowledged due to Beach developing our marine consent application in parallel with our request for your CIA it was difficult for iwi to assess some of the impacts of our proposed activity on their culture, beliefs and kaitiakitanga which was not our intent. Conveyed many contributing factors that determine when the business commences a consenting application process such as regulatory time frames and rig availability, but equally as important is your cultural perspective. We acknowledged that some information had not been available at the time we requested your CIA. It is for this reason I have paused our application lodgement to EPA, as it is important that we get this right. Shared the draft marine consent application to help inform your assessment of potential cultural impacts for the final draft CIA. Noted this was a draft, and advised some sections referenced in the table of contents are not included – awaiting input from the CIA(s). Reassured iwi that our relationships are important to Beach and we are committed to understanding these better through their CIA.
	31-01-2022	Ngāti Manuhiakai Hapū	Email	Meeting deferred as agreed to Wednesday 2nd of Feb at 11:00am.
	18-01-2022	Te Korowai o Ngāruahine Trust	Text	TKoNT advised they were sending out the CIA first draft to TKoNT hapū chairs today (18th of Jan) for their feedback.
	25-01-2022	Te Korowai o Ngāruahine Trust	Text	Beach conveyed to TKoNT that Beach had been seeking a joint meeting with both TRoNRT and TKoNT. Suggested 1:00pm 9th Feb. Awaiting response from TRoNRT re availability.
	25-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT responded to Beach comments on draft CIA, advised that iwi had sought hapū advice on comments. Provided advice that the CIA is the view of TRoNRT on the entire operation and does not align to consents or planning constructs stating it may be used as part of any consenting process. CIA can take the form that iwi considers relevant. Advised that they were reviewing the revised application after Beach had made changes to the application having considered the draft CIA. Acknowledged Beach pause in the application for further discussion and the revised application to be viewed which will be reflected on the final CIA. TRoNRT noted that hapū from Ngāruahine were developing a separate CIA which they anticipated may impact on timing on the application. Beach had sought guidance from TRoNRT as to the best method to provide comments on first draft. Typically, this would be undertaken kanohi ki te kanohi but given the COVID-19 pandemic on the advice of TRoNRT we put our comments in writing. A number of follow up phone calls, texts were made to provide responses to the questions asked. NB: TRoNRT have been heavily involved in their COVID-19 response as the pandemic was peaking in the local community. Their priority at this time has been community wellbeing and their support via TRoNRT Healthcare.
	27-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach reached out to TRoNRT. Checking as to when TRoNRT staff member would be back from annual leave.
	28-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Discussed process, dates and time for upcoming hui regarding the Beach CIA. Agreement was reached process, dates and times going forward.
	28-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Email confirmation dates and times agreed for preliminary discussion with both TRoNRT and TKoNT.
	28-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Email confirmation received from TRoNRT stating that the process, dates and times was agreed.
	28-01-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Acceptance to attend Pre CIA Meetings Discussion TRoNRT.
February 2022	01-02-2022	Ngāti Manuhiakai Hapū	Phone	NMH confirmed that it will be undertaking its own CIA and have engaged a relevant consultant(s) to lead this work for them.
	02-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	General exchange regarding upcoming meeting.
	02-02-2022	Ngāti Manuhiakai Hapū	Text	NMH asked questions about the content of the historical Origin Kupe Gas Plant Cultural Analysis document that they had helped inform in 2005, particularly regarding mana whenua. Requested copy of the document.
	02-02-2022	Ngāti Manuhiakai Hapū	Text	Beach asked NMH was aware if Ngāruahine hapū chairs had responded to the application summary TKoNT had provided. NMH confirmed that the input had been summarised and shared.
	02-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach reached out to TRoNRT to see how was placed for a meeting later this morning. No response from TRoNRT.
	03-02-2022	Te Korowai o Ngāruahine Trust	Phone	Beach discussed costs associated with getting hapū's feedback on the summary of the of the marine consent application for inclusion in the CIA. Aware that many of the hapū have full time positions and support their respective hapūs in their personal time. TKoNT expressed request that Ngāruahine hapū as the cultural subject matter experts for their hapū should be paid for their expertise and the hours worked. Beach agreed to compensate hapū for their time in evaluating the marine consent application.
	04-02-2022	Ngāti Manuhiakai Hapū	Text	General exchange regarding upcoming meeting.

Month	Date	Organisation	Method	Communication Detail
	04-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach advised had spoken to TKoNT on 3/2 and advised TKoNT was keen to meet next week next Wed at 1pm TRoNRT, Beach and TKoNT. TRoNRT advised he would call later. No contact until Tuesday 15th of Feb.
	07-02-2022	Ngāti Manuhiakai Hapū	Text	NMH gave a quick appraisal of questions they would like to put to Beach environmental advisor. Predominantly questions pertained to release of drill cuttings, cement disposal, timeframes MODU, H& S systems. Meeting with Beach confirmed to discuss in depth. Beach confirms face to face meeting Wednesday 9th of Feb at 10:00am
	09-02-2022	Ngāti Manuhiakai Hapū	Meeting (Teams)	Meeting with NMH post review of the draft application. Clarification and questions raised about drill cuttings, IAA, timeframe for MODU, water-based muds, health and safety systems.
	08-02-2022	Ngāti Manuhiakai Hapū	Text	Clarification of NMH's position on the content of the TKoNT first draft CIA. Kuia reiterated that TKoNT did not speak for the Hapū. NMH were not satisfied by the content of the TKoNT first draft of the CIA. Discussion about consultants who might be able to support NMH position.
	08-02-2022	Ngāti Manuhiakai Hapū	Phone	Discussion regarding content of the marine consent application, anticipated questions hapū would be likely to ask.
	08-02-2022	Department of Conservation - National Office	Email	Email update to Department of Conservation on the application process, and provision of the draft marine consent application for review/comment.
	09-02-2022	Ngāti Manuhiakai Hapū	Face to face meeting	Meeting with NMH kuia, cultural advisor, hapū chair and two external parties (consultants) to discuss the content of the TKoNT first draft of the CIA. NMH advised they want to pursue an independent CIA. Held in Hawera an attended by Beach.
	09-02-2022	Te Korowai o Ngāruahine Trust	Text	Beach conveyed that we were yet to hear back from TRoNRT in respect to a planned meeting on the 9th of Feb. TKoNT suggested that we defer until all parties can attend.
	09-02-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT advised Beach that staff member would be on annual leave until Wednesday 9th of February, advising that if the matter was urgent, they could be reached on the mobile phone number he provided.
	10-02-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT provided contact details of person who will provide vendor information for setting up TKoNT in Beach vendor system for payments to hapū for reviewing Beach marine consent application to inform hapū views for the CIA.
	10-02-2022	Te Korowai o Ngāruahine Trust	Email	Proposed new date and time for the Beach CIA workshop. TKoNT unable to attend on the agreed date and time.
	10-02-2022	Ngāti Manuhiakai Hapū	Phone	NMH rang Beach to discuss the use of consultants for development of the CIA. Advised that now that understood it correctly was comfortable with the hapū engaging the consultants for the CIA. Kuia felt that consultants would bring the relevant context for the present and that she could add value from the past perspective. Confirmed that the consultants would sit amongst them at the meeting on the 12th of Feb with Beach.
	11-02-2021	Te Korowai o Ngāruahine Trust	Text	TKoNT advised could not attend the workshop meeting on the 9th as had a meeting clash.
	13-03-2020	Ngāti Manuhiakai Hapū	Text	NMH sought confirmation of the dates consultation with NMH had commenced regarding the Kupe Phase 2 Development Drilling Programme. Beach confirmed that first meeting was mid-July but that initial consultation had begun in early July 2021.
	14-02-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT provided completed new supplier form and bank account details to enable TKoNT to be set up in the Beach vendor system. Beach has been mindful of cost of time and or resources on hapū to provide their CIA, consequently reached an agreement in advance of CIA commencement.
	14-02-2022	Te Korowai o Ngāruahine Trust	Phone	TKoNT advised that unable to attend the scheduled workshop, stating that another staff member may be able to attend? TKoNT advised that that person could not attend.
	15-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone call	TRoNRT postponed hapū workshop on 16th of Feb previously agreed to by the parties. Purpose of the workshop was to respond to any questions from iwi or hapū on the application. Felt time was better served reviewing the draft application. Requested Beach updated the Cultural sections in the application based on the first draft of the CIAs even though two draft CIA documents were yet to be integrated into a final draft. Agreed to Beach making comment on the first draft of the CIA. Beach awaiting a meeting date to work through the recommendations outlined in the first drafts of the CIA.
	15-02-2022	Ngāti Manuhiakai Hapū	Meeting (Teams)	NMH conveyed that they had reviewed the Kupe Phase 2 development Drilling Programme Marine Consent and Marine Discharge Consent Application. Beach responded to various questions including questions about release of drill cuttings, cement disposal, water-based muds.
	16-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach emailed draft Kupe Phase 2 Development Drilling Programme Consent Application with Section 4.4 Cultural Environment and Section 5 Existing Interests now included. Noted that the Section 7.4.1 will be populated once finalised CIAs are received and this may also mean changes to Section 7.10, the Conclusion, and the Executive Summary. In addition, we envisage that our comments as we discussed on the first draft of the TRoNRT CIA will be emailed to you shortly for review as you suggested.
	17-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Advised TRoNRT and TKoNT had a hui this morning. With the input from all the hapū of Ngāruahine we will be doing another Draft ready for review end of March 2022. Advised TRoNRT that timeframes will impact our consent application lodgement.
	17-02-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT extended invitation to zoom hui to Beach.
	18-02-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT postponed meeting to next week, due to Beach staff member being unwell.

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	18-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	TRoNRT advised they will review the revised application, also noting that Ngāruahine hapū are now required to respond for the CIA. Advised that this will likely impact on the timeframe.
	18-02-2022	Ngāti Manuhiakai Hapū	Face to face meeting	Meeting with NMH kuia, cultural advisor, hapū chair and two external parties (consultants) to discuss the content of the TKoNT first draft of the CIA. NMH advised they want to pursue an independent CIA. Held in Hawera an attended by Beach. NMH conveyed that the relationship between Beach and the hapū respectful and enduring developed over many years. NMH involved with Beach and predecessor Lattice and Origin over 10 plus years. NMH advised that they were not satisfied with the content of the TKoNT first draft CIA and did not believe it was accurate.
	21-02-2022	Te Korowai o Ngāruahine Trust	Meeting (Teams)	Discussed Kupe Phase 2 Development Drilling Programme project in general, interaction between Hapū and TKoNT, TKoNT confirmed that NMH would be involved in the collaborative CIA process.
	22-02-2022	Department of Conservation - National Office	Email	Department of Conservation acknowledged receipt of draft application and informed that its capacity is stretched so were not in a position to provide comments within a timely manner. The draft was distributed to the Department's technical advisors for review, and it was noted that they would come back to Beach for clarification if required.
	22-02-2022	Department of Conservation - National Office	Email	SLR acknowledged the update from Department of Conservation and reiterated if the Department had any further clarifications required to please get in touch.
	22-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach reached out to TRoNRT. Extended wellbeing wishes. Beach requested an update on CIA timing.
	22-02-2022	Ngāti Manuhiakai Hapū	Phone	Follow on status of NMH CIA.
	22-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach emailed TRoNRT to follow up on earlier text and telephone messages. Send Beach thoughts on the first draft of CIA. Given Covid has not been possible to meet te kanohi te kanohi so therefore after seeking TRoNRT guidance sent Beach thoughts on CIA in writing. Also noted that TKoNT hapū are now required to respond for the CIA. Beach advised suggested meeting dates and times for iwi consideration. Thursday 24th of Feb 9-12 or 11-12pm. Alternatively Friday 25th Feb anytime between 1pm - 3pm.
	23-02-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT advised they was about to send out comms to Hapū chairs and wanted to confirm koha arrangements aligned to their business values, right and interest in the IAA as its the TKoNT policy, and the potential impacts of the project on those rights. TKoNT confirmed they had discussed the integration of the Hapū cultural values into the CIA with TRoNRT representation and advised that are seeking to have it completed by March 10. Understand we are trying to get a meeting set up with TKoNT and TRoNRT. TKoNT advised they will send comms out to hapū chairs today once he had confirmation that Beach would pay for their time to review the consent and provide input.
	23-02-2022	Te Korowai o Ngāruahine Trust	Email	Advised TKoNT that Beach had agreed koha for hapū to review the consent application data. Requested confirmation of value of the payment to 6 hapū. Advised that TKoNT was now set up in our vendor system. Conveyed timing for integrated CIA was getting very tight for Beach as conveyed to TKoNT and TRoNRT in earlier conversations and emails. Reiterated business conversations with TRoNRT and TKoNT advising of the consent lodgement pause on two occasions, 7th of December, and 19th January, and in parallel provided additional information to support the development of their cultural impact assessments. Also conveyed to TKoNT this means we have less flexibility in application lodgement dates, that now rescheduled for early March. However, if we have the final integrated CIA completed and back to us by the 10th of March, or earlier, I think we will go very close. On this basis we would hope to see a final draft by the 7th of March (or earlier), so that we have time to review and incorporate its findings into our consent application.
	23-02-2022	Te Korowai o Ngāruahine Trust	Email	Email confirmation of the koha agreed.
	23-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach followed up TRoNRT latest email re CIA conditions. No response from TRoNRT.
	24-02-2021	Te Korowai o Ngāruahine Trust	Phone	Advised TKoNT that we have not heard back from TRoNRT with regard to a joint meeting. Advised TKoNT that we emailed proposed dates and times for the meeting. TKoNT conveyed that they had sent out the relevant project information to the hapū chairs for their evaluation on 23.2.2021. TKoNT conveyed that they too had any discussions with TRoNRT for some time.
	25-02-2022	Te Rūnanga o Ngāti Ruanui Trust	Meeting (Teams)	TRoNRT conveyed to Beach staff the ongoing pressure that the South Taranaki community are under in respect to Covid. TRoNRT Healthcare's priority has been the care and wellbeing of their patients in recent weeks. Hence the delays in response on the CIA. TRoNRT conveyed that they had now received TKoNT hapū update for inclusion in the final draft. TRoNRT confirmed that it was integrating the TKoNT final draft, completing the review of the application. Beach conveyed that the business could not continue to pause the submission lodgement given our previous pauses to enable further hapū advice. Review of the proffered conditions recommendations was undertaken and how Beach envisaged incorporating into the application. Summaries were provided by email 25/3/2022 and TRoNRT have committed to finalising the CIA for inclusion in our submission for 1st April 2022.
March 2022	02-03-2022	Te Korowai o Ngāruahine Trust	Email	Thanked TKoNT for time yesterday to discuss the progress on the TKoNT CIA for Beach, it was indeed appreciated. I understand from our discussion that you have shared an application summary with all the hapū groups for their review and comment and that TRoNRT are meeting on the 10th of March to integrate the two updated CIA documents incorporating hapū's views. As I conveyed in my earlier email, and we touched on this again yesterday the business is working towards lodging our application on the 11th of March, so it will be important for us to see a final draft as soon as we can, so that we can review, and incorporate the findings into our consent application.

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	01-03-2022	Te Korowai o Ngāruahine Trust	Phone	Discussed progress on the TKoNT CIA. Beach asked TKoNT if they had shared the application summary with all the hapū groups for review and comment. Beach conveyed new lodgement date of 11th of March. Beach checked with TKoNT as to whether they were open to amending points relating to insufficient information given we had paused our application, provided all of the information. TKoNT conveyed that they would email Beach to confirm that the CIA reflected the extra time and the information provided.
	03-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach advised phone calls and texts are in response to TRoNRT's last email regarding the Beach CIA. As per TRoNRT email advising Beach to reach out if we had any questions. Beach advised we would like to meet to discuss the mitigation conditions proposed this week if possible via teams. Advised that TKoNT has agreed to this hence we were seeking a date and time that would be suitable to all. Advised TRoNRT that we were working towards an application lodgement date of the 11th of March.
	03-03-2022	Te Korowai o Ngāruahine Trust	Email	Notification of Marine survey, advisement that Beach has commenced planning for conducting a marine survey in the offshore South Taranaki Bight. Attached a letter that provides additional information of the proposed survey. Conveyed Beach is keen to consult iwi.
	11-03-2022	Te Korowai o Ngāruahine Trust	Email	TKoNT advised they had amended the CIA document to reflect the extra time and information provided to Beach. TKoNT also advised that would be ideal for a meeting as the 10th is fast approaching.
	11-03-2022	Te Korowai o Ngāruahine Trust	Text	Beach asked TKoNT if the hapū feedback that has been provided to TKoNT for inclusion in the CIA report is shared with all of the other Ngāruahine hapū groups. TKoNT advised that would only occur if the respective hapū group gives permission for this to occur. Beach was checking on the relevant cultural protocols.
	15-03-2022	Te Korowai o Ngāruahine Trust	Meeting (Teams)	KP2 Development Drilling - TKoNT CIA recommendation discussion and consensus.
	15-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach texted TRoNRT. Follow up phone calls in response to your last email dated 25th of Feb. Request to meet to discuss mitigation conditions proposed in first draft of TRoNRT CIA. Beach would like to meet to discuss the mitigation conditions proposed this week if possible via Teams. Beach also conveyed to TRoNRT that TKoNT has agreed to this if we can find a time that suits all. Advised our revised submission lodgement date is 11th of March 2022.
	15-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach explained that we have been calling TRoNRT since 25th of February to follow up on the email response provided from TRoNRT. Their priority at the moment has been iwi COVID-19 vaccination response. Beach advised the reason for our calls was to set up a meeting with TRoNRT to discuss proposed conditions for the marine consent application. Beach that as a courtesy we have always called to discuss matters directly in advance of sending emails directly on the matter. Beach also advised that we had met with TKoNT today and that our discussions were now well advanced, and we were very keen to meet with TRoNRT in this regard also.
	15-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach explained that we have been calling TRoNRT since 25th of February to follow up on the email response provided from TRoNRT. Their priority at the moment has been iwi COVID-19 vaccination response. Beach advised that as a courtesy we have always called to discuss matters directly in advance of sending emails directly on the matter. Beach also advised that we had met with TKoNT today and that our discussions were now well advanced, and we were very keen to ensure that TRoNRT followed suit.
	16-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach called TRoNRT seeking a meeting regarding CIA conditions. Requested TRoNRT call back.
	16-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach requested meeting with TRoNRT next week to finalise CIA for our marine consent application. No response from TRoNRT.
	16-03-2022	Te Korowai o Ngāruahine Trust	Meeting (Teams)	Beach requested meeting with TKoNT to discuss additional information provided by Beach to TKoNT.
	16-03-2022	Ngāti Manuhiakai Hapū	Phone	NMH advised that due to a family bereavement of NMH chairperson they wished to postpone the meeting scheduled for this week. NMH also conveyed they need to finalise report content before they meet with Beach, and it is important that the NMH chairperson be present at this meeting.
	16-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach texted TRoNRT to request a meeting.
	22-03-2022	Te Korowai o Ngāruahine Trust	Phone	Follow up call to TKoNT to understand whether a meeting has been set with TRoNRT to incorporate the updated TKoNT draft CIA post hapū input. Beach advised TKoNT that tried on a several occasions to speak to TRoNRT but without response as yet. TKoNT advised that they had sent the updated CIA through to TRoNRT, but they had not had a response back from them to date.
	22-03-2022	Ngāti Manuhiakai Hapū	Meeting (Teams)	Review of draft CIA. in advance of meeting with consultants scheduled for Thursday 24th March. Beach checked with NMH on final draft as she had been provided two versions of the document.
	23-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Meeting (Teams)	Further email to TRoNRT seeking Teams meeting. Suggested 10:00am this morning or an alternative time when we can meet via teams or face to face if that is the preference. Noted that Beach had reached out a number of times by phone and text since receiving email dated 25th Feb in response. Beach noted that in recent weeks TRoNRT's COVID response has been the priority. 9:26am TRoNRT responded by return email agreeing to a Teams meeting on Friday 25th of March 1:30pm.

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	23-03-2022	Ngāti Manuhiakai Hapū	Meeting (Teams)	Discussion on elements of the CIA. Meeting to understand kuia, cultural advisor and hapū chairs perspective and potential amendments in advance of the recommendations meeting scheduled for 24/3/2022. NMH conveyed it was their hope that the CIA demonstrated to other Ngāruahine hapū what could be achieved if the forged stronger relationships with business as they have with Beach. Further emphasis the CIA process has been an opportunity for NMH work with the wider hapū, develop hapū understanding. NMH believes the document will be a good foundation document that they will be able to use both now and in the future.
	24-03-2022	Ngāti Manuhiakai Hapū	Meeting (Teams)	Meeting called by NMH and consultants to review the proffered conditions, CIA recommendations and mitigations and Beach's perspective in response to these.
	25-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Beach emailed TRoNRT thanking them for their commitment to a final CIA draft for inclusion on our submission scheduled to be lodged 1st April. Emailed summary of the Proffered Conditions discussed this afternoon for review and comment.
	25-03-2022	Ngāti Manuhiakai Hapū	Email	Beach thanked NMH for their time on the 24th of March to review proffered conditions, and to understand their perspective on the summarised content we propose to include in our consent application for their review and comment.
	27-03-2022	Ngāti Manuhiakai Hapū	Text	NMH confirmed final hapū review of the Beach CIA, agreed position on terms and conditions. NMH conveyed final draft to be sent to Beach shortly advising that final CIA draft to send next few days. NMH consultants sent through updated CIA draft with comments. NMH thanked Beach for the opportunity to take and respond to comments on the CIA from our meeting last week. This was completed at the hapū hui 27/04. Specific note made of NMH role as mana whenua which hapū intends to take up with TKoNT and TRoNRT directly. Beach thanked NMH very much for letting them know and advised we looked forward to receiving the final document in advance of submission lodgement 1.4.2022
	28-03-2022	Ngāti Manuhiakai Hapū	Phone	NMH consultant thanked Beach for the opportunity to take and respond to the comments on the CIA from last week. Hapū met on Sunday 27th to respond to those conditions. The main point is the wording of the conditions that might elevate the interest of other parties such as TKoNT and TRoNRT at the same level as NMH which they believe is out of step with role which NMH are obligated to provide as mana whenua. Whilst Beach acknowledges the relationship with NMH over time and the views that have been expressed, we have conveyed that it for the relevant iwi and hapū to determine.
	29-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	TRoNRT conveyed they are currently reviewing the conditions post our meeting on 25.03.22 with a view to responding later today.
	29-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone / Text	TRoNRT requested word document with proffered conditions which were subsequently sent by Beach.
	29-03-2022	Te Korowai o Ngāruahine Trust	Phone	Beach rang TKoNT as a courtesy provide a status update with regard to the CIA given, they had been on annual leave. Conveyed that Beach had met with TRoNRT on the 25th of March. Advised TKoNT that we had conveyed that we were working towards application lodgement on Friday 1st of April and that TRoNRT had committed to providing the final CIA that incorporated TKoNT update from hapū and that no doubt a final draft for his review would be shared with him in advance of this. TKoNT thanked Beach for status update that was much appreciated.
	29-03-2022	Ngāti Manuhiakai Hapū	Phone	NMH called to check that Beach had received the CIA documentation. Explained that the NMH huis undertaken over many weeks had been very helpful for the Hapū. Kuia conveyed the importance of the CIA document for NMH as mana whenua given their long-standing relationship with Beach and Beach's predecessor Origin over time. Lengthy discussion about Mauri (life giving principle) and NMH Māori world view.
	30-03-2022	Ngāti Manuhiakai Hapū	Email	Beach thanked NMH consultant for advising Beach about the TKoNT hui.
	31-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach texted TRoNRT to check on status of final CIA.
	31-03-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach texted TRoNRT in response to missed call. No response received thereafter.
April 2022	01-04-2022	Ngāti Manuhiakai Hapū	Email	Email confirmation that a hui has been set with TKoNT for Monday 4th of April at 2:00pm. NMH consultant also advised that she had sought a meeting with TRoNRT but had not had a response. NMH consultant will advise after the meeting. 7:15pm Beach acknowledged NMH consultant email and advised we look forward to hearing from after hui has taken place.
	04-04-2022	Ngāti Manuhiakai Hapū	Phone	NMH Kuia discussed with Beach the hui with TKoNT scheduled for 2pm this afternoon. The purpose of the meeting was to discuss with TKONT the NMH view with regard to the relationship with Beach and their position in leading future cultural discussions in relation to Beach's application.
	04-04-2022	Te Korowai o Ngāruahine Trust	Email	Invoice for koha for TKoNT hapū contributions to cultural impact statements as TKoNT subject matter expertise was received from TKoNT as agreed with Beach. Beach has been mindful of any cost of time and or resources on iwi and hapū in providing their CIA.
	04-04-2022	Ngāti Manuhiakai Hapū	Phone	Followed up with cultural advisor for NMH following meeting with consultant last Friday. NMH confirmed hui taking place with TKoNT this afternoon. NMH confirmed that NMH chairperson would be available to participate in the zoom hui. NMH was made aware that our marine application was not lodged on Friday as we need NMH final CIA. Beach conveyed that the business must forge ahead, and submission lodgement needed to occur this week. NMH acknowledged timelines conveyed.
	04-04-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Left message for TRoNRT to call Beach regarding commitment to addendum to CIA that acknowledges the pause in application lodgement and supply of full application for their review.

Month	Date	Organisation	Method	Communication Detail
	04-04-2022	Ngāti Manuhiakai Hapū	Text	Beach wished kuia well for hui with TKoNT this afternoon. Kuia conveyed that NMH cultural advisor felt that it was important that this hui take place with TKoNT.
	04-04-2022	Ngāti Manuhiakai Hapū	Phone	Long discussion with kuia regarding NMH's rights in respect to mana whenua and mana moana within their takiwa. Kuia went to some lengths to convey the history with the Kupe Production Station previously owners Origin and Lattice, describing the relationship over time and the relationship that has evolved. The purpose of the discussion was to ensure that their perspective about their rohe and their concerns with the crossover between TKoNT and TRoNRT.
	04-04-2022	Ngāti Manuhiakai Hapū	Phone	NMH advised that hui with NMH representatives and TKoNT took place yesterday. Kuia advised that the outcome of the hui was not as positive as they had hoped. The NMH consultant will advise outcome today, NMH CIA not yet finalised which has impacted by key hapū representative being away. In addition, kuia advised that NMH was considering liaising directly with the EPA to ensure EPA understanding of the relationship that has been formed with Beach over time and their Māori world view in respect to mana whenua, mana moana within their takiwa.
	05-04-2022	Ngāti Manuhiakai Hapū	Text	Beach contacted NMH to follow up the hui held with TKoNT yesterday at 1pm to discuss mana whenua, mana moana within their takiwa. NMH CIA to be finalised post hui with TKoNT and TRoNRT respectively.
	05-04-2022	Ngāti Manuhiakai Hapū	Phone	NMH met with TKoNT on the 4th of April, also conveyed as a consequence of the hui yesterday will not pursue a meeting with TRoNRT. Advised that NMH are ready to move forward and finalise the CIA advising that their consultants will contact Beach today to close this out.
	05-04-2022	Te Rūnanga o Ngāti Ruanui Trust	Phone	Beach left message with TRoNRT to determine when the offered addendum to the CIA would be sent to Beach as conveyed in TRoNRT email dated 25/2/2022, stating that ... " As an addendum to the CIA we would be happy to acknowledge the pause in the application for further discussion and a revised application to be viewed".
	05-04-2022	Te Rūnanga o Ngāti Ruanui Trust	Text	Beach sent follow up text to TRoNRT conveying… Further to my voicemail message this text is to check when we might receive the addendum to the CIA acknowledging the pause in the application for further discussion and Beach providing the full revised application for review as noted his email dated 25/2/2022. Conveyed we would very much appreciate it if he could let Beach know as soon as possible.
	05-04-2022	Ngāti Manuhiakai Hapū	Phone	Brief discussion on proffered conditions and responses to recommendations proposed in the NMH CIA.
	05-04-2022	Ngāti Manuhiakai Hapū	Phone	Brief discussion on proffered conditions and responses to recommendations proposed in the NMH CIA.
	05-04-2022	Te Rūnanga o Ngāti Ruanui Trust	Email	Email sent to TRoNRT with responses to their recommendations summarising what we discussed with both TRoNRT and TKoNT respectively in advance of receiving their final collaborative CIA. Advisement that we will integrate these responses into our application which we intend to lodge 6/04/2022. Noted TRoNRT had acknowledged the pause in the application for further discussion and Beach's provision of the full draft application for iwi and hapū review as conveyed in your earlier email. We pointed out that it is not included in the CIA, but recall TRoNRT suggestion it be added as Addendum to the CIA. Advised with their endorsement we would like to reference the pause and further engagement undertaken with you in our application. No response.
	05-04-2022	Te Korowai o Ngāruahine Trust	Email	Email sent to TKoNT with responses to their recommendations summarising what we discussed with you both TKoNT and TRoNRT respectively in advance of receiving their final collaborative CIA. Advisement that we will integrate these responses into our application which we intend to lodge tomorrow 6/4/2022. Noted that TKoNT acknowledged the pause in the application and the additional information (full draft application) for TKoNT and hapū review as conveyed in your earlier email. TKoNT advised in previous email that their CIA would reflect this change however we note it is not included in the final CIA. With your endorsement we would like to reference the pause and further engagement undertaken with you in our application. No response.
	06-04-2022	Ngāti Manuhiakai Hapū	Phone	Kuia advised that discussions had been undertaken yesterday with NMH cultural advisor, CIA consultant and herself. Final CIA approved by hapū and will be closed out for Beach asap. NMH aware of the urgency.
	06-04-2022	Ngāti Manuhiakai Hapū	Phone	NMH conveyed that their consultants had provided the updated CIA for his final review. He confirmed conversations between NMH consultants on the 5th of April and their understanding that Beach was lodging the application today. NMH has given the NMH consultants the authority to finalise the CIA and to provide it to Beach.
	06-04-2022	Ngāti Manuhiakai Hapū	Email	NMH provided final CIA to inform Beach Energy's Kupe Development Drilling application.

APPENDIX H

Regional Economic Impacts

INSIGHT | ECONOMICS

Final Report: 17 February 2022

Assessment of Economic Impacts of Proposed Gas Field Drilling Campaign in Taranaki

Prepared for:

Beach Energy Resources NZ (Kupe) Limited

Authorship

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Contents

1. Executive Summary

Context and Purpose of Report

Beach Energy Resources NZ (Kupe) Limited (Beach) operates the Kupe gas field and processing plant (Kupe) in the Taranaki Basin. It is a critical part of New Zealand's energy infrastructure, providing 15% of the country's natural gas, half of its liquefied petroleum gas (LPG), and condensate that is exported. To maximise the productive potential – and hence economic life – of the Kupe field, Beach seeks consent for the Kupe Phase 2 Development drilling programme (planned for 2023). Initially only one development well is planned to be drilled from the WHP, however two development wells will be included as part of the regulatory approvals process. As such only one development well is considered as part of this assessment, unless otherwise specified. This report assesses the likely national economic effects of additional production enabled by the proposed campaign, plus the regional economic impacts of the proposed drilling campaign itself.

About Natural Gas, LPG, and Condensate

We start by explaining the composition of Kupe's three key outputs – natural gas, LPG, and condensate – then chart annual production by each gas field over time. Next, we identify the transmission network via which most gas is supplied, before identifying its key uses. These include being a feedstock for electricity generation and petrochemical processes, plus as an energy source for heating and gas-fired cooking in nearly 300,000 household and businesses across the North Island. Finally, we describe the role of development drilling in prolonging the useful life of gas fields to maximise their economic potential over time.

Policy Context

Next, we acknowledge that New Zealand is transitioning to a low-emissions economy, including a target of 100% renewable electricity by 2035, and net zero emissions of all greenhouse gases (except biogenic methane) by 2050. This means reducing reliance on fossil fuels (including natural gas and LPG) in favour of renewable energy sources. Despite near-universal agreement that we need to transition towards a cleaner energy future, however, there will still be a need to produce and consume natural gas and LPG well into the foreseeable future. To meet those needs given the moratorium on new exploration permits, future gas and LPG needs must be met by maximising the productive capacity and hence useful lives of existing gas fields, such as Kupe. The drilling campaign analysed in this report explicitly acknowledges and responds to that requirement.

National Impacts of Additional Production

If successful, the proposed campaign will enable significant incremental field production, which itself will generate material economic benefits. They include:

- **Production-Related Jobs and Incomes** – maintained employment for 59 fulltime equivalent NZ staff through to decommissioning, which translates to total wages/salaries of $88 to $106 million. Plus, extra production will support indirect employment by the field and its key partners/suppliers.

- **Demand-Side (Consumption) Impacts** – the supply of additional gas from Kupe will also enable major users to continue their productive processes and thereby keep employing hundreds of New Zealand workers for a longer period, plus it delays the need for smaller/domestic customers to convert to appliances with different fuel sources.

- **Support for Just Transition** – additional production will support a just transition away from fossil fuels until other, cleaner industries establish locally and provide new employment options for those currently working in the O&G sector.

- **Fiscal Benefits to the Crown** – Beach estimate that extra production (from one additional well) will result in extra tax, royalties, and levies of $80 to $90 million.

- **Gas Market Impacts** – extending Kupe's field life will bolster competition and thereby help keep wholesale and retail gas prices as low as possible for the benefit of its users.

- **Avoidance of Higher Carbon Alternatives –** additional supply may help dual-fired plants (such as electricity generators) to minimise or avoid the use of dirtier fuels, such as coal, which emit about twice the carbon of gas per unit of energy delivered**.**

- **Economic Efficiency of Maximising Existing Assets/Investments** – extra field life will achieve high degrees of economic efficiency because it will leverage existing field investments and have minimal requirements of its own (beyond the drilling campaign).

- **Electricity Price Stability** - gas is the largest source of non-renewable electricity generation, so its price flows through to wholesale electricity prices in times of peak demand. Accordingly, greater gas supply will help maintain wholesale gas and electricity prices.

- **Export Earnings** – additional condensate production (and some LPG) will be exported and hence earn export receipts while helping to improve our trade balance.

Regional Impacts of the Drilling Campaign Itself

In addition to the economic benefits of additional production enabled, the drilling campaign itself will also have significant one-off economic impacts. We quantified these using an analytical technique called multiplier analysis, which enables the wider economic impacts of a change in one sector to be traced through the economy to estimate the overall impacts, including flow-on effects.

To that end, Table 1 shows the estimated regional economic impacts of the two development wells based on the methodology above and incorporating data provided by Beach (and acknowledging that only one well will be drilled initially).

Table 1: Overall Regional Economic Impacts (2 Wells)

Impact Measures	Direct	Flow-on	Total
Regional GDP $m	$15.4	$5.5	$20.9
Employment (FTE-years)	117	47	164
Household Incomes $m	$8.9	$2.1	$11.0

In short, including flow-on effects, we estimate that the regional impacts of the proposed drilling campaign (for 2 wells) could equal increased GDP of up to $20.9 million, employment for 164 FTE-years[1], and household incomes of $11.0 million. These are significant impacts and will provide much needed support for a skilled local workforce as it gradually transitions toward a more sustainable energy future.

Summary

This report shows that the proposed drilling campaign will have significant, quantifiable impacts on the national and regional economy, both in its own right, and particularly via the additional production enabled.

[1] FTE-years equal the number of full-time employees multiplied by the duration of their employment. For example, 10 FTE-years could mean 2 people employed full-time for 5 years, or 20 people employed full-time for half a year.

2. Introduction

2.1. Context and Purpose of Report

Beach Energy Resources NZ (Kupe) Limited (Beach) operates the Kupe gas field and processing plant (Kupe) in the Taranaki Basin. It is a critical part of New Zealand's energy infrastructure, providing 15% of the country's natural gas, and half of its liquefied petroleum gas (LPG) and condensate is exported. To maximise the productive potential – and hence economic life – of the Kupe field, Beach seeks consent for its Phase 2 development drilling programme, which consists of drilling up to two development wells. This report assesses the likely national economic effects of additional production enabled by the proposed campaign, plus the regional economic impacts of the proposed drilling campaign itself.

2.2. Structure of Report

The remainder of this report is structured as follows.

- **Section 3** briefly describes the composition, production, distribution, and end uses of natural gas, LPG, and condensate (i.e. the three main outputs of Kupe). Then, it explains the importance of development work in extending the life of gas fields.

- **Section 4** acknowledges the policy context within which the proposal falls, and explains that there will be an ongoing need for natural gas and LPG to be supplied via existing fields well into the foreseeable future as we transition towards a more sustainable energy future.

- **Section 5** identifies the location of the proposed activities, and briefly describes them.

- **Section 6** considers the likely national impacts of additional production enabled by the proposed campaign, and

- **Section 7** quantifies the likely regional economic impacts of the proposed drilling campaign itself.

3. About Natural Gas, LPG, and Condensate

This section provides a brief overview of Kupe's three outputs - natural gas, LPG, and condensate.

3.1. What is it?

Natural gas (or 'dry' gas) is a naturally occurring hydrocarbon gas mixture, which consists mainly of methane, but may also include trace amounts of carbon dioxide, hydrogen sulphide, or helium. It is used for a range of uses, as described further below.

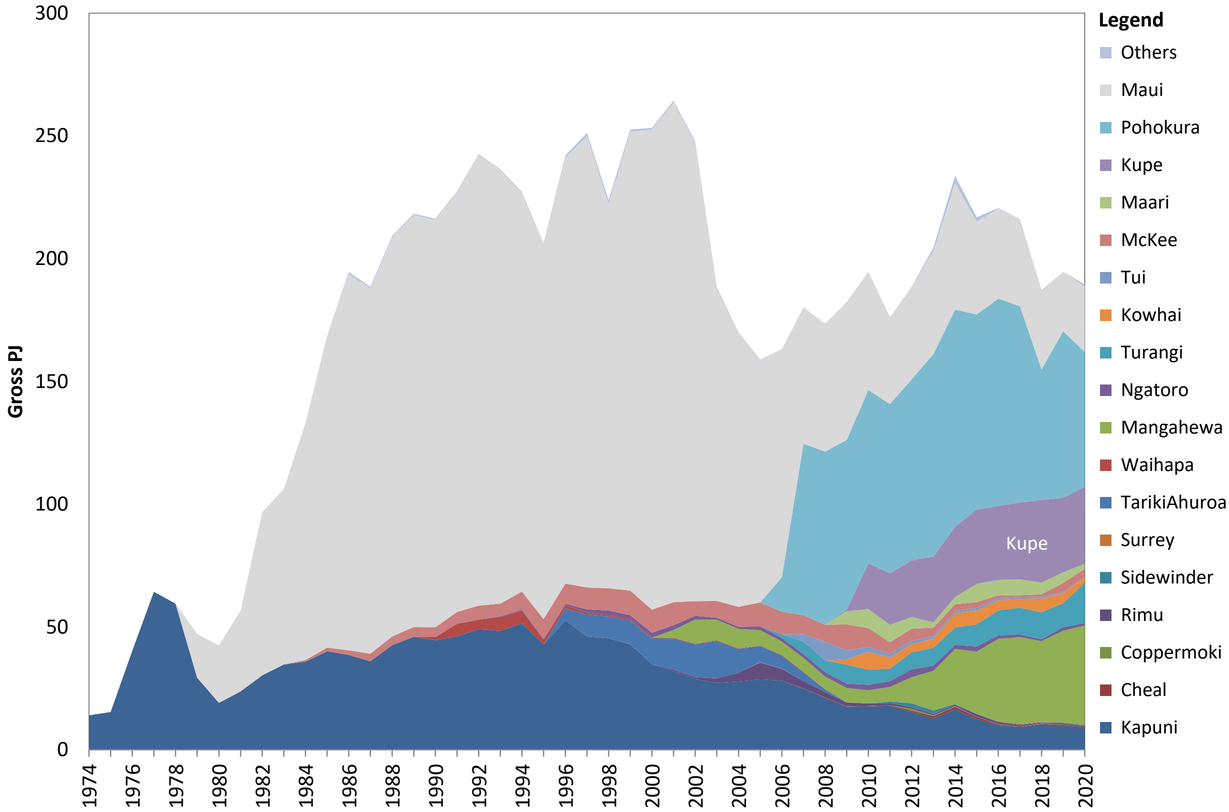
Liquid Petroleum Gas (or LPG) is denser than natural gas and consists of a mix of propane and butane, thus it forms a liquid. LPG is easier to store and transport than natural gas, so is distributed around New Zealand via tanker trucks or in bottles, like those used with gas barbecues.

Condensate is a low-density mix of hydrocarbon liquids, which can occur when temperatures and pressures drop sufficiently. They are used to produce motor fuels, and in chemical processes.

3.2. Production

All New Zealand natural gas, LPG and condensate production occurs in the Taranaki basin, where there are about 20 fields. Despite the large number of fields operating, however, the four largest contributed more than 80% of total production in 2020. Kupe was the third largest, providing nearly 17% of annual supply. The graph below shows the contribution of each natural gas field to annual production since the mid-1970s.

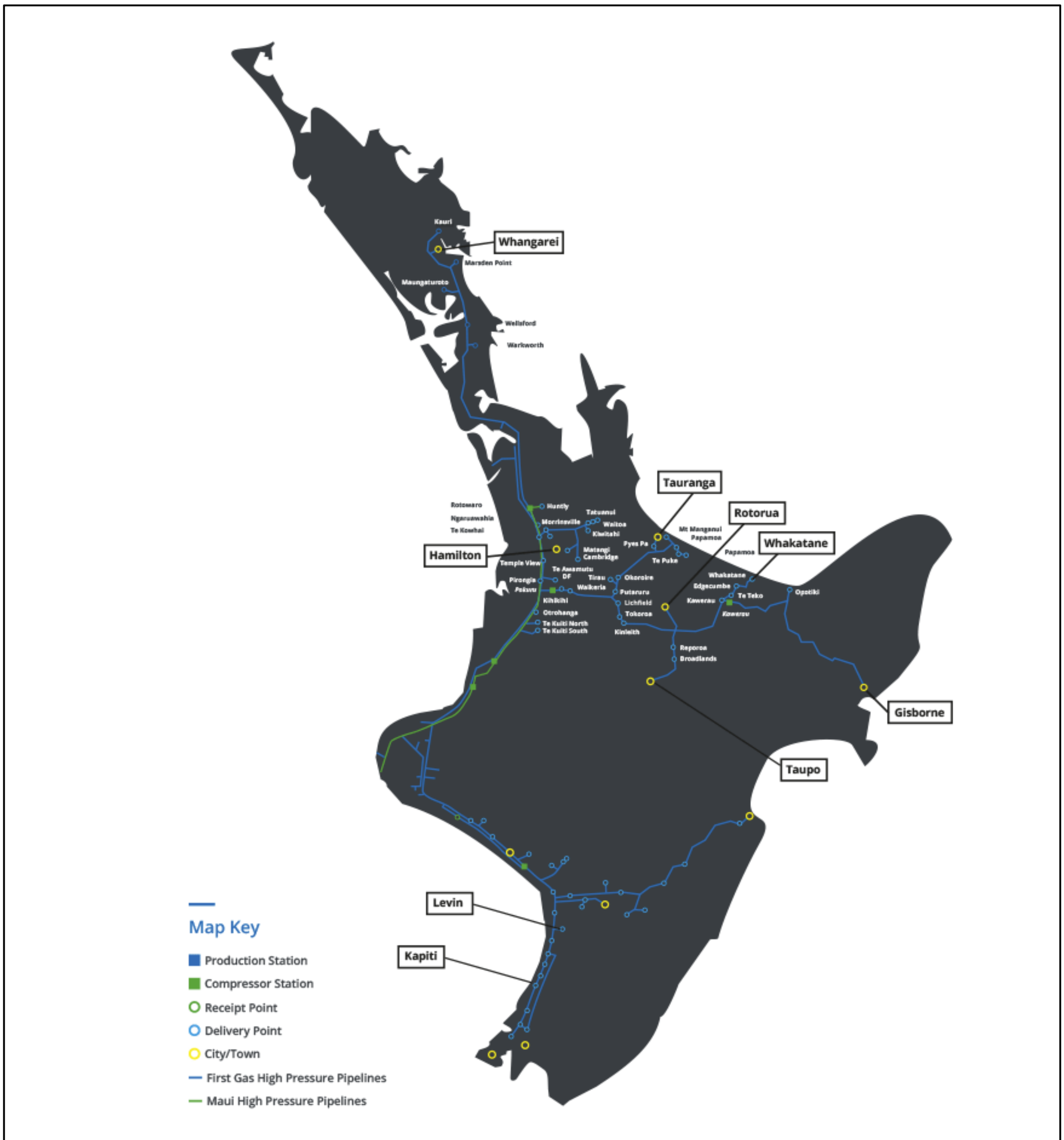
Figure 1: Natural Gas Production by Field



3.3. Transmission and Distribution

LPG is bottled and distributed mostly by truck to consumers across New Zealand, while natural gas is transmitted via high-capacity reticulated networks that originate in Taranaki and terminate in various North Island centres. These high-capacity transmission networks then feed into various low capacity "distribution" networks, which directly connect to end users. Figure 2 shows the gas transmission networks that forms the backbone of the natural gas delivery system.

Figure 2: High-Capacity Gas Transmission Network



3.4. Uses

While most locally produced condensate and oil is exported, virtually all gas & LGP produced in New Zealand is used locally for a variety of uses (because exporting it is costly and difficult, especially given natural gas' low density compared to liquids and solids).

Approximately a third of annual natural gas production is used to fuel gas-fired power stations, which produce about 20% of our electricity supply. About another quarter is used as key inputs to petrochemical production processes, specifically:

- Methanol – large quantities of methanol are produced at the Methanex plant in Taranaki, which are then mainly exported. While exact figures are unknown due to commercial sensitivity, these exports are understood to be worth around $1 billion per annum.

- Urea – significant quantities of urea are produced by Agri-Ballance at its plant in Kapuni, which is used as a fertiliser on farms across New Zealand. The urea produced at Kapuni meets about 40% of domestic demand, with the other 60% imported.

The remaining 40% of annual production is distributed via a piped reticulation network to nearly 300,000 customers across the North Island. Households account for 95% of customers, but only 4% of annual consumption. About 15,000 New Zealand businesses also rely on gas for various uses, particularly continuous hot water supply, heating, and cooking.

Natural gas also comprises half the energy used for food processing/manufacturing, and a third of the energy used in wood processing. These products, in turn, comprise some of New Zealand's key exports. Accordingly, natural gas not only plays a vital role in meeting the daily energy needs of about 280,000 households, but it also plays an integral role in New Zealand's economy.

3.5. The Role of Exploration and Development

The oil & gas (O&G) industry comprises three parts:

1. **Upstream** – finding and extracting O&G reserves.
2. **Midstream** – storing and transporting O&G products.
3. **Downstream** – refining, distributing, and selling O&G products.

This report focuses on the economic impacts of development drilling, which is part of the upstream phase. Below is a brief description of this activity.

Development Drilling

Petroleum permits and/or licences are typically held by global O&G companies, who employ a range of local staff and businesses to help complete drilling projects. The drilling of production wells themselves are performed by a mobile offshore drilling unit (MODU), which is contracted on a daily basis. Once towed into place, the MODU commences the drilling programme to penetrate the layers of rock below until it reaches the desired total depth. This can take several weeks depending on the type of rock, and the total depth required.

Development drilling occurs after an area has been proven to hold oil or gas reserves and is typically the final phase of the drilling process.

4. Policy Context

This section briefly describes the policy context for the proposal.

4.1. Transition to a More Sustainable Energy Future

New Zealand has committed to transitioning towards a lower-carbon energy future over time and has announced some key milestones for that journey. They include aiming to achieve:

- 100% renewable electricity generation being by 2030, and
- Net zero emissions of all greenhouse gases, other than biogenic methane, by 2050.

Although the Government's stated targets are still many years away, the transition away from fossil fuels is already underway. In 2018, a moratorium was placed on *new* offshore O&G permits. Further, earlier this year, the Climate Change Commission (CCC) proposed that natural gas be phased out of existing buildings by 2050, with no new natural gas connections created after 2025. Exactly when and how these proposed transitions occur will have important implications for the energy system, the Taranaki economy, and natural gas end users. Natural gas and LPG will continue to support the countries energy security and move away from coal fuel uses as the country transitions to increasingly renewable energy.

4.2. Obstacles to a Purely Renewable Future

Despite widespread agreement that New Zealand (and the rest of the developed world) needs to transition to a more sustainable energy future, current renewable energy options face their own challenges, which limit our ability to rely solely on them over the short to medium term. These limitations are briefly discussed below.

Hydroelectricity (hydro) – this currently provides 55% of our electricity generation and is thus a critical energy source. However, New Zealand has relatively low water storage capacity, so hydro generation relies on regular rainfall to refill dams. This, in turn, undermines its reliability during "dry years". In addition, constructing new dams is expensive, and takes many years from the initial planning phases through to final plant commissioning.

Wind – this is another important source of renewable energy, with our windswept west coast providing ideal conditions to harness it. Wind infrastructure is also relatively fast to construct. However, the development of some windfarms has faced opposition due to perceived visual and noise impacts. Consequently, its contribution to electricity generation has remained at about 5% of the total since 2012. Moreover, just as hydro electricity needs rainfall, wind energy needs wind. Still conditions therefore limit capacity.

Solar – solar power harnesses the sun's energy and is a silent process with (typically) little visual impact. But, current solar options are expensive, so they account for only 0.4% of total electricity generation.

Geothermal – unlike the three sources of renewable energy above, geothermal does not depend on weather conditions, and instead harnesses thermal energy emanating below the earth's surface. However, it needs careful management to control water and pressure levels, and to prevent land subsidence and depletion. In addition, it does emit small amounts of greenhouse gases so is not as environmentally friendly as other renewable options.

Not only do existing renewable energy sources face their own unique constraints, as above, but finding and commercialising new renewable energy sources will be a gradual process that will likely take many years.

4.3. The Importance of Natural Gas as a Transition Fuel

Given the limits on existing renewable options, non-renewable energy sources will still be required to meet annual energy deficits well into the foreseeable future. Of the options available, natural gas is regarded as the best choice. Not only does it emit less carbon than oil or coal per unit of energy, but it also has a wide range of uses. Despite the CCC's strong stance on the long-term elimination of fossil fuel use, it acknowledges that natural gas plays an important role in the energy system, particularly for generating high-process heat, and as a backup fuel for electricity generation.

The need for an orderly transition away from gas over time also reflects the fact that the 300,000 households and businesses that currently use it cannot all immediately replace their gas-fired appliances with new ones. For example, if the average cost of replacing all gas-fired appliances in a typical house or business was (say) $10,000, the total cost of switching from gas to another fuel source would be nearly $3 billion for all existing gas users. This is a significant outlay, which naturally limits the rate at which New Zealand can transition to other fuels, particularly for households with lower socio-economic status. A phased transition away from natural gas, conversely, will allow households and businesses to replace gas-fired appliances at the end of their natural lives with non-gas equipment.

Another reason to rely on gas as a transition fuel is that the O&G industry is a cornerstone of the Taranaki regional economy, accounting for 28% of its GDP, and contributing over 7,000 jobs[2]. In this context, the Taranaki 2050 Roadmap sets out a 'just transition' to a low-emissions economy. This involves proactively encouraging a shift from fossil fuels to new technologies such as wind, solar, wave and biofuel, while retaining and developing local talent and expertise. A high priority is the creation of a 'local hydrogen economy'. For example, we recently worked with Hiringa Energy Limited and Ballance Agri-nutrients on a proposal to develop a renewable hydrogen hub at Kapuni.

Finally, we note that removing gas from the system too quickly could make electricity supply both more unpredictable and more expensive. At the same time, it could hinder progress on carbon-friendly projects such as the electrification of transport systems.

[2] https://www.venture.org.nz/sector-development/energy/

4.4. Summary and Conclusion

Despite near-universal agreement that New Zealand needs to transition towards a cleaner energy future, there will still be an ongoing need to produce and consume natural gas well into the foreseeable future. To meet those future gas needs given the moratorium on new exploration permits, future needs must be met by maximising the productive capacity and hence useful lives of existing gas fields, such as Kupe. The drilling campaign analysed in this report explicitly acknowledges and responds to that requirement.

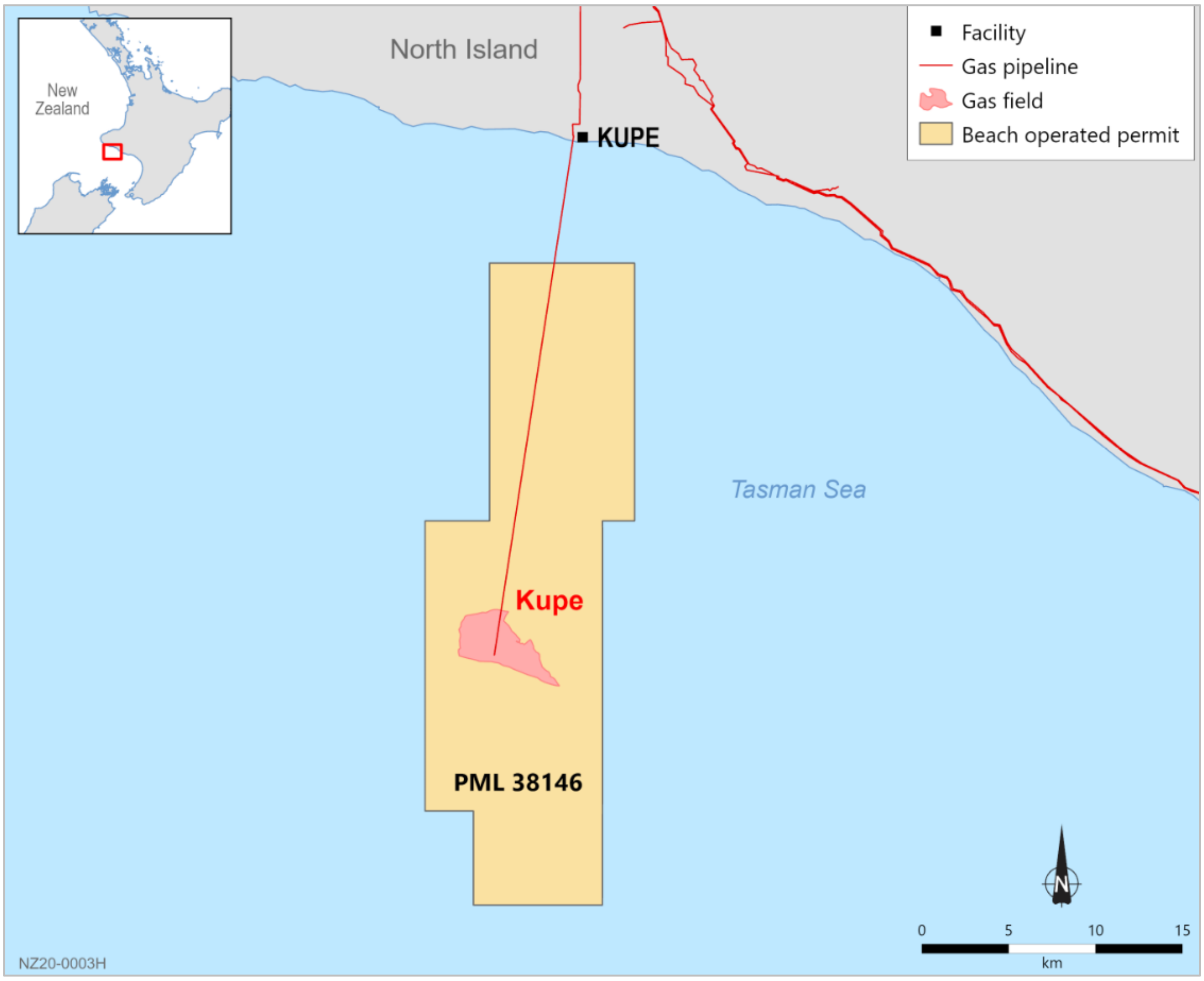
5. About the Proposed Campaign

This section identifies the location of the proposed campaign and briefly describes its key elements.

5.1. Location

The proposed drilling campaign falls within Petroleum Mining Licence (PML) 38146, which is located offshore in the Taranaki Basin, just south of Manaia. It includes the Kupe gas field, which is located approximately 30 kilometres south of the Taranaki coastline, at a depth of around 35 metres. The permit area and the location of the Kupe gas field are illustrated in Figure 3 below.

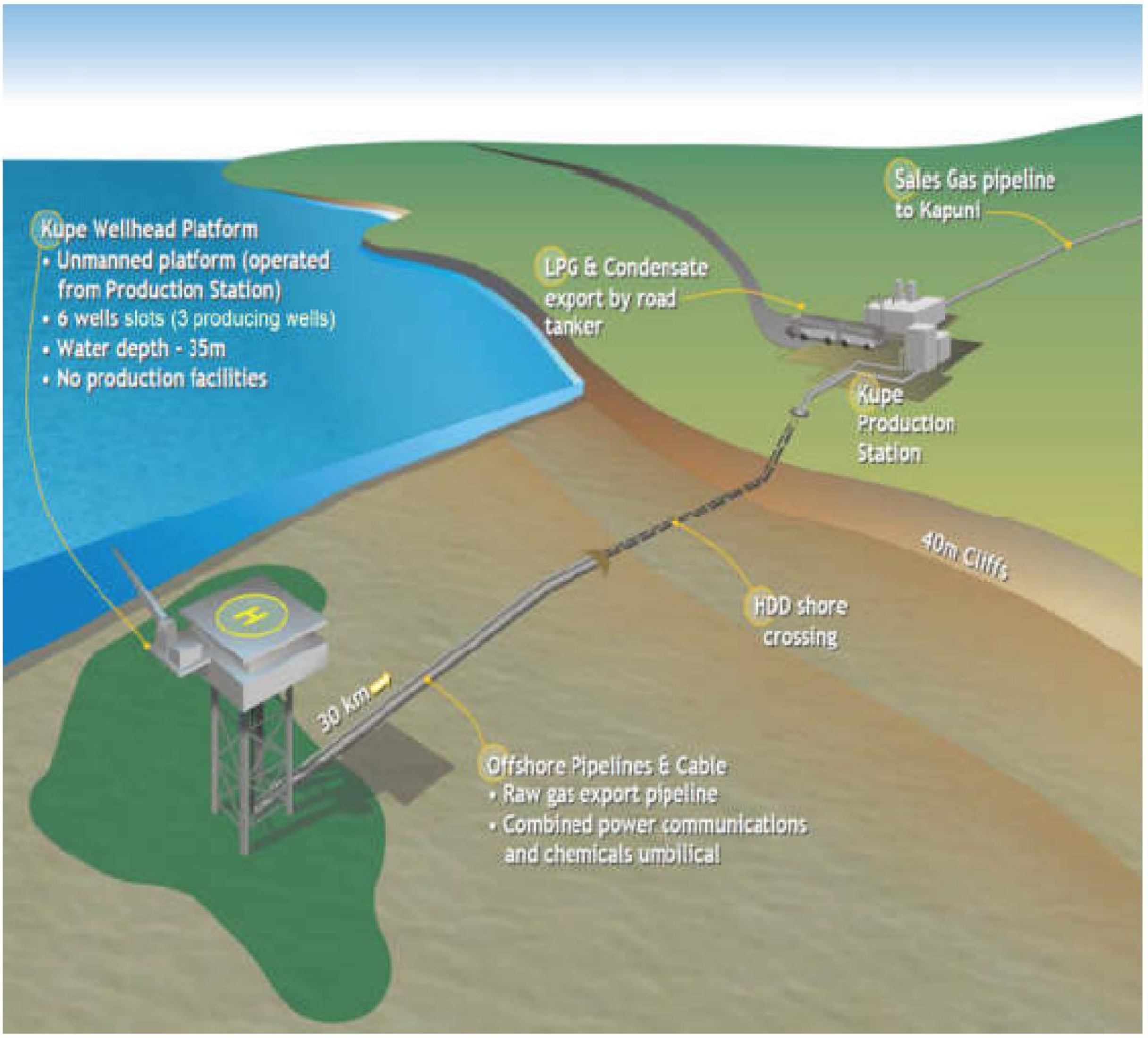
Figure 3: Location of Proposed Drilling Campaign



5.2. Description of Existing Kupe Operations

The Kupe Wellhead Platform (WHP) is built above three existing production wells within the Kupe gas field. Raw gas and liquids from the Kupe WHP are transported onshore via a subsea pipeline, where they are processed. Once processed, a sales gas pipeline takes natural gas from the production station to Kapuni where it is injected into the North Island transmission network. Condensate is transported from the production station via road and shipped internationally, while LPG is transported via road for the local market. This process is illustrated in Figure 4 below.

Figure 4: Kupe Production Process



5.3. Proposed Drilling Campaign

Two development wells are proposed to be drilled from the WHP, which can accommodate up to six wellheads.

6. National Impacts of Additional Production

This section considers the likely economic effects of additional field production enabled by the proposed drilling campaign (presuming that it is successful).

6.1. Production-Related Jobs and Incomes

Incremental production enabled by a successful development campaign will sustain jobs and incomes for dozens of New Zealand-based Beach employees, plus people employed by key project partners and suppliers. To assess these impacts, Beach estimated that additional field production would be approximately 11 mmboe, broken down as follows:

- 47 PJ of sales gas;
- 1.2 mmbbls of condensate; and
- 207 kt of LPG.

In addition, Beach reported that Kupe currently employs (or has long term contracts with) 59 full-time-equivalent staff in New Zealand, and a further 10 in Australia. The New Zealand staff earn $8.8 million per annum, which translates to an average annual salary of nearly $150,000. We understand that incremental production enabled by the proposed drilling campaign will extend this for 10 to 12 years. This represents a total increase in wages/salaries paid to New Zealand staff of $88 to $106 million.

While these figures themselves are significant, they only represent people employed directly for daily field operations. Others will be contracted to work indirectly on a semi-permanent basis and/or ad-hoc during one-off events or periods of sustained high production. Accordingly, the additional wages and salaries paid to New Zealanders will exceed our estimated range above.

For example, our input output tables, which we use later to estimate the economic impacts of the drilling campaign itself, show that the O&G extraction industry employs 10 people indirectly across supporting industries for every person directly employed. This is borne out by employment data, which show that industries supporting the O&G sector are up to 16 times more important to Taranaki regional employment than the national average. Accordingly, extending the field's productive life will create enduring incomes and employment for dozens – if not hundreds – of regional workers, both directly and indirectly.

6.2. Demand-Side (Consumption) Impacts

Enabling Kupe to maximise its productive field life will also have important demand-side impacts. First, it will enable domestic and small-scale gas users to continue operating their gas-fired appliances and thus delay the costly conversion to other appliances (as discussed earlier).

Second, and perhaps more significantly from an economic perspective, the proposal will ensure that major gas users can continue their own productive processes and thereby maintain jobs and incomes for the hundreds or thousands of people employed by them.

This latter point is particularly relevant for the handful of very large gas users located in Taranaki, such as Methanex and Ballance, which have direct supply contracts with several major fields. With no easy way to store or export gas in times of excess supply, these major users have played a critical role in balancing gas supply and demand over time. In short, when gas supply is abundant, these major users take as much gas as they need to operate at or near capacity. However, when gas supplies are lean, the amount provided to them is curtailed accordingly to maintain a supply-demand balance. As a result, these large and flexible users avoid the need to import, export, or store gas when production is higher or lower than expected.

Because the contracts between gas fields and these major users is highly confidential, we are unsure whether – or to what extent – Kupe supplies them directly. However, even if Kupe does not directly supply those major users, extending its field life will allow it to keep supplying all other (smaller) users and hence free up the supply of other fields to continue feeding major ones. As a result, the proposed drilling campaign will also (directly or indirectly) enable major gas users to operate at higher levels than they would have otherwise, and therefore support the ongoing employment of the hundreds (or thousands) of people employed by them, either directly or indirectly.

6.3. Support for Just Transition

The extraction and use of oil and natural gas has a long history in the Taranaki region, with the first seeps observed on New Plymouth's coastline 150 years ago. While early exploration efforts produced mixed results, persistence paid off. Nearly 100 years later, New Zealand's first major field – Kapuni – was discovered, marking the start of a new chapter in our energy history. Fast forward to today, and the region has become the home of New Zealand's O&G sector, with production not occurring elsewhere in the country.

While Taranaki's specialisation in O&G production was historically a blessing, enabling a wide range of related economic activity to flourish over time, the region now faces the challenge of pivoting towards other economic activities. This need to move away from O&G production is clearly signalled in a recent document titled *Taranaki 2050 Roadmap - Our Just Transition to a Low-Emissions Economy*. It acknowledges that recent policy changes and the tide of public opinion have mandated a shift away from fossil fuel use, but notes that a managed and orderly "just transition" is essential to avoid potentially enduring unintended consequences.

The proposed drilling campaign, and associated extensions of productive field life, directly support a just transition by enabling people employed in the O&G sector to keep working and thus providing for their families until other industries begin to emerge over time and provide new work opportunities.

6.4. Fiscal Benefits to the Crown

O&G producers pay taxes and royalties to the Crown in return for the right to extract and sell O&G reserves. Accordingly, prolonging Kupe's useful life will also generate fiscal benefits for the Crown via increased taxes and royalties over time. Specifically, incremental production at Kupe will be subject to the following suite of taxes, levies, and royalties.

- **Royalties** – which equals 12.5% of wellhead value;
- **Emissions Trading Scheme (ETS) payments** – which are levied per tonne of CO_2 in relation to gas, but not condensate as it is exported.
- **Company tax** – which equals 28% of net profits.

Noting the above, Beach inform us that, in their baseline scenario, incremental field life will result in $80 to $90 million of additional tax and royalty payments, which we consider a significant benefit to the Crown.

6.5. Gas Market Impacts

In addition to the demand-side impacts briefly described above, failure to gain consent for the proposed drilling campaign (and hence the subsequent loss of incremental production) would also have long-term impacts on the wider gas market. For example, firms that hold contracts with other fields will eventually need to renegotiate them as their terms expire. If Kupe is no longer in production, those other fields will have a higher degree of market power than they would have otherwise, enabling them to charge higher prices. Hence, over the medium to longer term, most gas-using organisations will likely pay more for gas than they would have if Kupe was consented to continue operating.

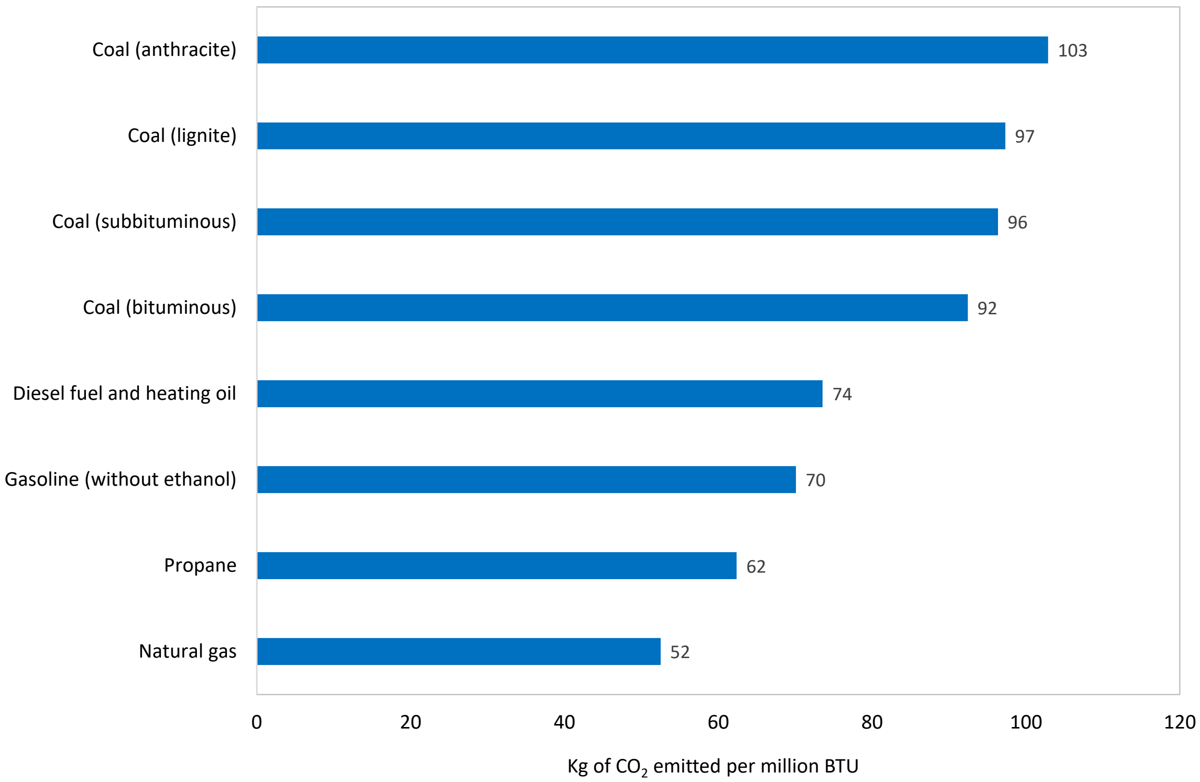
More generally, the fewer gas fields operating in future, the easier it will be for them to charge more for gas, thereby placing pressure on wholesale gas prices. As wholesale gas prices increase, so too will retail prices to maintain retail margins. For homes and businesses reliant on gas, this will increase their daily costs of operating/living, and reduce the money available to spend on other goods and services

6.6. Avoidance of Higher Carbon Alternatives

Natural gas emits less CO_2 than other fossil fuels per unit of energy delivered. This is illustrated in the chart below, which shows the amount of CO_2 emitted by various fossil fuels per million BTU (or British Thermal units, a standardised measure of the heat/energy content of fuels). It shows that natural gas emits 52 kg of CO_2 per unit of energy, compared to 103 for anthracite coal, the "dirtiest" form of coal. [3]

[3] Data sourced from https://www.eia.gov/tools/faqs/faq.php?id=73&t=11

Figure 5: Comparison of CO_2 Emissions by Fossil Fuels (kg CO_2 per million BTU)



By unlocking a steady, reliable, and ongoing future stream of natural gas, the proposed drilling campaign would enable major gas users (such as electricity generators and major industrial processors) to continue using it as their primary energy source, rather than switching to coal or other "dirtier" fuel source options. This is particularly relevant for so-called dual-fired (or dual-fuelled) plants, which can run on two energy sources, usually gas or coal. For these users, the cheapest or most readily available fuel source is typically used, with the other used when it becomes the better option.

The Huntly power plant, which is New Zealand's largest by generation capacity, is a good example. It includes a 403MW gas-fired unit plus two 250MW coal/gas-fired units, which can switch between the two energy sources depending on the cost and availability of supply.[4]

By providing an affordable and reliable ongoing source of natural gas, the extension of Kupe's field life can help avoid the use of coal in these dual-fired plants. This also applies to other boilers that operate in a similar manner.

Not only does the ability to source natural gas locally from Kupe avoid the need to use coal in plants that can use either, but it also avoids the possibility that those dirtier, alternative fuel sources are imported from elsewhere. If that were to occur, additional carbon impacts would arise from the transport fuels burned to ship the coal here. Additional gas supply, conversely, can be

[4] https://www.genesisenergy.co.nz/assets

efficiently conveyed to end users via the existing transmission/distribution system, which we understand has only minimal energy requirements.

Accordingly, enabling the drilling campaign – and thus the likely extension of field life – helps us to meet ambitious climate change targets by avoiding the use of dirtier alternatives.

6.7. Economic Efficiency of Maximising Existing Assets/Investments

The costs of finding and developing O&G fields is expensive, with even a single drilling campaign often costing hundreds of millions of dollars. For example, the drilling programme analysed in this report is estimated to cost about $220 million. When all the other costs that have already been incurred to date to discover and develop the Kupe field are accounted for, the costs can easily run into the billions of dollars.

Given the very expensive costs of exploring, appraising, and developing O&G fields, activities such as ongoing development of existing fields that can help prolong their useful life maximise economic efficiency by making the most of existing (sunk) investments. These existing investments not only include prior exploration/appraisal efforts, but also the physical structures onsite, such as the WHP, subsea cables, and connections to the transmission network. By making greater use of these existing investments, the proposal will enhance the overall economic efficiency of the field by maximising the value of its outputs while minimising the costs of its inputs. This, in turn, maximises the economic value added – or GDP – of the field over the course of its life.

6.8. Electricity Price Stability

In 2020, nearly 14% of New Zealand's electricity generation was gas-fired, making it the largest source of non-renewable electricity generation by a long way[5]. In short, when peak electricity demand is expected to occur, gas-fired plants are used to top up the generation that is provided most of the time by traditional/renewable sources, such as hydro and geothermal. Further, when wholesale gas prices are high, they feed directly into the cost of wholesale electricity (at peak times when gas-fired plants are used to supplement baseload generators). By enabling Kupe's gas supply to continue further into the future than it may have otherwise, the proposal will help to contain the wholesale electricity price during peak times. This, in turn, will provide cost savings for energy-intensive businesses, many of which are our largest exporters and sustain thousands of permanent jobs for workers and their households.

6.9. Export Earnings

While natural gas produced by Kupe is all consumed domestically, a significant share of its condensate and LPG production is exported to customers overseas. These export markets, in turn, enable greater domestic production, support economic growth, and generate export receipts.

[5] Next is coal on 5%.

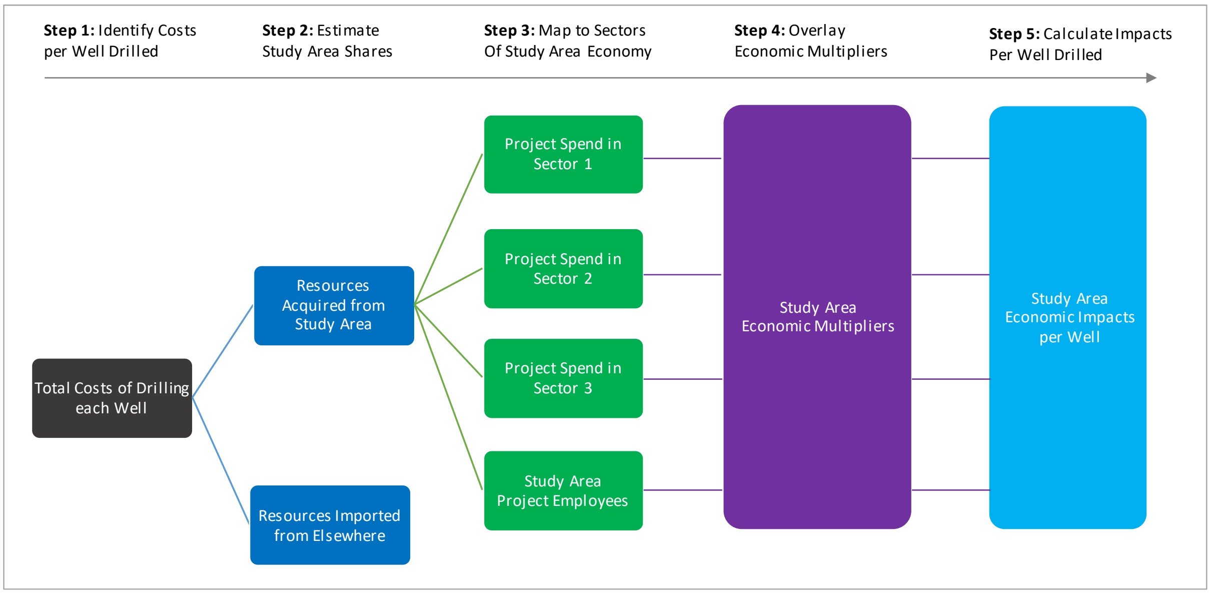
7. Regional Impacts of Drilling Campaign

While previous section focussed on the likely national economic impacts of future production enabled by the proposed drilling campaign, this section estimates the likely regional economic impacts of the campaign itself.

7.1. Steps in the Analysis

The proposal entails drilling two development wells within the Taranaki Basin. The likely economic impacts of drilling each well were estimated using the process outlined in the figure below, with the results then added together to estimate total impacts.

Figure 6: Steps to Estimate Regional Economic Impacts of Drilling Each Well



To summarise: the likely costs of drilling each well were estimated using data supplied by Beach, with a share of each expenditure item allocated to the Taranaki region. These estimates of regional expenditure were then mapped to sectors of the economy and overlaid with economic multipliers to estimate the impacts of drilling the well, including flow-on effects.

In simple terms, these effects arise when the project's various tasks acquire resources from the regional economy, both through the employment of local workers, and the purchase of project services and suppliers from local businesses. Both actions stimulate the regional economy and give rise to economic benefits, which can be quantified as described further below.

7.2. Introduction to Multiplier Analysis

The economic impacts of the drilling campaign were quantified using a technique called multiplier analysis. These incorporate detailed matrices called input-output tables, which describe the supply chains that comprise an economy. As a result, they enable the wider economic impacts of increased activities in certain sectors to be traced through the economy to estimate the overall impacts, including flow-on effects. These impacts are typically measured in terms of changes in national GDP, household incomes, and employment.

The economic impacts estimated by multiplier analysis comprise two parts, namely:

- **Direct Effects** – these are the direct economic effects of the entity (or entities) in question, plus the economic effects of their immediate suppliers; and

- **Flow-On Effects** – these are the broader economic impacts of the wider supply chain that support the project's immediate suppliers. In addition, they capture the additional economic stimulus of increased spending by people employed as a result of the project (either directly or indirectly).

The overall economic impact of the proposed activity is the sum of the direct effects and flow-on effects, and these are measured in terms of:

- Contributions to value-added (GDP),
- The number of New Zealanders employed full-time, and
- Total wages and salaries paid to workers, which are reported in economic impact assessments as 'household incomes.'

7.3. Costs of Campaign

Beach provided information about the likely costs of each campaign element, which we have used in our analysis. These costs are listed in the table below and are expressed in New Zealand dollars.

Table 2: Estimated Total Cost of Campaign ($m)

Campaign Element	**Development Well 1**	**Development Well 2**	**Total Cost**
Rig mobilisation / demobilisation	$31.4	-	$31.4
Well engineering planning	$5.7	$4.3	$10.0
Regulatory approvals	$2.4	-	$2.4
Office support / comms / overheads	$0.9	$0.9	$1.7
Site surveys	$3.6	-	$3.6
Supply base, transportation, and storage	$0.9	$0.9	$1.9
Rig assurance and modifications	$0.8	-	$0.8
Pre-spud preps and drilling	$42.0	$42.0	$84.0
Completions	$13.8	$13.8	$27.6
Rig down and move off	$4.6	-	$4.6
Total	**$106.1**	**$61.9**	**$168.0**

As part of the upcoming Kupe Phase 2 Development drilling programme (planned for 2023), only one development well is planned to be drilled from the WHP, however two development wells will be included as part of the regulatory approvals process. As such two development wells are included as part of this assessment.

In summary, the estimated total campaign cost for two development wells is NZ$168 million. Of this, $106 million is for a standalone development well, with $62m for a second development well, assuming this was undertaken within the same drilling campaign. The lower cost of a second development well in this scenario reflects the fact that the MODU will already have been mobilised and in place. As noted for the upcoming Kupe Phase 2 Development drilling programme only one development well is planned to be drilled from the WHP.

7.4. Regional Cost Shares

Table shows the share of each campaign costs expected to be occur in Taranaki.

Table 3: Estimated Taranaki Regional Share of Campaign Spend

Campaign Element	Total Cost ($m)	Taranaki Share	Taranaki Spend ($m)
Rig mob / demob	$31.4	0%	$0.0
Well engineering planning	$10.0	20%	$2.0
Regulatory approvals	$2.4	90%	$2.1
Office support / comms / overheads	$1.7	100%	$1.7
Site surveys	$3.6	80%	$2.9
Supply base, transportation and storage	$1.9	70%	$1.3
Rig assurance and modifications	$0.8	20%	$0.2
Pre-spud preps and drilling	$84.0	30%	$25.2
Completions	$27.6	25%	$6.9
Rig down and move off	$4.6	20%	$0.9
Total	**$168.0**	**26%**	**$43.2**

Half of the total project cost ($84m) arises from pre-spud preparations and drilling, which includes renting and operating the MODU. Despite being the most significant cost, only 30% is assumed to be spent in the region. This is because the MODU is leased from an international pool of drilling units, not sourced locally. The next biggest item, rig mobilisation and demobilisation, includes transporting the MODU to and from overseas, and does not generate local spend.

Overall, around $43m will be spent in Taranaki, which is 26% of the total campaign cost.

7.5. Mapping of Expenditures to Regional Economy

The Taranaki expenditures estimated above were mapped to sectors of the regional economy based on the types of activities involved. For example, the bulk of well engineering planning activities were assigned to the ‘scientific, architectural, and engineering services’ sector, while many other costs were allocated to the ‘mining support services’ sector. The following table shows the final mapping of expenditures to sectors of the economy.

Table 4: Mapping of Expenditure to Sectors of Regional Economy

Sector	Total ($m)
Mining support services	$25.0
Basic material wholesaling	$5.8
Machinery and equipment wholesaling	$5.8
Scientific, architectural, and engineering services	$1.9
Legal and accounting services	$1.5
Local government administration services	$0.8
Fabricated metal product manufacturing	$0.8
Heavy and civil engineering construction	$0.8
Other transport	$0.8
Total	**$43.2**

The greatest economic stimulus from the proposed drilling campaign is expected to be felt by the 'mining support services' sector, which is expected to assist with several key project tasks. Other sectors that will experience a boost include basic material wholesaling (through the provision of well cement and associated products), as well as heavy engineering businesses, who will provide a range of key services.

7.6. Economic Impacts of Proposed Drilling

The next step was to overlay the regional project expenditures above with corresponding multipliers to derive the resulting economic impacts per well drilled. These are summarised in the table below.

Table 5: Regional Economic Impacts per Well Drilled

Development Well 1	**Direct**	**Flow-on**	**Total**
Regional GDP ($ millions)	$9.0	$3.1	$12.1
Employment (FTE-years)	70	26	96
Salaries/Wages ($ millions)	$5.2	$1.2	$6.4
Development Well 2	**Direct**	**Flow-on**	**Total**
Regional GDP ($ millions)	$6.4	$2.4	$8.8
Employment (FTE-years)	48	20	67
Salaries/Wages ($ millions)	$3.7	$0.9	$4.6
Campaign Totals	**Direct**	**Flow-on**	**Total**
Regional GDP ($ millions)	$15.4	$5.5	$20.9
Employment (FTE-years)	117	47	164
Salaries/Wages ($ millions)	$8.9	$2.1	$11.0

In short, including flow-on effects, we estimate that the proposed drilling campaign could generate $21 million of regional GDP, provide employment for 164 FTE-years[6], and generate household incomes of $11 million. Clearly, the proposed drilling activities will have significant impacts and provide ongoing incomes and employment for many local O&G workers.

[6] FTE-years equal the number of full-time employees multiplied by the duration of their employment. For example, 10 FTE-years could mean 2 people employed full-time for 5 years, or 20 people employed full-time for half a year.

APPENDIX I

Sodium Hypochlorite SDS

Wilhelmsen Ships Service

Product brands by Wilhelmsen

UNITOR

NALFLEET

SODIUM HYPOCHLORITE POTABLE GRADE

Wilhelmsen Ships Service Ltd

Catalogue number: **909001**	Issue Date: **08/08/2017**
Version No: **8.17**	Print Date: **12/03/2019**
Safety Data Sheet according to HSNO Regulations	S.GHS.NZL.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	SODIUM HYPOCHLORITE POTABLE GRADE
Synonyms	241A1T-SODIUM HYPOCHLORITE LG TAP - BLEACH
Proper shipping name	HYPOCHLORITE SOLUTION
Other means of identification	909001, 909001

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Use according to manufacturer's directions.

Details of the supplier of the safety data sheet

Registered company name	**Wilhelmsen Ships Service Ltd**	**Wilhelmsen Ships Service AS***	**Outback (M)SDS portal: http://jr.chemwatch.net/outb/account /autologin?login=wilhelmsen**
Address	6B Wagener Place Auckland 1025 New Zealand	Willem Barentszstraat 50 Rotterdam Netherlands	--------Use our Outback portal to obtain our (M)SDSs in other languages and/or format.--------- For questions relating to our SDSs please use Email: WSS.GLOBAL.SDSINFO@wilhelmsen.com --------- Norway
Telephone	(+64) 9 8494783	+31 10 4877 777	Not Available
Fax	Not Available	+31 10 4877888	Not Available
Website	Not Available	http://www.wilhelmsen.com	Not Available
Email	Not Available	wss.rotterdam@wilhelmsen.com	Not Available

Emergency telephone number

Association / Organisation	**CHEMTREC**	**Dutch nat. poison centre**	**American Chemistry Council 24hrs - Chemtrec**
Emergency telephone numbers	**(+64) 9 8455758**	**+ 31 30 274 88 88**	**+1 703 527 3887**
Other emergency telephone numbers	**Not Available**	**Not Available**	**(800) 424 9300**

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

Continued...

Classification [1]	Skin Corrosion/Irritation Category 1C, Acute Aquatic Hazard Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from CCID EPA NZ; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI*
Determined by Chemwatch using GHS/HSNO criteria	8.2C, 9.1A

Label elements

Hazard pictogram(s)	

SIGNAL WORD	DANGER

Hazard statement(s)

H314	Causes severe skin burns and eye damage.
H400	Very toxic to aquatic life.

Precautionary statement(s) Prevention

P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P273	Avoid release to the environment.

Precautionary statement(s) Response

P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
7681-52-9*	100	sodium hypochlorite, solution 12 % Cl active

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Continued...

Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay. ▸ Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema. ▸ Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs). ▸ As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested. ▸ Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered. **This must definitely be left to a doctor or person authorised by him/her.** (ICSC13719)
Ingestion	▸ For advice, contact a Poisons Information Centre or a doctor at once. ▸ Urgent hospital treatment is likely to be needed. ▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Transport to hospital or doctor without delay.

Indication of any immediate medical attention and special treatment needed

for corrosives:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary oedema .
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.
- Where eyes have been exposed, flush immediately with water and continue to irrigate with normal saline during transport to hospital.
- **DO NOT** use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- Skin burns should be covered with dry, sterile bandages, following decontamination.
- **DO NOT** attempt neutralisation as exothermic reaction may occur.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

EMERGENCY DEPARTMENT

- Laboratory analysis of complete blood count, serum electrolytes, BUN, creatinine, glucose, urinalysis, baseline for serum aminotransferases (ALT and AST), calcium, phosphorus and magnesium, may assist in establishing a treatment regime.
- Positive end-expiratory pressure (PEEP)-assisted ventilation may be required for acute parenchymal injury or adult respiratory distress syndrome.
- Consider endoscopy to evaluate oral injury.
- Consult a toxicologist as necessary.

BRONSTEIN, A.C. and CURRANCE, P.L. EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994

SECTION 5 FIREFIGHTING MEASURES

Continued...

Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered a significant fire risk, however containers may burn. May emit corrosive fumes.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material. ▸ Check regularly for spills and leaks. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment.
Major Spills	

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area. ▸ **DO NOT** allow clothing wet with material to stay in contact with skin
Other information	▸ Store in original containers. ▸ Keep containers securely sealed. ▸ Store in a cool, dry, well-ventilated area.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Lined metal can, lined metal pail/ can. ▸ Plastic pail. ▸ Polyliner drum. For low viscosity materials ▸ Drums and jerricans must be of the non-removable head type. ▸ Where a can is to be used as an inner package, the can must have a screwed enclosure. For materials with a viscosity of at least 2680 cSt.
Storage incompatibility	▸ Contact with acids produces toxic fumes

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Not Available

Continued...

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
sodium hypochlorite, solution 12 % Cl active	Sodium hypochlorite	2 mg/m3	54 mg/m3	630 mg/m3

Ingredient	Original IDLH	Revised IDLH
sodium hypochlorite, solution 12 % Cl active	Not Available	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk.
Personal protection	
Eye and face protection	▸ Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure. ▸ Chemical goggles.whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted. ▸ Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
Skin protection	See Hand protection below
Hands/feet protection	▸ Elbow length PVC gloves ▸ When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots. The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and.has to be observed when making a final choice.
Body protection	See Other protection below
Other protection	▸ Overalls. ▸ PVC Apron. ▸ PVC protective suit may be required if exposure severe.

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
'Forsberg Clothing Performance Index'.
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
SODIUM HYPOCHLORITE POTABLE GRADE

Material	CPI
NATURAL RUBBER	A
NATURAL+NEOPRENE	A
NEOPRENE	A
NITRILE	A
NITRILE+PVC	A
PVC	A

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as 'feel' or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Continued...

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Greenish yellow

Physical state	Liquid	**Relative density (Water = 1)**	1.22 - 1.26
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	11-13	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	216	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	23.94	**Gas group**	Not Available
Solubility in water	Miscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	2.5	**VOC g/L**	Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. The material has **NOT** been classified by EC Directives or other classification systems as 'harmful by inhalation'. This is because of the lack of corroborating animal or human evidence.
Ingestion	The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion. The material has **NOT** been classified by EC Directives or other classification systems as 'harmful by ingestion'. This is because of the lack of corroborating animal or human evidence.
Skin Contact	The material can produce severe chemical burns following direct contact with the skin. Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

Continued...

Eye	The material can produce severe chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating. If applied to the eyes, this material causes severe eye damage.
Chronic	Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Bronchial irritation, with cough, and frequent attacks of bronchial pneumonia may ensue. Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

SODIUM HYPOCHLORITE POTABLE GRADE

TOXICITY	IRRITATION
Not Available	Not Available

sodium hypochlorite, solution 12 % Cl active

TOXICITY	IRRITATION
Oral (mouse) LD50: 5800 mg/kg[2]	Eye (rabbit): 10 mg - moderate
Oral (rat) LD50: 8910 mg/kg[2]	Eye (rabbit): 100 mg - moderate
Oral (woman) TDLo: 1000 mg/kg[2]	Skin (rabbit): 500 mg/24h-moderate

Legend: *1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

sodium hypochlorite, solution 12 % Cl active	Hypochlorite salts are classified by IARC as Group 3: **NOT** classifiable as to its carcinogenicity to humans. Evidence of carcinogenicity may be inadequate or limited in animal testing. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. Hypochlorite salts are extremely corrosive and can cause severe damage to the eyes and skin. A number of skin cancers have been observed in mice, when applied to their skin. as sodium hypochlorite pentahydrate
SODIUM HYPOCHLORITE POTABLE GRADE & sodium hypochlorite, solution 12 % Cl active	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant.

Acute Toxicity	✘	**Carcinogenicity**	✘
Skin Irritation/Corrosion	✔	**Reproductivity**	✘
Serious Eye Damage/Irritation	✘	**STOT - Single Exposure**	✘
Respiratory or Skin sensitisation	✘	**STOT - Repeated Exposure**	✘
Mutagenicity	✘	**Aspiration Hazard**	✘

Legend: ✘ *– Data either not available or does not fill the criteria for classification*
✔ *– Data available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

SODIUM HYPOCHLORITE POTABLE GRADE

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

sodium hypochlorite, solution 12 % Cl active

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	0.032mg/L	4
EC50	48	Crustacea	0.026mg/L	2
EC50	72	Algae or other aquatic plants	0.018mg/L	2
NOEC	72	Algae or other aquatic plants	0.005mg/L	2

Continued...

Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

Very toxic to aquatic organisms.
Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
Prevent, by any means available, spillage from entering drains or water courses.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
	No Data available for all ingredients	No Data available for all ingredients

Bioaccumulative potential

Ingredient	Bioaccumulation
	No Data available for all ingredients

Mobility in soil

Ingredient	Mobility
	No Data available for all ingredients

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	‣ Containers may still present a chemical hazard/ danger when empty. ‣ Return to supplier for reuse/ recycling if possible. Otherwise: ‣ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. ‣ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ‣ It may be necessary to collect all wash water for treatment before disposal. ‣ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ‣ Recycle wherever possible. ‣ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. ‣ Treat and neutralise at an approved treatment plant.

Ensure that the hazardous substance is disposed in accordance with the Hazardous Substances (Disposal) Notice 2017

Disposal Requirements

Packages that have been in direct contact with the hazardous substance must be only disposed if the hazardous substance was appropriately removed and cleaned out from the package.
The package must be disposed according to the manufacturer's directions taking into account the material it is made of.
Packages which hazardous content have been appropriately treated and removed may be recycled.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	
HAZCHEM	2X

Land transport (UN)

UN number	1791
UN proper shipping name	HYPOCHLORITE SOLUTION
Transport hazard class(es)	Class: 8 Subrisk: Not Applicable
Packing group	II
Environmental hazard	Environmentally hazardous
Special precautions for user	Special provisions: Not Applicable Limited quantity: 1 L

Air transport (ICAO-IATA / DGR)

UN number	1791
UN proper shipping name	Hypochlorite solution
Transport hazard class(es)	ICAO/IATA Class: 8 ICAO / IATA Subrisk: Not Applicable ERG Code: 8L
Packing group	II
Environmental hazard	Environmentally hazardous
Special precautions for user	Special provisions: A3 A803 Cargo Only Packing Instructions: 855 Cargo Only Maximum Qty / Pack: 30 L Passenger and Cargo Packing Instructions: 851 Passenger and Cargo Maximum Qty / Pack: 1 L Passenger and Cargo Limited Quantity Packing Instructions: Y840 Passenger and Cargo Limited Maximum Qty / Pack: 0.5 L

Sea transport (IMDG-Code / GGVSee)

UN number	1791
UN proper shipping name	HYPOCHLORITE SOLUTION
Transport hazard class(es)	IMDG Class: 8 IMDG Subrisk: Not Applicable
Packing group	II
Environmental hazard	Marine Pollutant
Special precautions for user	EMS Number: F-A , S-B Special provisions: 274 900 Limited Quantities: 1 L

Transport in bulk according to Annex II of MARPOL and the IBC code

SOURCE	PRODUCT NAME	POLLUTION CATEGORY	SHIP TYPE
	Sodium hypochlorite solution (15% or less)	Y	2

Continued...

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

This substance is to be managed using the conditions specified in an applicable Group Standard
HSR No: 002684 - Water treatment Chemicals (Subsidiary Hazard) Group Standard 2017.

SODIUM HYPOCHLORITE, SOLUTION 12 % CL ACTIVE(7681-52-9*) IS FOUND ON THE FOLLOWING REGULATORY LISTS

GESAMP/EHS Composite List - GESAMP Hazard Profiles	New Zealand Hazardous Substances and New Organisms (HSNO) Act - Classification of Chemicals
IMO IBC Code Chapter 17: Summary of minimum requirements	New Zealand Hazardous Substances and New Organisms (HSNO) Act - Classification of Chemicals - Classification Data
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk	New Zealand Inventory of Chemicals (NZIoC)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs	United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (Chinese)
International Air Transport Association (IATA) Dangerous Goods Regulations	United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (English)
International Maritime Dangerous Goods Requirements (IMDG Code)	United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (Spanish)

Hazardous Substance Location

Subject to the Health and Safety at Work (Hazardous Substances) Regulations 2017.

Hazard Class	Quantity beyond which controls apply for closed containers	Quantity beyond which controls apply when use occurring in open containers
Not Applicable	Not Applicable	Not Applicable

Certified Handler

Subject to Part 4 of the Health and Safety at Work (Hazardous Substances) Regulations 2017.

Class of substance	Quantities
9.1A, 9.2A, 9.3A, and 9.4A	Any quantity

Refer Group Standards for further information

Tracking Requirements

Not Applicable

National Inventory Status

National Inventory	Status
Australia - AICS	Yes
Canada - DSL	Yes
Canada - NDSL	No (sodium hypochlorite, solution 12 % Cl active)
China - IECSC	Yes
Europe - EINEC / ELINCS / NLP	Yes
Japan - ENCS	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	Yes
USA - TSCA	Yes
Legend:	*Yes = All ingredients are on the inventory* *No = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Revision Date	08/08/2017
Initial Date	08/08/2017

CONTACT POINT

Continued...

- For quotations contact your local Customer Services - http://wssdirectory.wilhelmsen.com/#/customerservices - - Responsible for safety data sheet Wilhelmsen Ships Service AS - Prepared by: Product HSE Manager, - Email: Email: WSS.GLOBAL.SDSINFO@wilhelmsen.com - Telephone: Tel.: +31 10 4877775

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios.

Powered by AuthorITe, from Chemwatch.

APPENDIX J

Oil Spill Trajectory Modelling

OIL SPILL TRAJECTORY MODELLING FOR THE KS-9 DEVELOPMENT WELL

Report prepared for Beach Energy Resources NZ (Holdings) Ltd

Version	Date	Status	Approved by
RevA	27/10/21	Draft for internal review	Zyngfogel
RevB	29/10/21	Draft for client review	McComb
Rev0	11/11/21	Approved for release	McComb
Rev1	03/12/21	Updated and approved for release	Zyngfogel
Rev2	28/03/22	Updated	Zyngfogel

CALYPSO
SCIENCE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Beach Energy Resources NZ (Holdings) has commissioned an assessment of the oceanic dispersal and beaching potential in the unlikely event of a major spill event during KS-9 development well drilling activities. The well site is in the South Taranaki Bight, New Zealand (39° 51’ 03.241” S, 174° 07’ 11.977” E) in approximately 34 m water depth (Fig. 1.1).

In this study, a stochastic approach has been adopted to define the statistical probabilities related to oil condensate (hereafter referred to as condensate) trajectory, dispersion, weathering, and beaching patterns. To achieve that, we have simulated the occurrence of 100 realistic spill events, randomly distributed over the previous decade. The results from these events are collated and used to generate statistics and probabilities for impact assessment. We have also selected the worst beaching and spreading event from the 100 events and provide a detailed examination of this situation.

This report is structured as follows. A description of the spill modelling methodology is provided in Section 2. In Section 3 we present the results of the modelling and provide an interpretation of the results. The findings are summarised in Section 4, and the references cited are listed in the final Section 5.

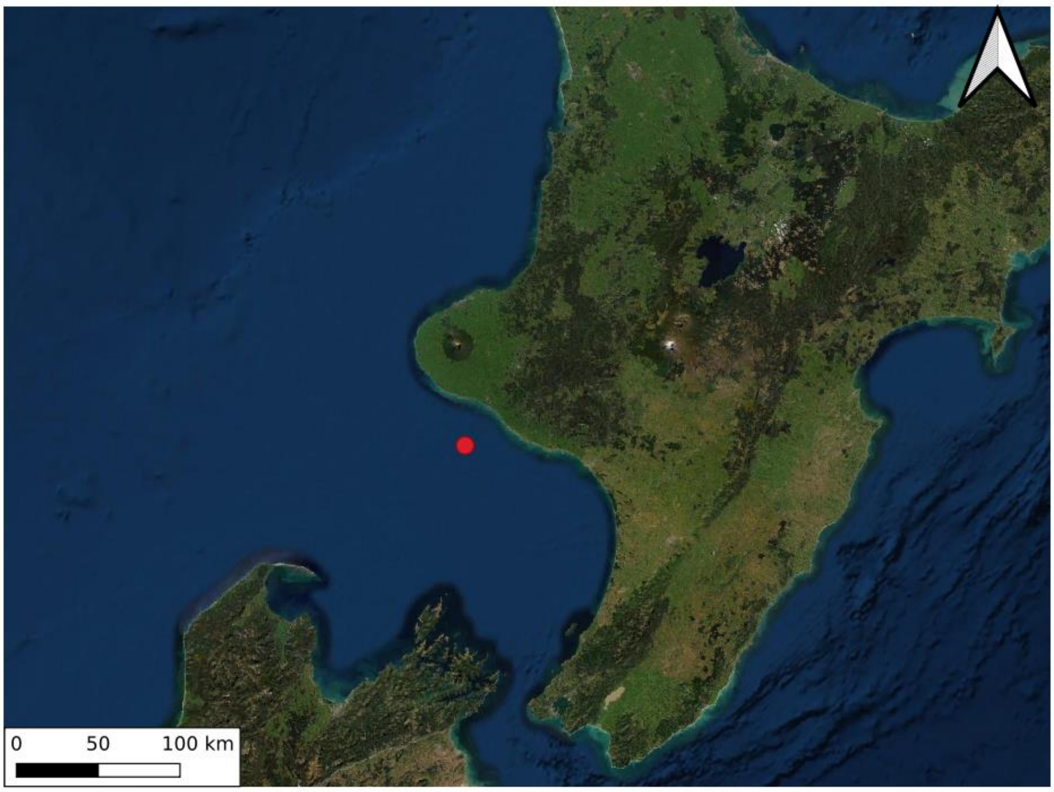


Figure 1.1 Location of the KS-9 development well.

2. METHODOLOGY

2.1. Spill scenario

The spill scenario under assessment has the following attributes:

- Oil properties are based on the KS-7 ST1 condensate.
- Release position at 2m above seabed, with a spill duration of 132 days.
- Variable rate of release, decreasing over time from 6914 stb/day to 2687 stb/day (see Fig. 2.1).
- The total volume released 633680 stb (100,747m^3).

For this scenario, a total of 100 spill events have been simulated for random times selected over a contemporary decade (2008-2017) but stratified by season (i.e., 25 spills per season).

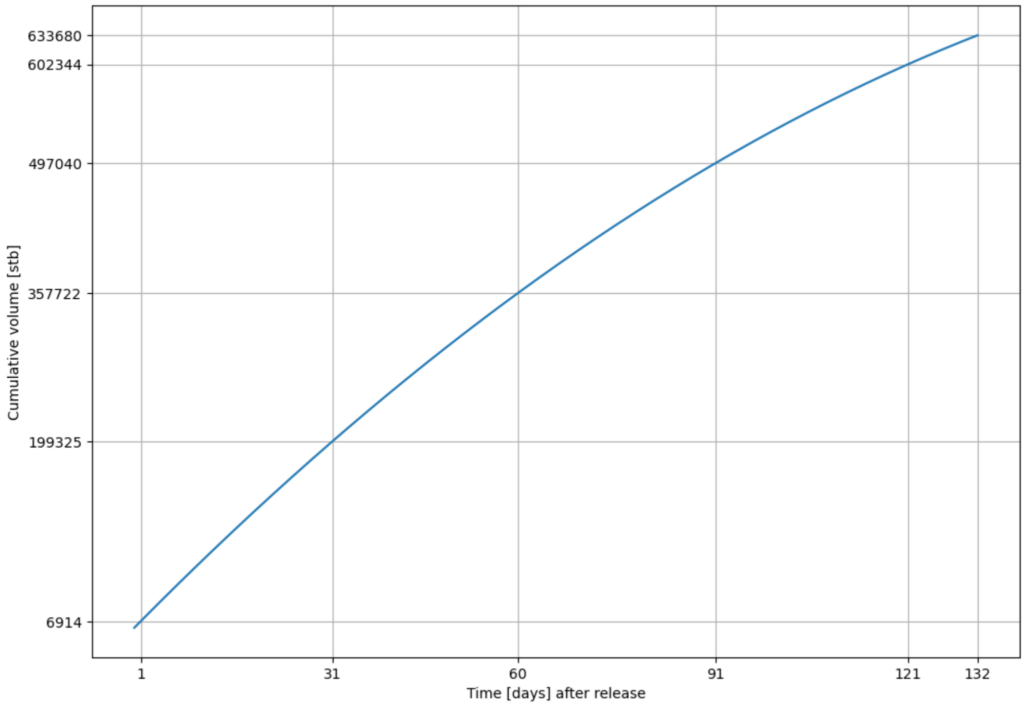


Figure 2.1 Spill release profile, showing decrease from 6914 to 2687 stb/day over the 132 simulations.

2.2. Spill product

Kupe KS-7 condensate has a density of 782 kg/m^3, a pour point of 18ºC, an API of 49.4, and the total wax content is 7.2% by mass (Intertek, 2008).

2.3. Oceanographic and atmospheric conditions

The following datasets were used in the spill modelling.

2.3.1. Winds

Wind conditions were prescribed from the ERA5 reanaylsis product, provided by the European Centre for Medium Range Weather Forecasting (ECMWF, 2019). ERA5 combines vast amounts of specifically curated historical observations with state-of-the-art 4D-Var data assimilation to produce a hindcast of unprecedented quality. These gridded data have resolution of 31 km spatial and 1 hourly temporal, and the surface (10 m elevation) wind fields were used I this study. The annual and seasonal wind roses for the Kupe Platform, derived from ERA5, are presented in Figure 2.2.

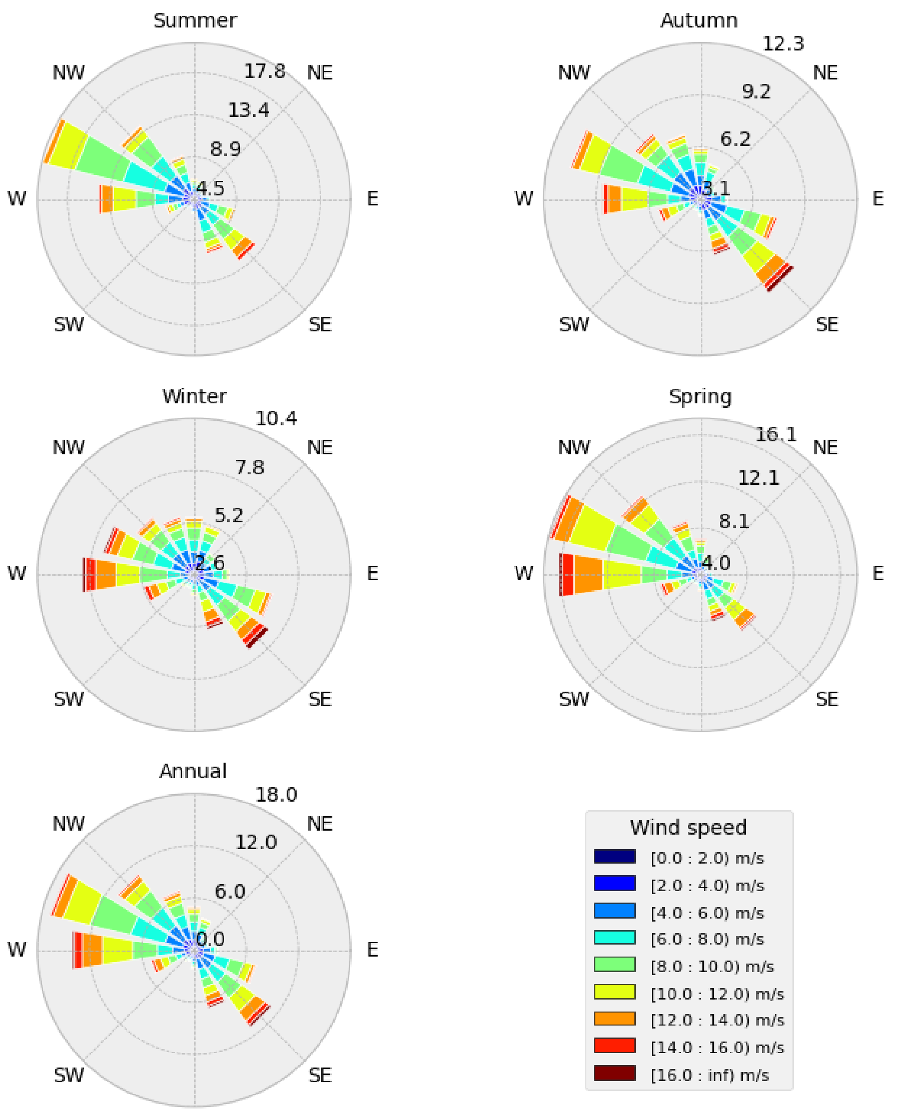


Figure 2.2 Annual and seasonal wind roses for the Kupe Field.

2.3.2. Waves

The wave conditions were defined from a national SWAN wave hindcast supplied by Oceanum Ltd. This product is a 3-hourly reconstruction of the wave spectral parameters at approximately 5 km resolution. The regional hindcast uses the ERA5 wind field and was nested inside a global WW3 hindcast that also used ERA5 as boundary condition.

2.3.3. Currents

The Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) was used to hindcast the hydrodynamic ocean conditions. An hour-by-hour replication of the three-dimensional flows. SCHISM is a hydrodynamic model (Zhang *et al*., 2016) based on an unstructured grid suitable for 2D or 3D baroclinic/barotropic circulation from ocean to coastal regions. The model grid (Fig. 2.3) has resolution ranging from 2 km m near the open ocean boundary to 300 m near the coast.

SCHISM was run in 3D baroclinic mode, with vertical sigma layers varying from 26 layers in the deeper ocean (>1000 m) and 10 layers in the coastal areas. Elevation and current amplitudes and phases of the dominant tidal constituents (M2, S2, N2, K2, K1, O1, P1, Q1) were sourced from the OTIS (Oregon State University Tidal Inversion Software) assimilated barotropic model. Residual velocities and water column properties were defined from the global 1/12-degree reanalysis products released by the EU-funded Copernicus Project. Atmospheric forcing (10 m wind speed, temperature, humidity, mean sea-level pressure, precipitation, and solar radiation) were sourced from ERA5.

The SCHISM hindcast has been extensively validated against measured data from the Kupe Field (see Fig. 2.4). Current roses for the well site are provided in Figure 2.5.

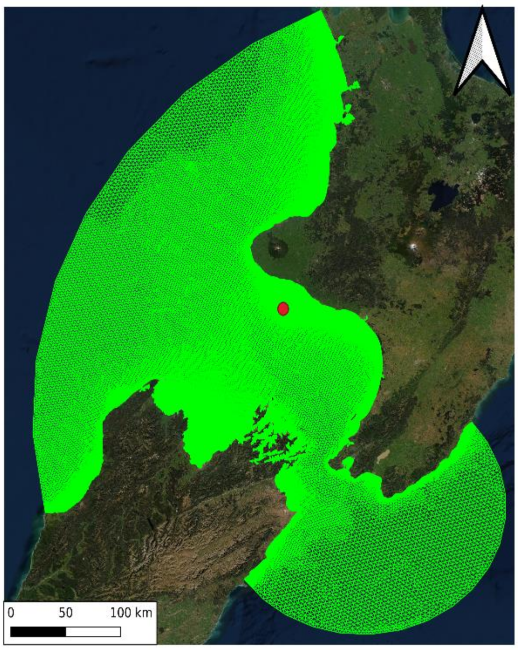


Figure 2.3 Extents of the SCHISM hydrodynamical model domain.

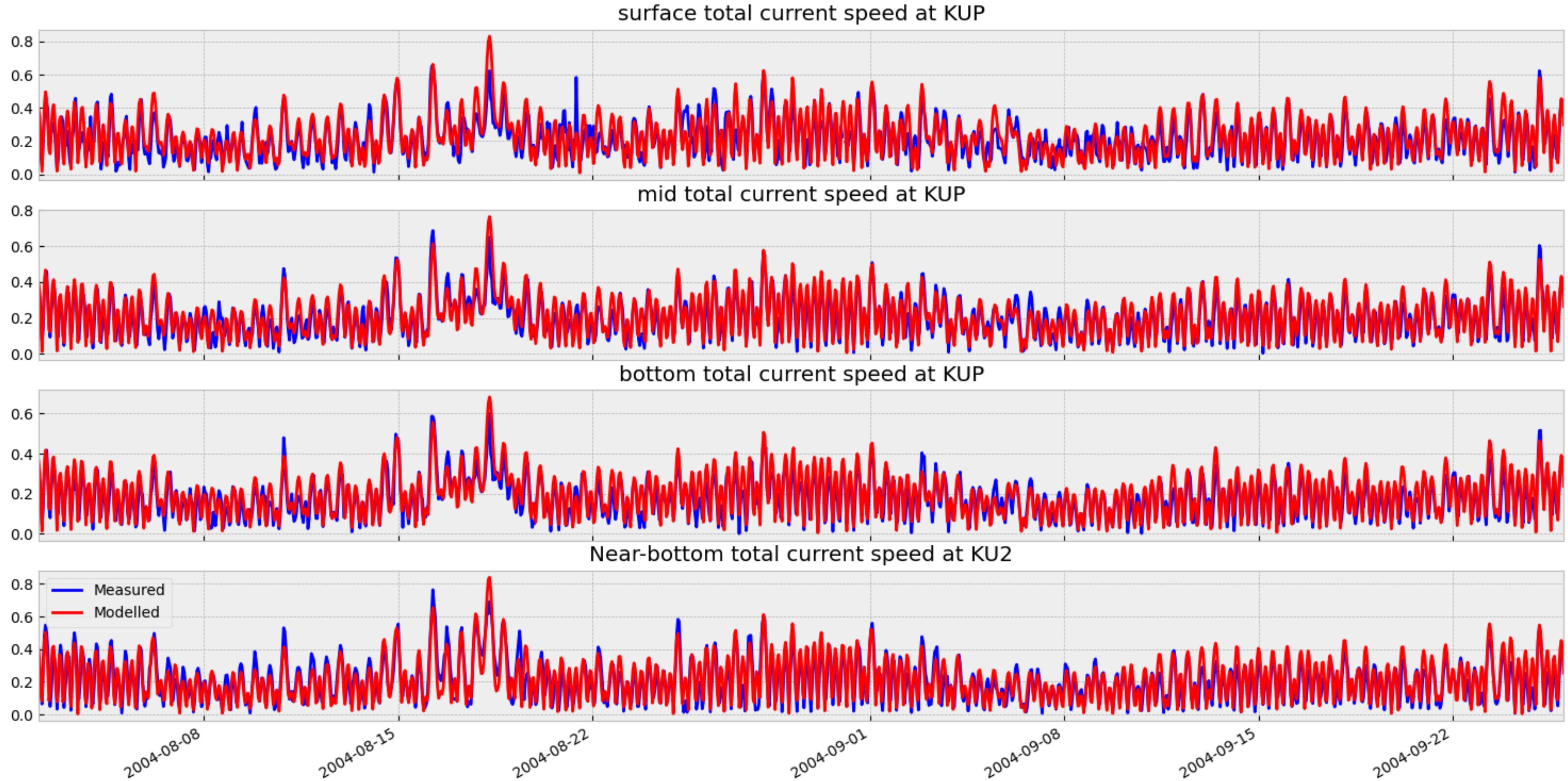


Figure 2.4 Time series plot showing the measured and modelled current speeds from two locations in the vicinity of the Kupe Field. Total currents include the tidal and the non-tidal flows, and validation at three levels in the water column are shown here. Normally, the water column is well mixed in this region and highly stratified flows are uncommon.

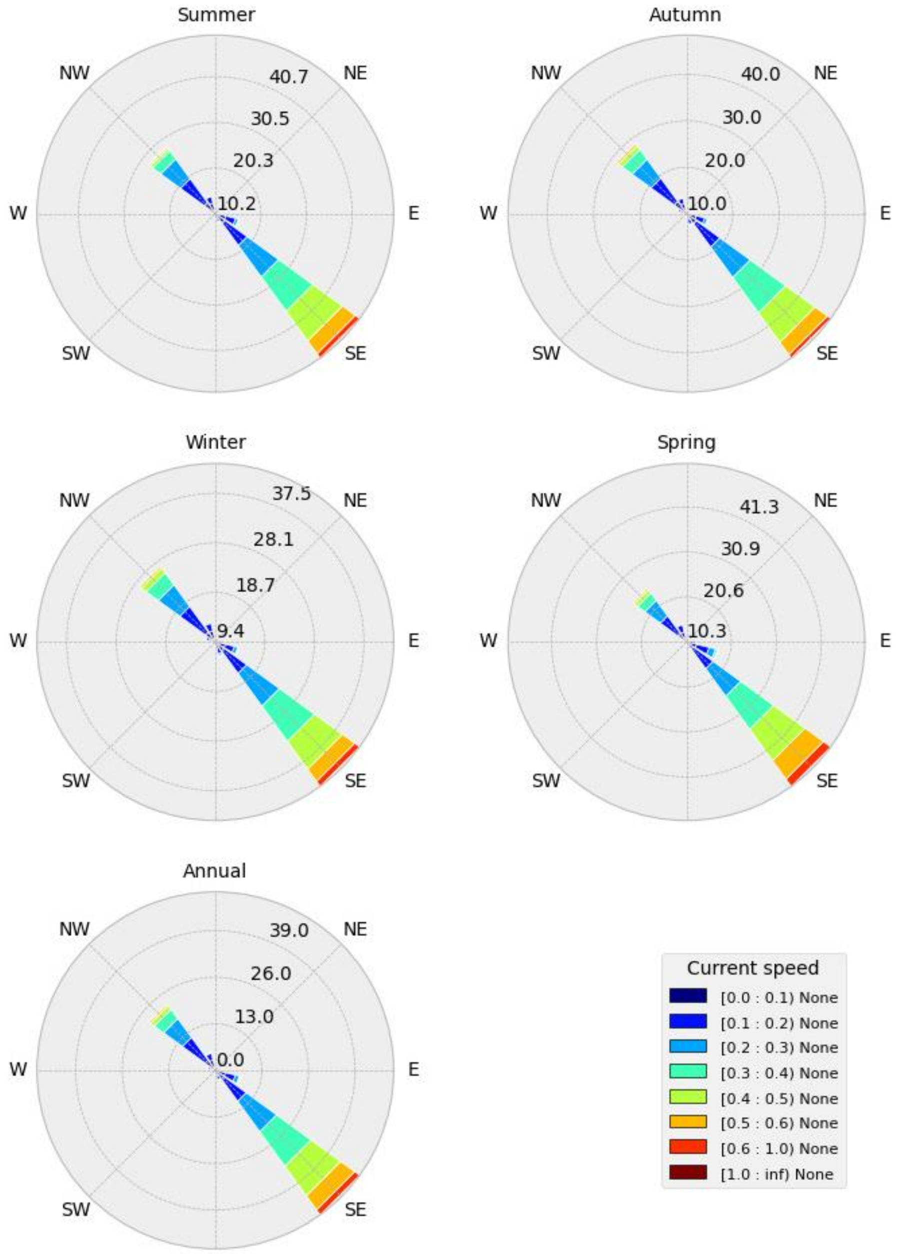


Figure 2.5 Annual and seasonal depth-averaged current roses for the Kupe Field. The flows are typically parabathic, with a predominance toward the southeast sector.

2.4. Oil spill modelling framework

The OpenOil simulation framework was used to model the weathering, dispersion, and trajectory of the spill. This module is part of the OpenDrift project[1] which is an open-source code base with considerable community input and ongoing peer review. Full technical details of the model are reported by Dagestad *et al*. (2018), and the key model settings used in the present study are provided in Table 2.1.

Note that while OpenOil includes the key processes of evaporation, emulsification and dispersion, there is no actual dissolution simulated within the model. The analysis of KS-7 condensate indicates around 23% aromatic fraction, which will have solubility that is not represented in the modelled oil budgets. Because evaporation typically affects the mass budget much more than dissolution, the results presented here will be slightly conservative during the ascendant plume phase and over the first few days on the surface.

The extent of the computational domain is presented in Figure 2.6.

Table 2.1 OpenOil model settings.

Parameter	**Value applied**
Windage	3%
Horizontal diffusion	1.0 $m^2.s^{-1}$
Stokes drift	from OpenOil model
Vertical diffusion coefficient	constant at 0.0001 $m^2 \cdot s^{-1}$
Model time step	900 s
Particles per spill	18912
Duration of each simulation	200 days
Droplet size distribution	Johansen et al. (2015)
Entrainment rate	Li et al. (2017)
Oil density	782 kg/m^3 at 15 degC
Oil dynamic viscosity	1.080 cSt at 50 degC
Shoreline	Sticky, no re-float

[1] https://github.com/OpenDrift/opendrift

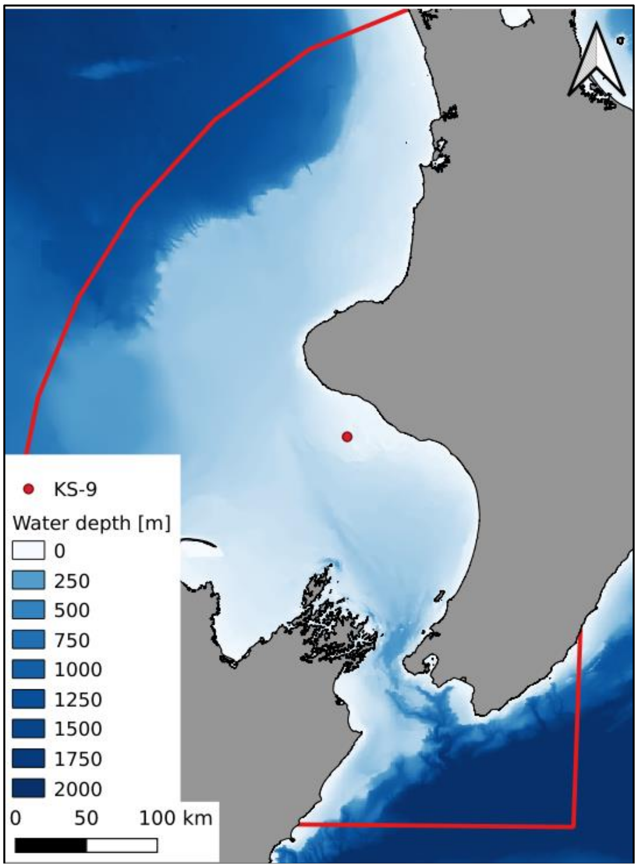


Figure 2.6 Extent of the computational domain for oil spill trajectory modelling.

2.5. Processing of results

Each model simulation was post-processed to derive condensate concentrations and statistical representations. For each timestep of every run, a bi-directional weighted histogram was calculated using the particles in the surface layer or particles that had beached. Surface concentrations (from 0 to -1m) were calculated from 2 X 2 km cells, with the histogram of values was normalized by the area of the cell to derive results in g.m^{-2}. For the beached concentrations, each histogram of values was divided by the length of coast to define the tonnes per km.

From the histogram timeseries, the following statistics were calculated:

- Persistence of plume - for each run the number of days the surface concentration is above 0.5 g.m^{-2} and 10 g.m^{-2} was calculated and the 50th and 99th percentile value derived.

- Surface time - for each run the number of days of condensate presence exceeding 0.5 g.m^{-2} and 10 g.m^{-2} was calculated, and the overall minimum and median time defined.

- Beaching risk – defined as the probability for one particle to land within that cell, irrespective of mass.

- Time to beaching - presented as the overall minimum and median time it takes for one particle to beach, irrespective of mass.

- Total condensate on beach - for each run the mass of oil entering a cell is summed, and the presented as the median and 99th percentile.

3. RESULTS

3.1. Stochastic simulations

The set of 100 randomly selected spills over an historical decade provide a robust dataset from which we can define the statistics of the spill trajectory, beaching along the shore, and expected mass budgets of spilled condensate.

The characteristics of the condensate, with a relatively high percentage of volatiles, means that within days at sea more than half of the spilled volume will be evaporated, dissolved, or dispersed. On the sea surface, strong winds will increase the rate of evaporation, while the wave conditions associated with these winds also act to mix and disperse the oil into the upper layers of the ocean. Consequently, the day-to-day weather conditions strongly influence the mass budget of condensate throughout the simulations.

For the annual condition, the dominant trajectory for spilled condensate is to the east and southeast in response to the prevailing winds (see Fig. 2.2) and surface currents (see Fig. 2.3). Figures 3.1 and 3.2 present mapped statistics derived from all 100 simulations: clearly demonstrating the main trajectory modes. Here, the median and 99^{th} percentiles are shown when the surface concentration exceeds 0.5 and 10 $g.m^{-2}$, respectively. These values are based on the practical limit of observing hydrocarbons in the marine environment (0.5 $g.m^{-2}$, AMSA, 2015a) and the concentration where ecological impacts have been estimated to occur (10 $g.m^{-2}$, French-McCay, 2009).

Beaching is defined as any particles touching the coastline (mean high water spring), and a sticky shoreline has been imposed in the model so there is no re-floating. In Figure 3.3, we show the locations where beaching occurred and assign a probability of occurrence that is independent of volume. The results from 100 simulations indicate the highest chance of condensate beaching occurs between Cape Egmont and Cape Terawhiti. Beaching quantities are presented as tonnes per km of coastline (Fig. 3.4, right plots). To consider these amounts in the context of impacts, AMSA (2015b) apply a value of 100 $g.m^{-2}$ as the threshold below which recovery is best achieved by natural processes alone. Deposition of 1 tonne per km, assuming a 10 m wide beaching zone, would equate to 100 $g.m^{-2}$. On an annual basis, the probability that this threshold could be exceeded is presented in Figure 3.5.

In the following subsections, we present seasonal results based on the timing of the start of a spill.

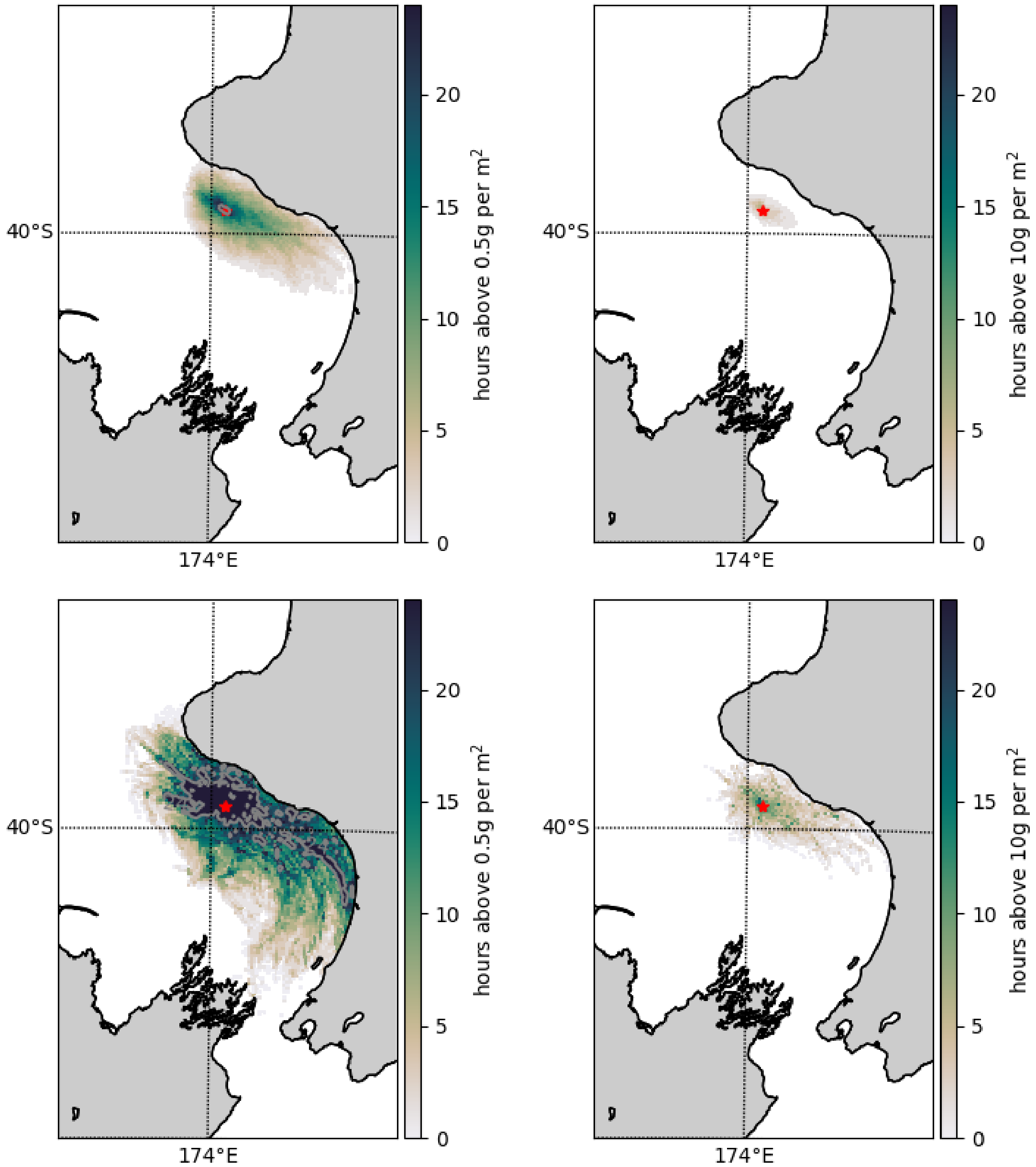


Figure 3.1 The median (top) and 99th percentile (bottom) amount of time (in hours) that the surface concentration exceeds 0.5 g.m^{-2} (left) and 10 g.m^{-2} (right).

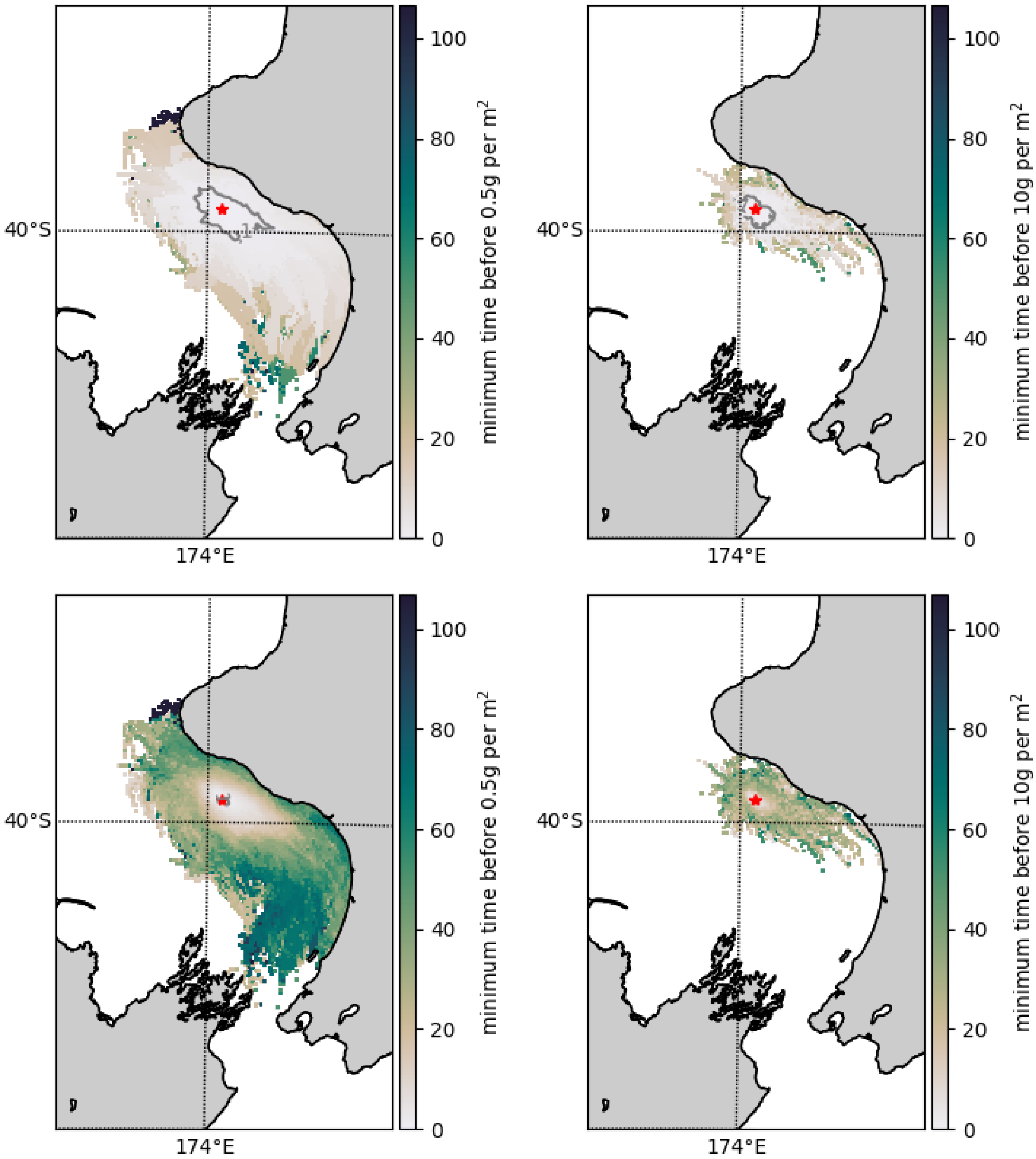


Figure 3.2 The minimum (top) and median (bottom) amount of time (in days) until the surface concentration reached 0.5 g.m^{-2} (left) and 10 g.m^{-2} (right).

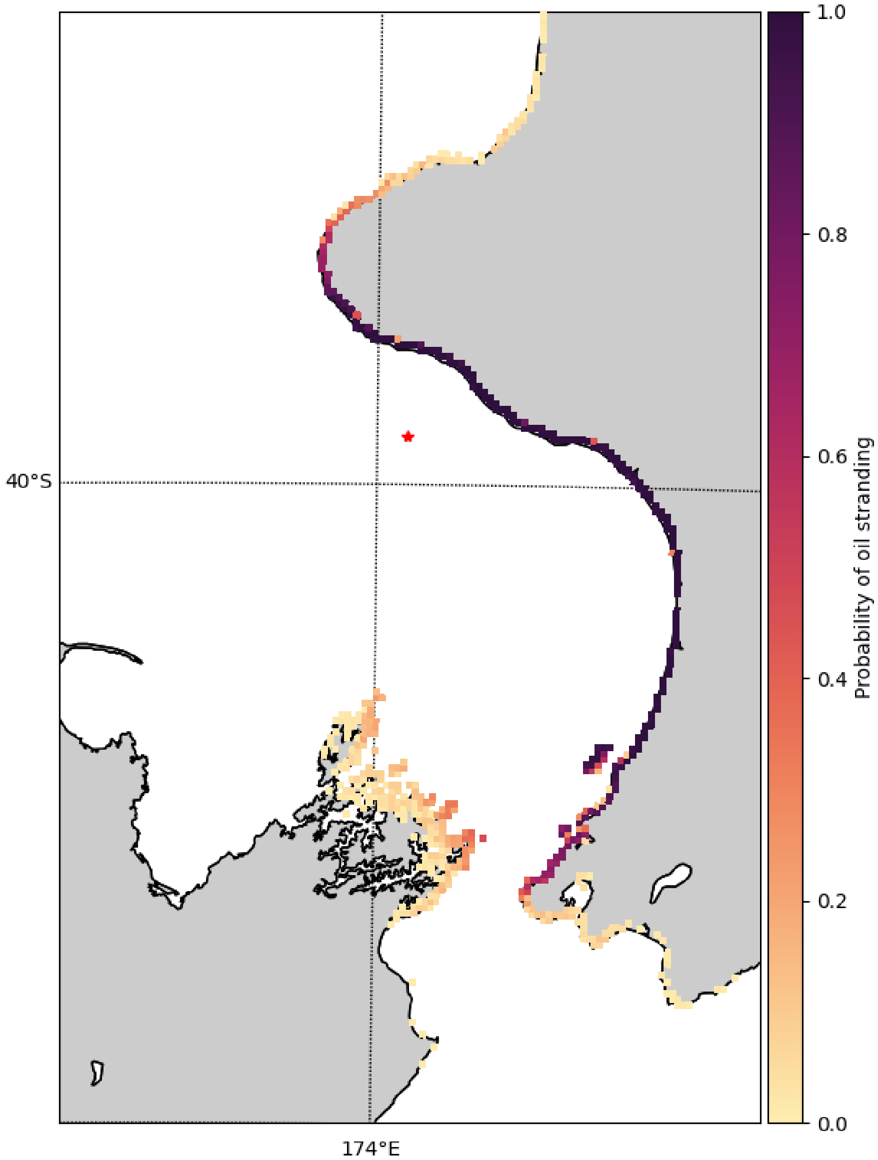


Figure 3.3 Probability for condensate being beached on the coast from any of the 100 simulated spills. A probability of 1 represents 100 % chance of beaching.

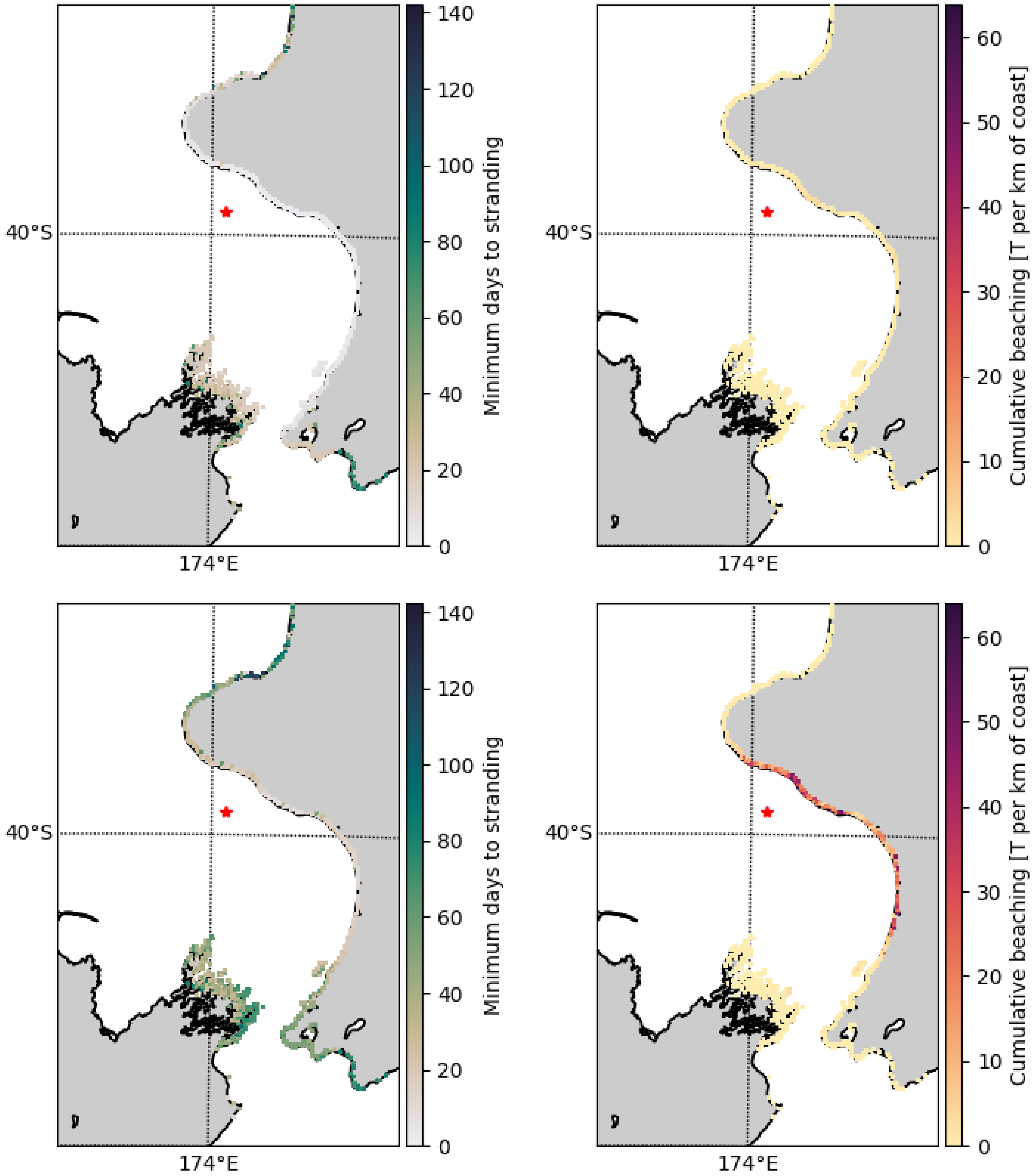


Figure 3.4 Overall minimum (top left) and median (bottom left) of the minimum time (in days) before beaching occurs, from the start of a spill. Overall median (top right) and 99th percentile (bottom right) of the total mass of oil beached during the 100 simulations.

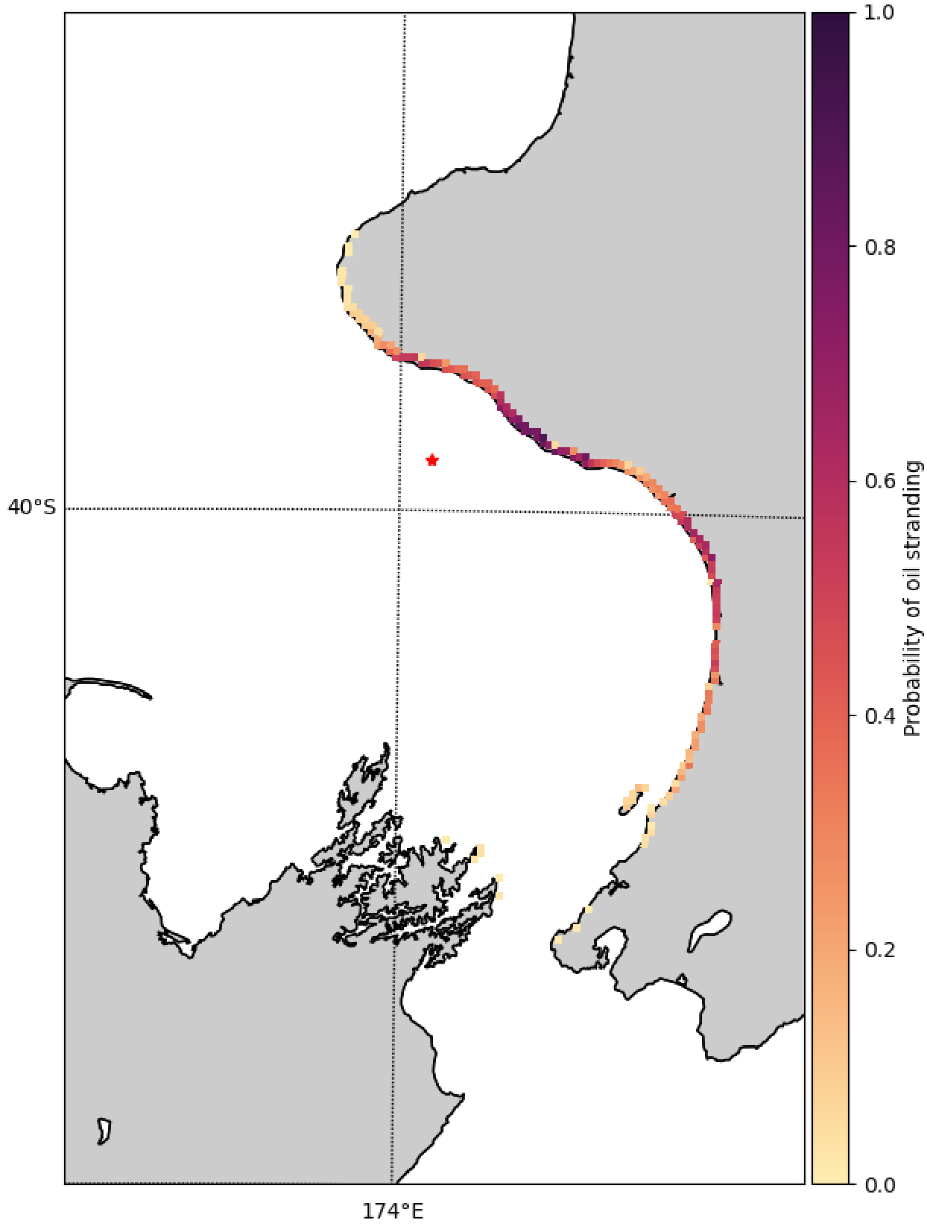


Figure 3.5 Probability for condensate beaching volumes >1 tonne per km of coast from the 100 simulated spills. A probability of 1 represents 100% chance of beaching.

3.2. Summer simulations

Statistics for the fate of condensate spills that start during Summer months (DJF) are presented in Table 3.1 (averages) and Table 3.2 (maxima). On average, around 1.5% of the spilled volume can be expected to beach, while the worst outcome from the simulations has around 3.2% beaching. The maximum volume of condensate reaching the shore from any one event is 3171 m^3, and the highest shoreline loading is 87 T/km.

Most of the condensate is expected to evaporate (average 40%) or become dispersed within the water column (average 59%). After 150 days, it is probable that none of the spilled volume will remain on the sea surface. The minimum time between spill and beaching is 1.8 days.

Table 3.1 Average distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Summer.

	1 day	2 days	7 days	31 days	100 days	150 days	200 days
Surface	0.19	0.26	0.21	0.42	0.34	0.00	0.00
Submerged	0.16	0.19	0.18	0.12	0.08	0.00	0.00
Evaporated	0.31	0.69	2.72	12.49	33.72	39.53	39.53
Dispersed	0.44	1.04	4.38	17.77	48.42	59.02	59.02
Beached	0.00	0.00	0.04	0.67	1.36	1.45	1.45

Table 3.2 Maximum distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Summer.

	1 day	2 days	7 days	31 days	100 days	150 days	200 days
Surface	0.50	0.91	0.90	1.50	0.87	0.00	0.00
Submerged	0.41	0.37	0.27	0.23	0.16	0.00	0.00
Evaporated	0.60	1.27	3.82	16.02	38.17	45.20	45.20
Dispersed	1.00	2.05	5.99	21.97	56.82	66.24	66.24
Beached	0.00	0.00	0.63	2.01	3.07	3.15	3.15

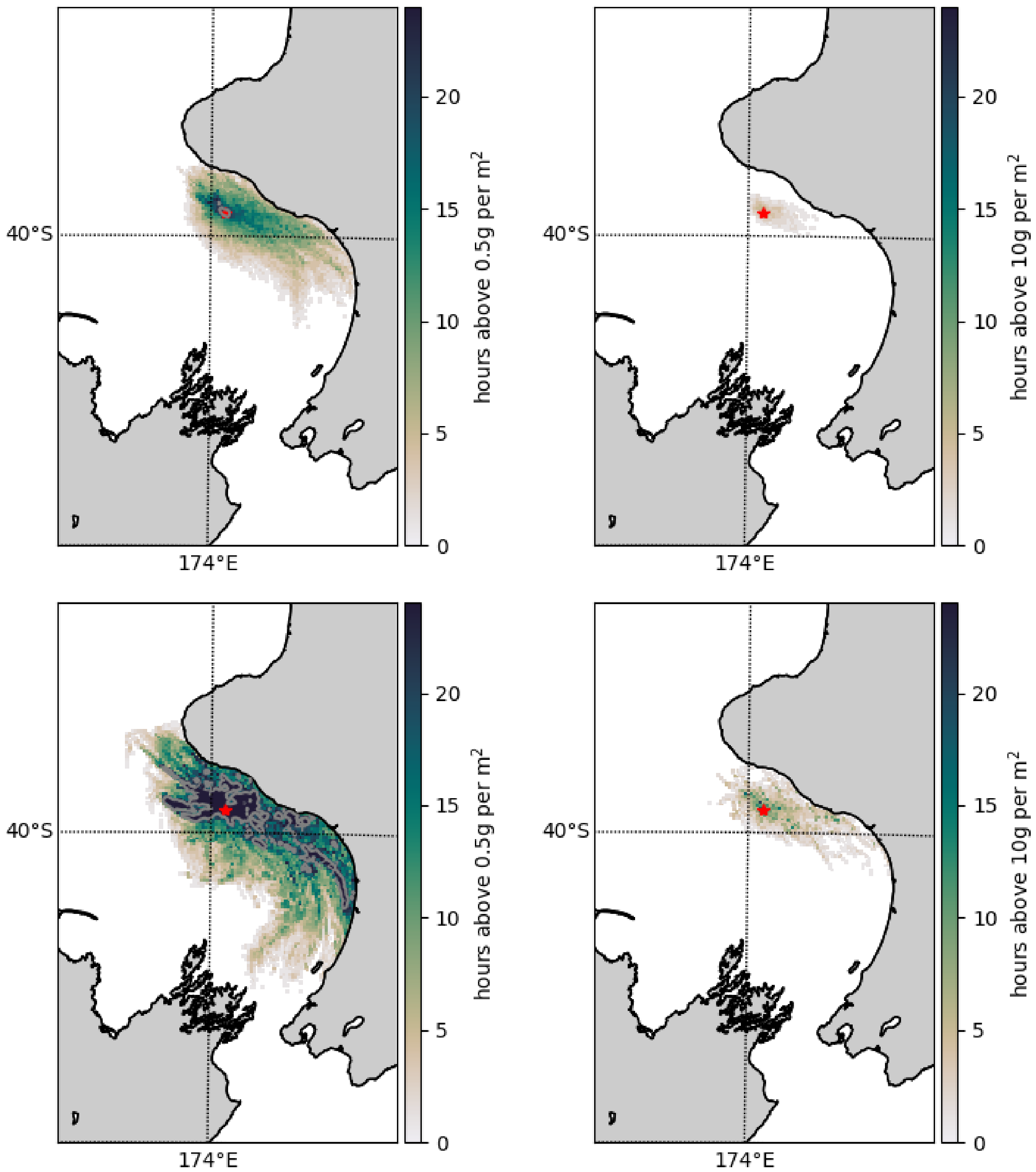


Figure 3.6 The median (top) and 99th percentile (bottom) amount of time (in hours) that the surface concentration exceeds 0.5 $g.m^{-2}$ (left) and 10 $g.m^{-2}$ (right) in Summer.

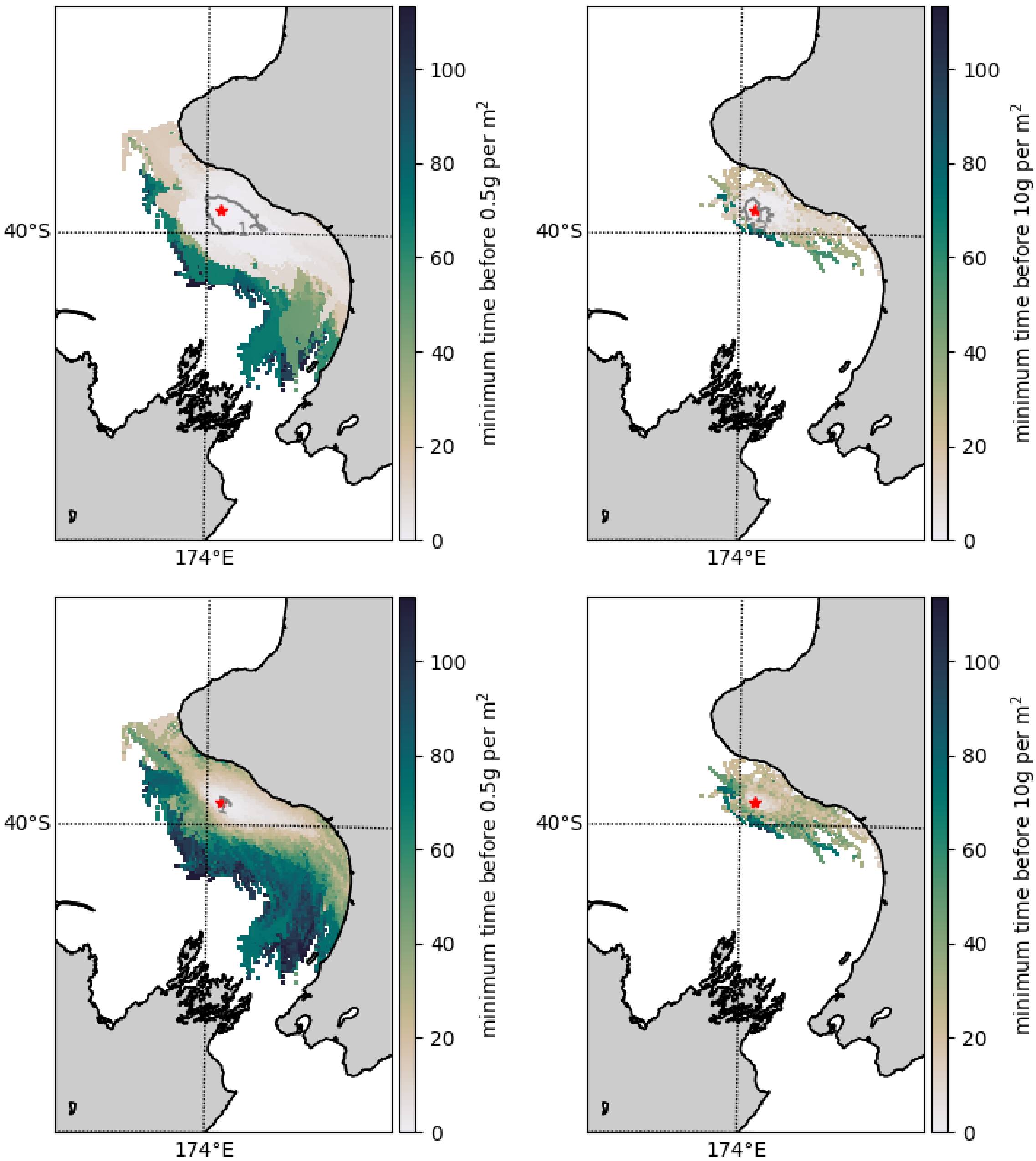


Figure 3.7 The minimum (top) and median (bottom) amount of time (in days) until the surface concentration reached 0.5 g.m-2 (left) and 10 g.m-2 (right) in Summer.

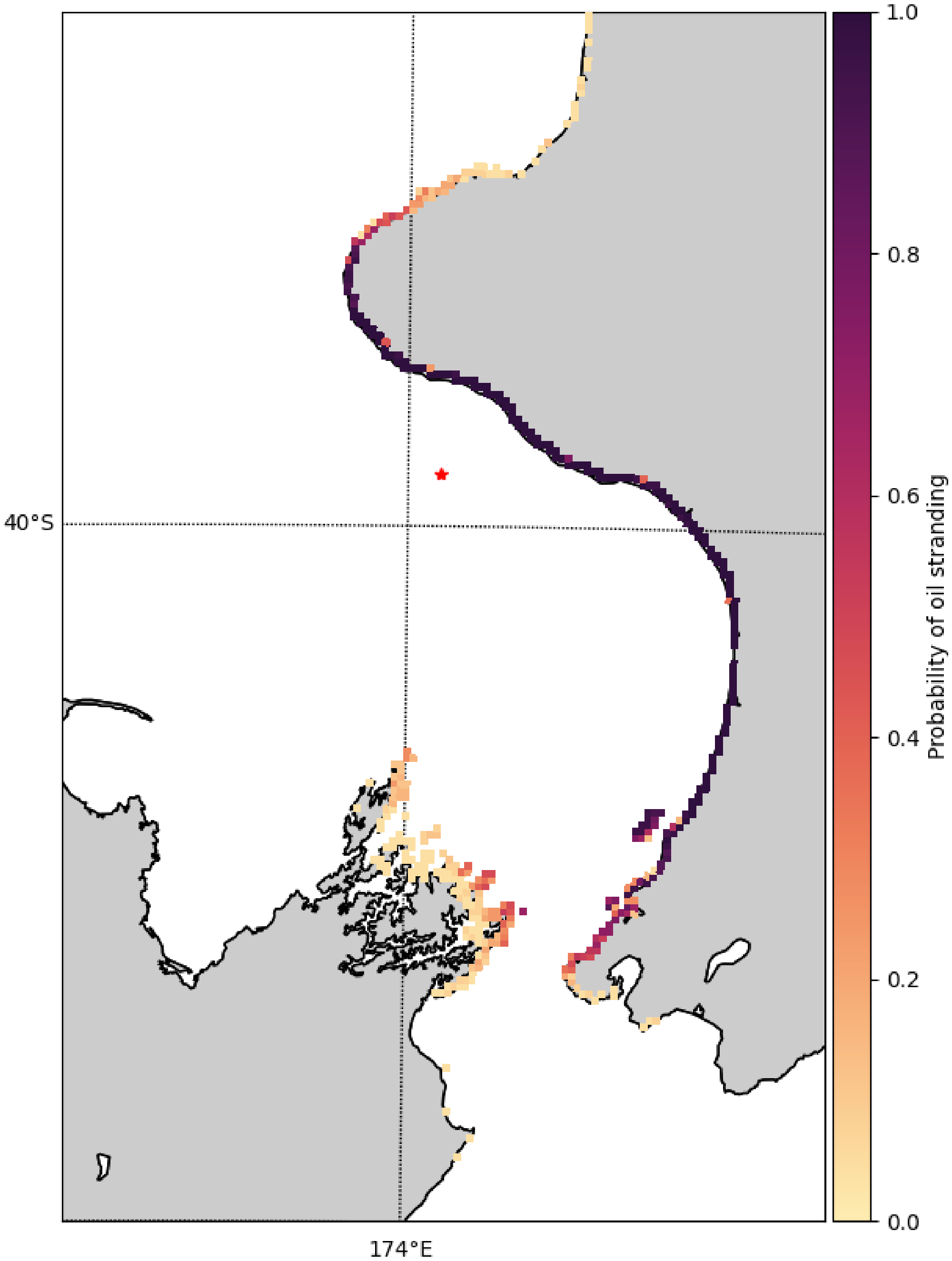


Figure 3.8 Probability for condensate being beached on the coast from any of the 25 simulated spills starting in Summer. A probability of 1 represents 100 % chance of beaching.

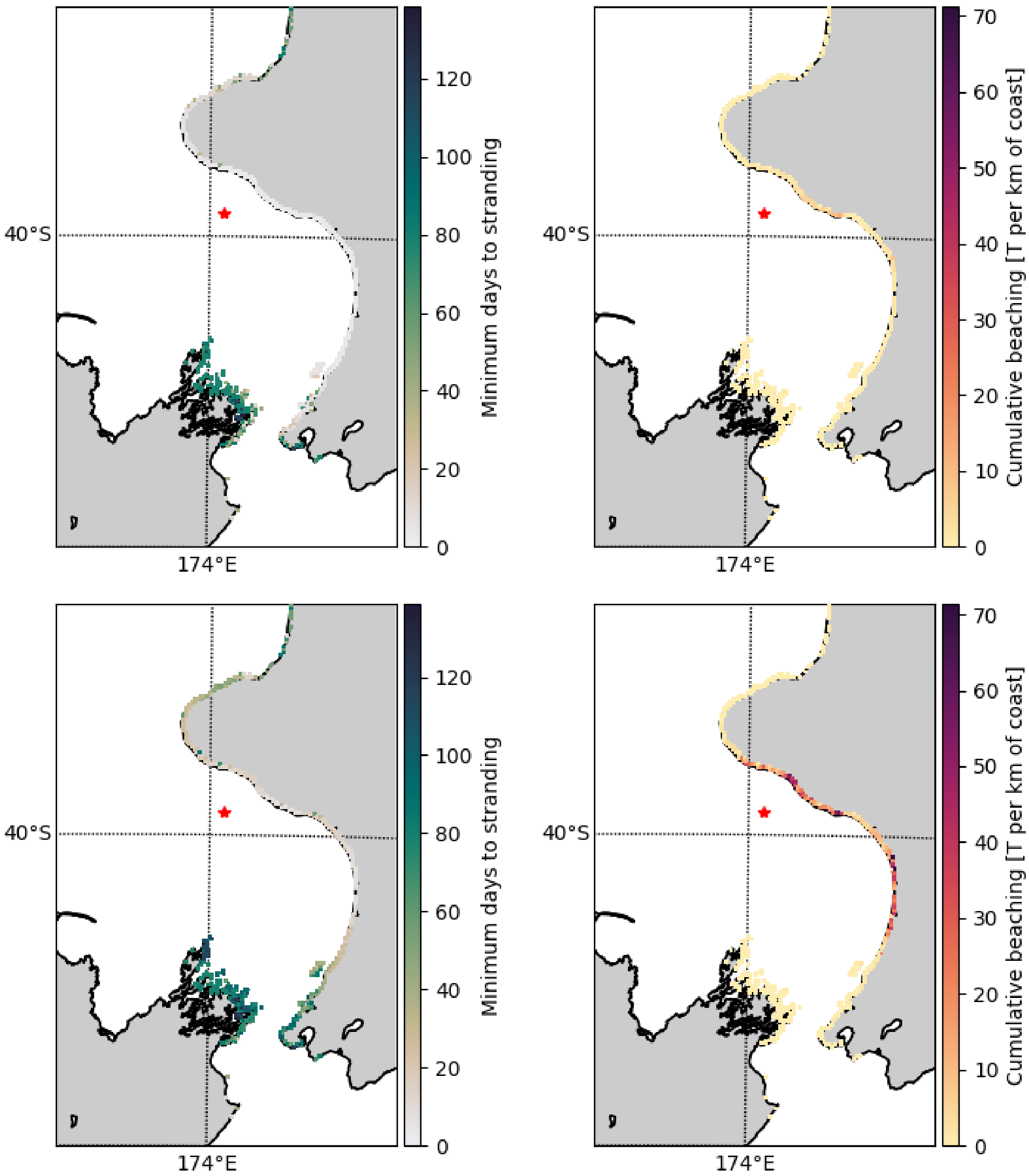


Figure 3.9 Overall minimum (top left) and median (bottom left) of the minimum time (in days) before beaching occurs, from the start of a spill. Overall median (top right) and 99th percentile (bottom right) of the total mass of oil beached during the 25 simulations starting in Summer.

3.3. Autumn simulations

Statistics for the fate of condensate spills that start during Autumn months (MAM) are presented in Table 3.3 (averages) and Table 3.4 (maxima). On average, around 0.6% of the spilled volume can be expected to beach, while the worst outcome from the simulations has around 1.5% beaching. The maximum volume of condensate reaching the shore from any one event is 1529 m^3, and the highest shoreline loading is 54 T/km.

Most of the condensate is expected to evaporate (average 36%) or become dispersed within the water column (average 64%). After 150 days, it is probable that none of the spilled volume will remain on the sea surface. The minimum time between spill and beaching is 1.8 days.

Table 3.3 Average distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Autumn.

	1 day	2 days	7 days	31 days	100 days	150 days	200 days
Surface	0.13	0.18	0.44	0.30	0.17	0.00	0.00
Submerged	0.17	0.16	0.14	0.11	0.08	0.00	0.00
Evaporated	0.27	0.57	2.54	11.96	30.09	35.83	35.83
Dispersed	0.53	1.28	4.42	18.81	53.05	63.58	63.58
Beached	0.00	0.00	0.01	0.29	0.51	0.58	0.58

Table 3.4 Maximum distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Autumn.

	1 day	2 days	7 days	31 days	100 days	150 days	200 days
Surface	0.49	0.88	1.32	0.87	0.99	0.00	0.00
Submerged	0.37	0.40	0.29	0.29	0.15	0.00	0.00
Evaporated	0.60	1.27	3.93	15.57	37.87	43.63	43.63
Dispersed	1.05	2.11	6.31	21.61	58.25	69.28	69.28
Beached	0.00	0.00	0.10	1.28	1.44	1.52	1.52

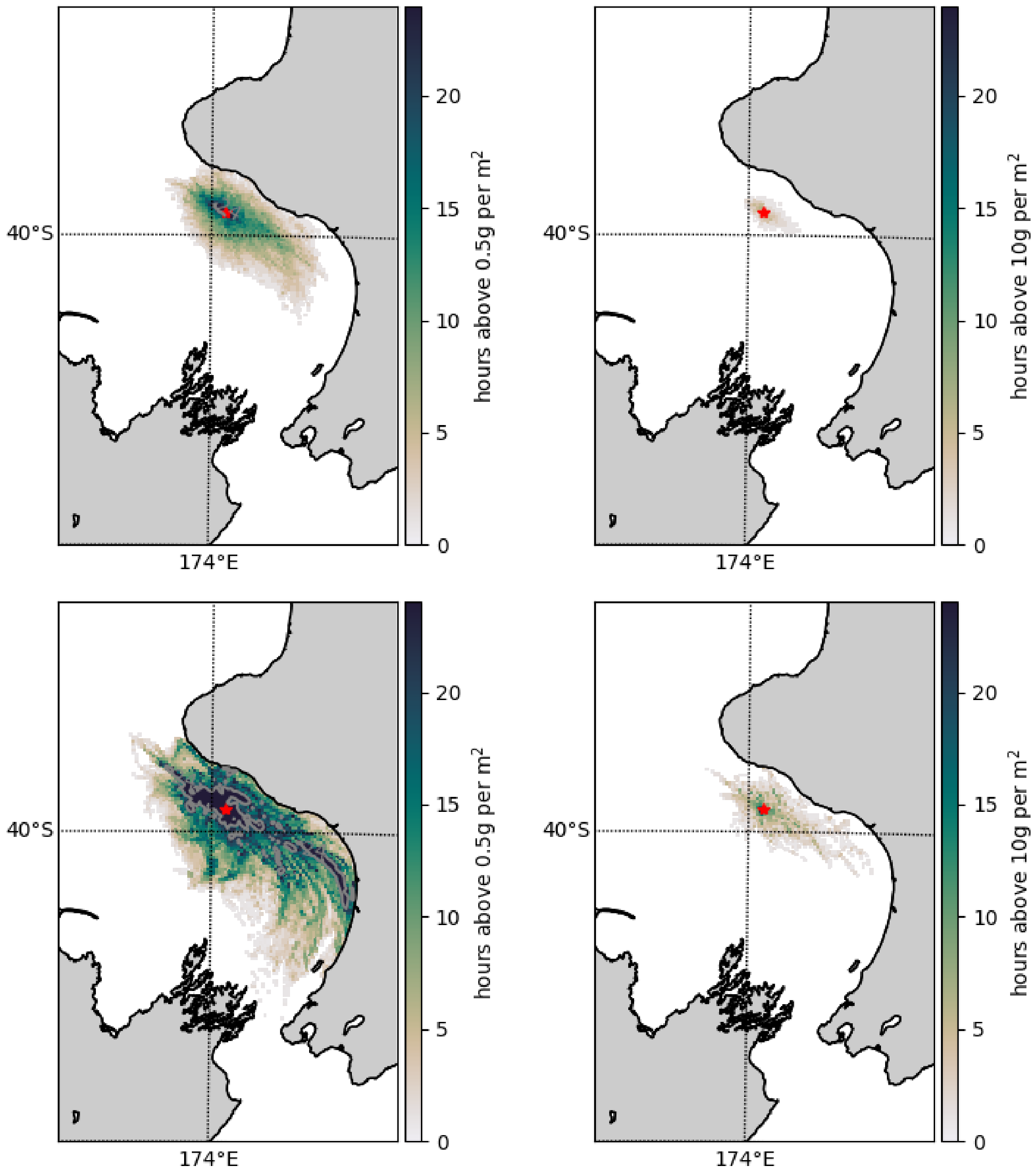


Figure 3.10 The median (top) and 99th percentile (bottom) amount of time (in days) that the surface concentration exceeds 0.5 g.m^{-2} (left) and 10 g.m^{-2} (right) in Autumn.

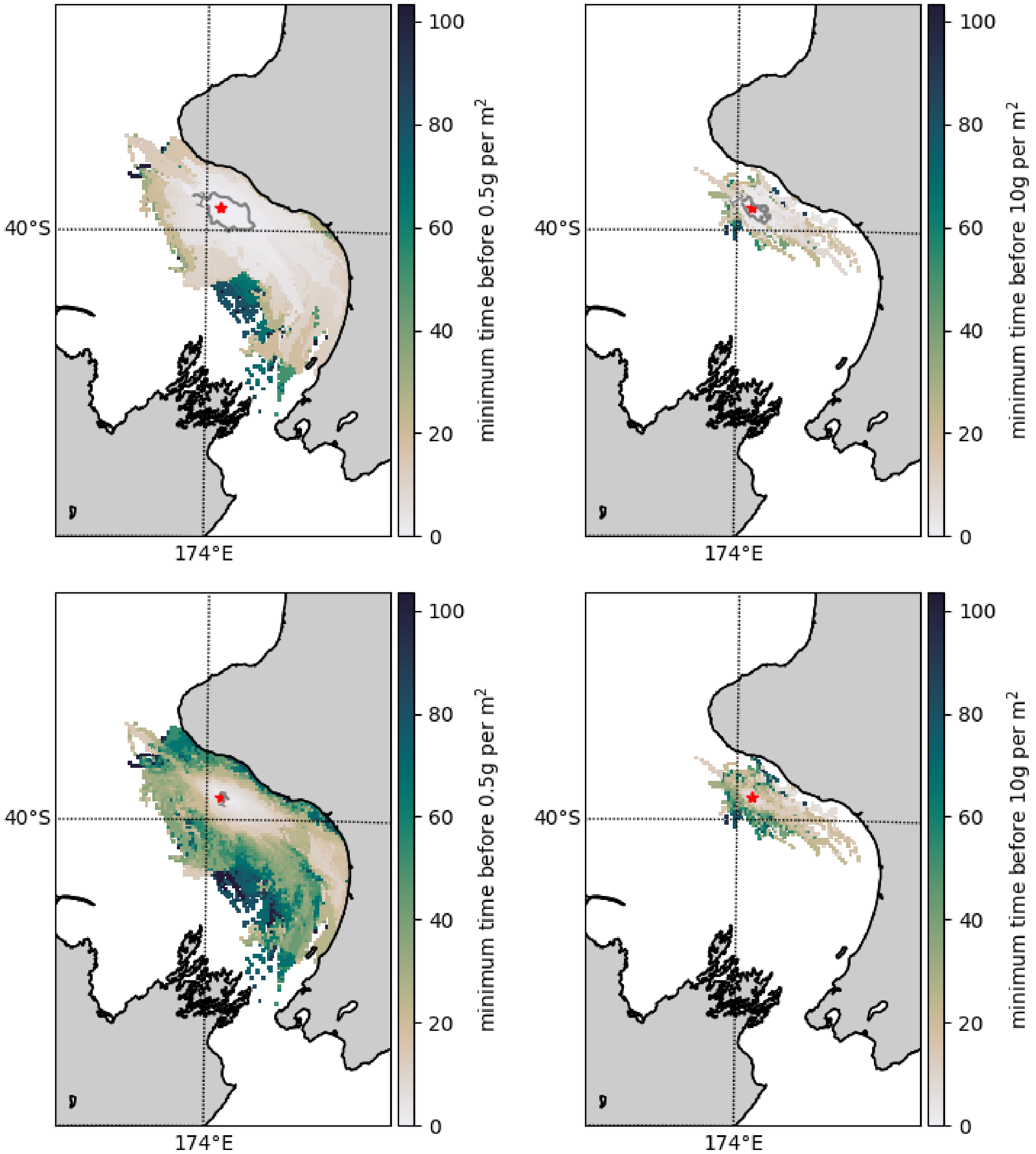


Figure 3.11 The minimum (top) and median (bottom) amount of time (in days) until the surface concentration reached 0.5 g.m-2 (left) and 10 g.m-2 (right) in Autumn.

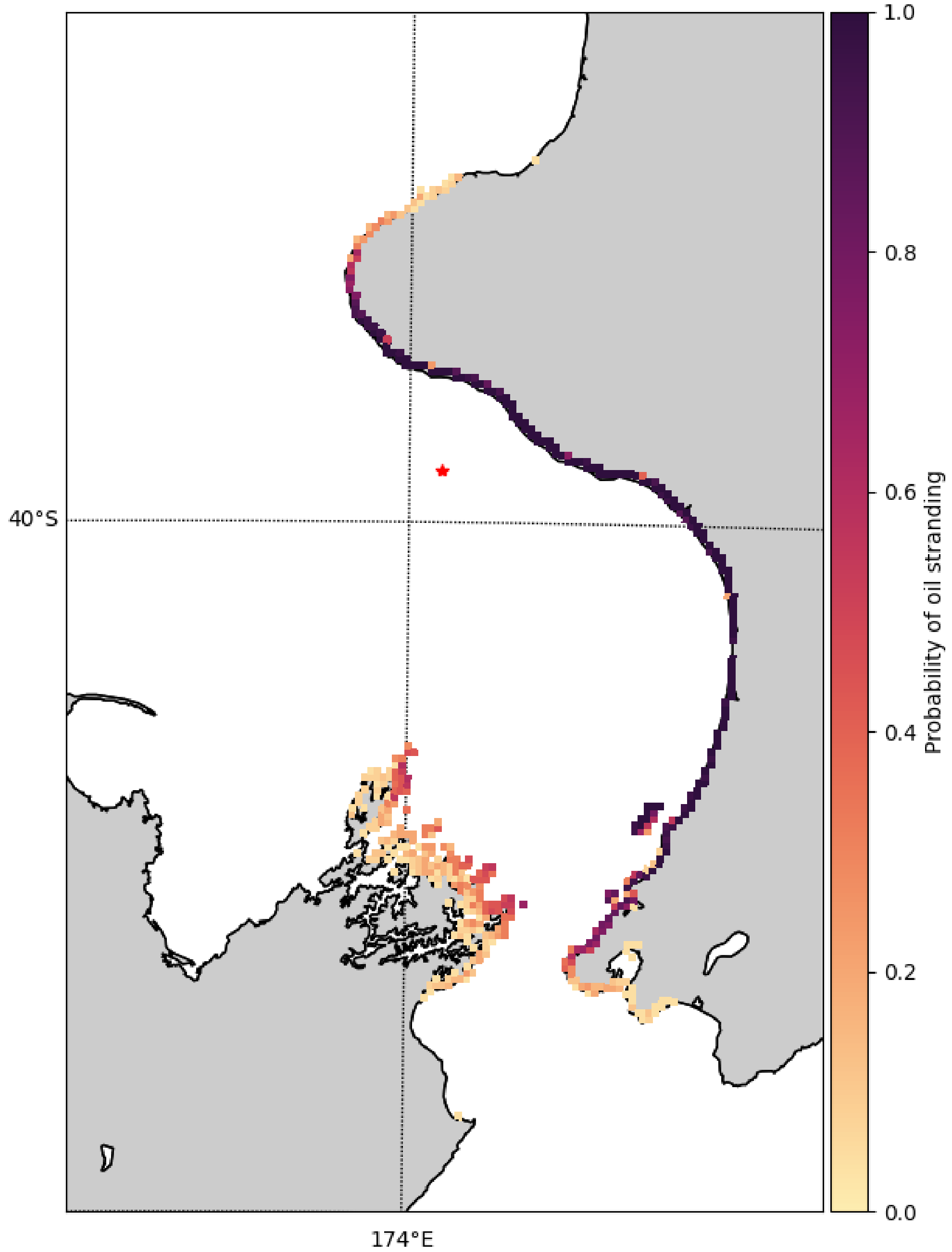


Figure 3.12 Probability for condensate being beached on the coast from any of the 25 simulated spills starting in Autumn. A probability of 1 represents 100 % chance of beaching.

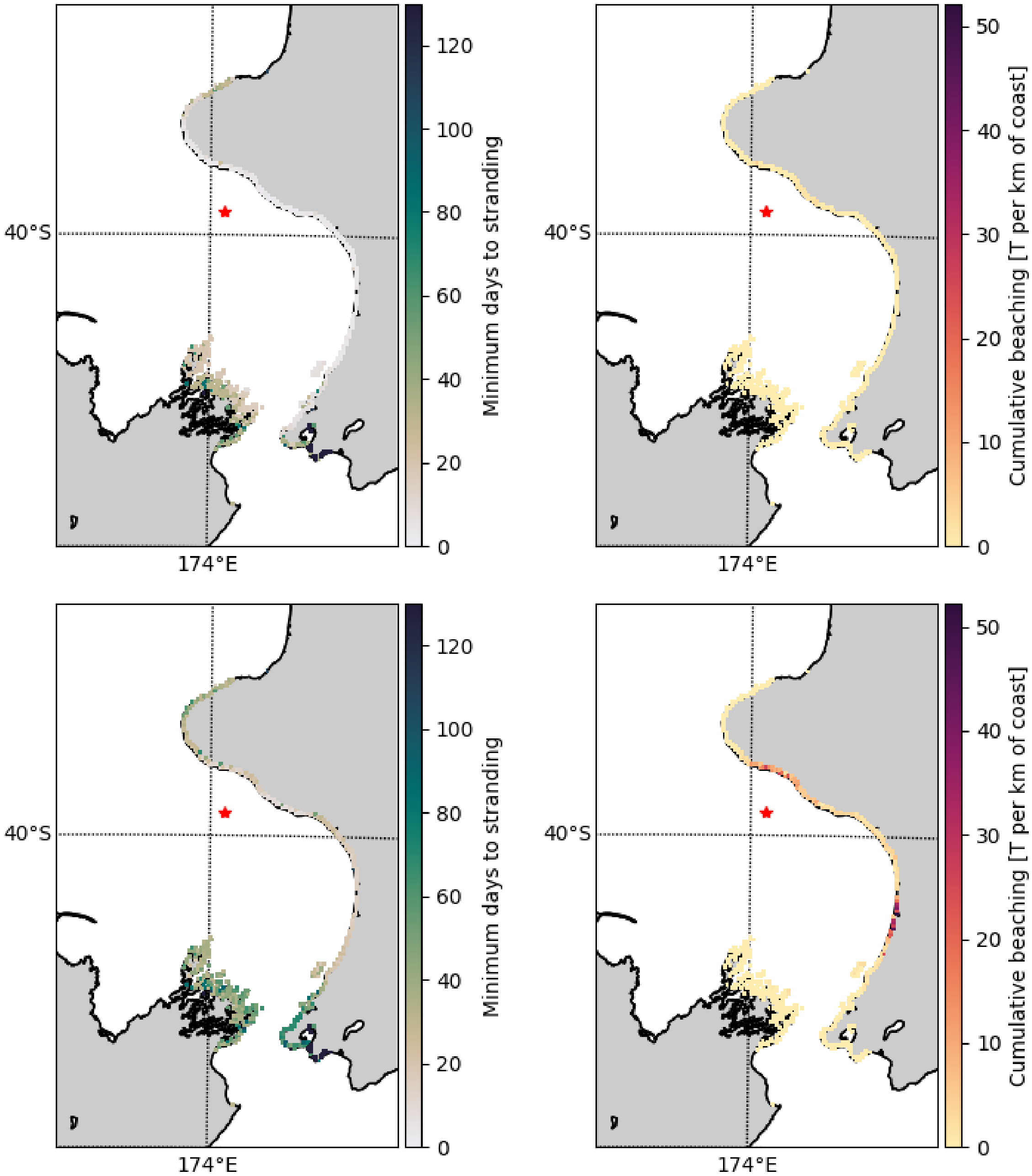


Figure 3.13 Overall minimum (top left) and median (bottom left) of the minimum time (in days) before beaching occurs, from the start of a spill. Overall median (top right) and 99th percentile (bottom right) of the total mass of oil beached during the 25 simulations starting in Autumn.

3.4. Winter simulations

Statistics for the fate of condensate spills that start during Winter months (JJA) are presented in Table 3.5 (averages) and Table 3.6 (maxima). On average, around 0.5% of the spilled volume can be expected to beach, while the worst outcome from the simulations has around 1.95% beaching. The maximum volume of condensate reaching the shore from any one event is 1960 m^3, and the highest shoreline loading is 36 T/km.

Most of the condensate is expected to evaporate (average 32%) or become dispersed within the water column (average 67%). After 150 days, it is probable that none of the spilled volume will remain on the sea surface. The minimum time between spill and beaching is 1.4 days.

Table 3.5 Average distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Winter.

	1 day	**2 days**	**7 days**	**31 days**	**100 days**	**150 days**	**200 days**
Surface	0.12	0.23	0.16	0.21	0.14	0.00	0.00
Submerged	0.19	0.19	0.16	0.11	0.08	0.00	0.00
Evaporated	0.26	0.57	2.09	10.37	27.10	32.33	32.33
Dispersed	0.54	1.19	5.12	20.69	56.27	67.17	67.17
Beached	0.00	0.00	0.01	0.09	0.33	0.50	0.50

Figure 3.14 Maximum distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Winter.

	1 day	**2 days**	**7 days**	**31 days**	**100 days**	**150 days**	**200 days**
Surface	0.52	0.97	0.68	1.04	0.70	0.00	0.00
Submerged	0.44	0.35	0.34	0.21	0.24	0.00	0.00
Evaporated	0.57	1.21	3.92	15.08	32.43	36.73	36.73
Dispersed	1.03	2.02	6.53	24.58	60.78	70.52	70.52
Beached	0.00	0.00	0.09	0.39	1.83	1.95	1.95

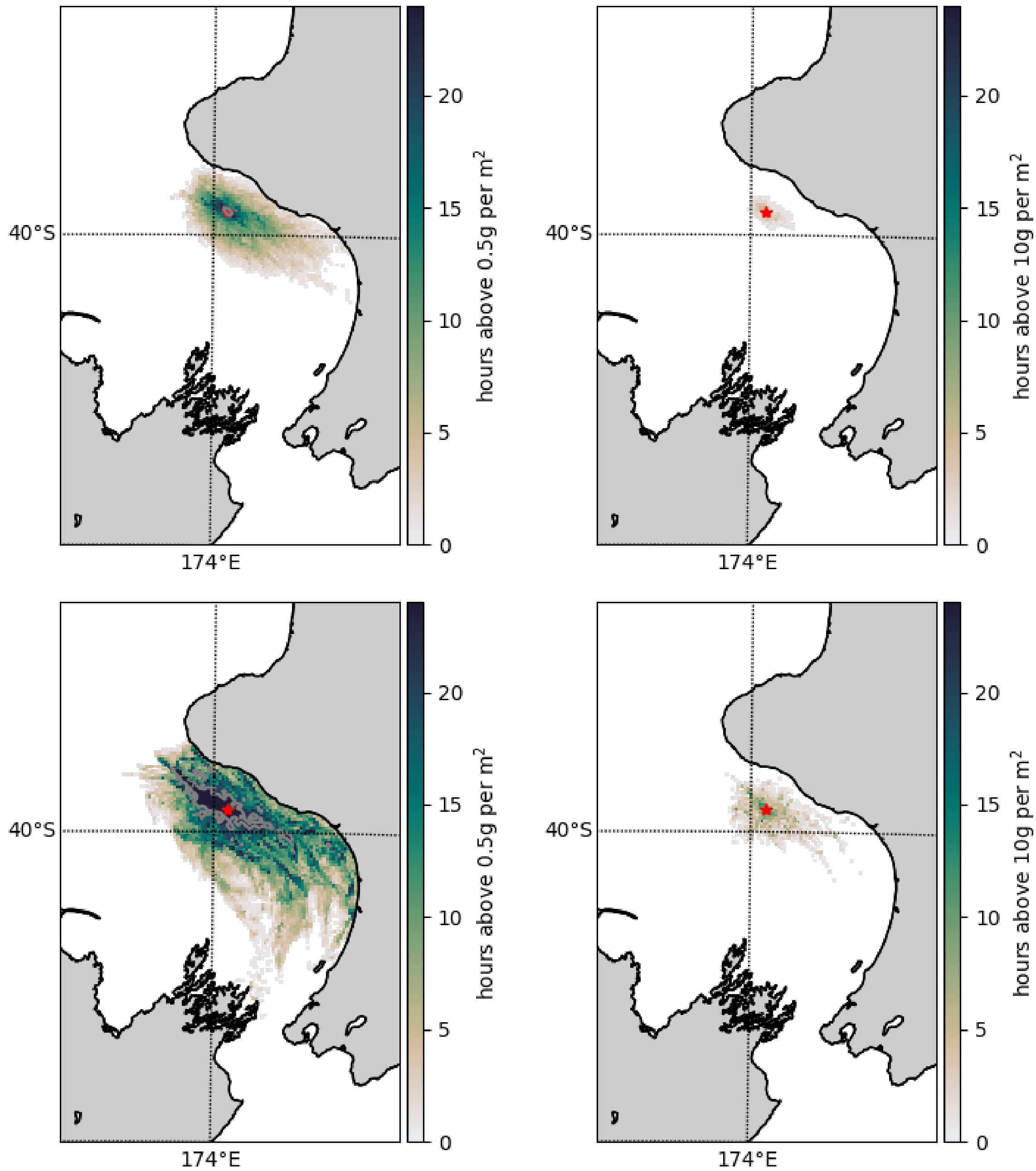


Figure 3.15 The median (top) and 99th percentile (bottom) amount of time (in days) that the surface concentration exceeds 0.5 g.m-2 (left) and 10 g.m-2 (right) in Winter.

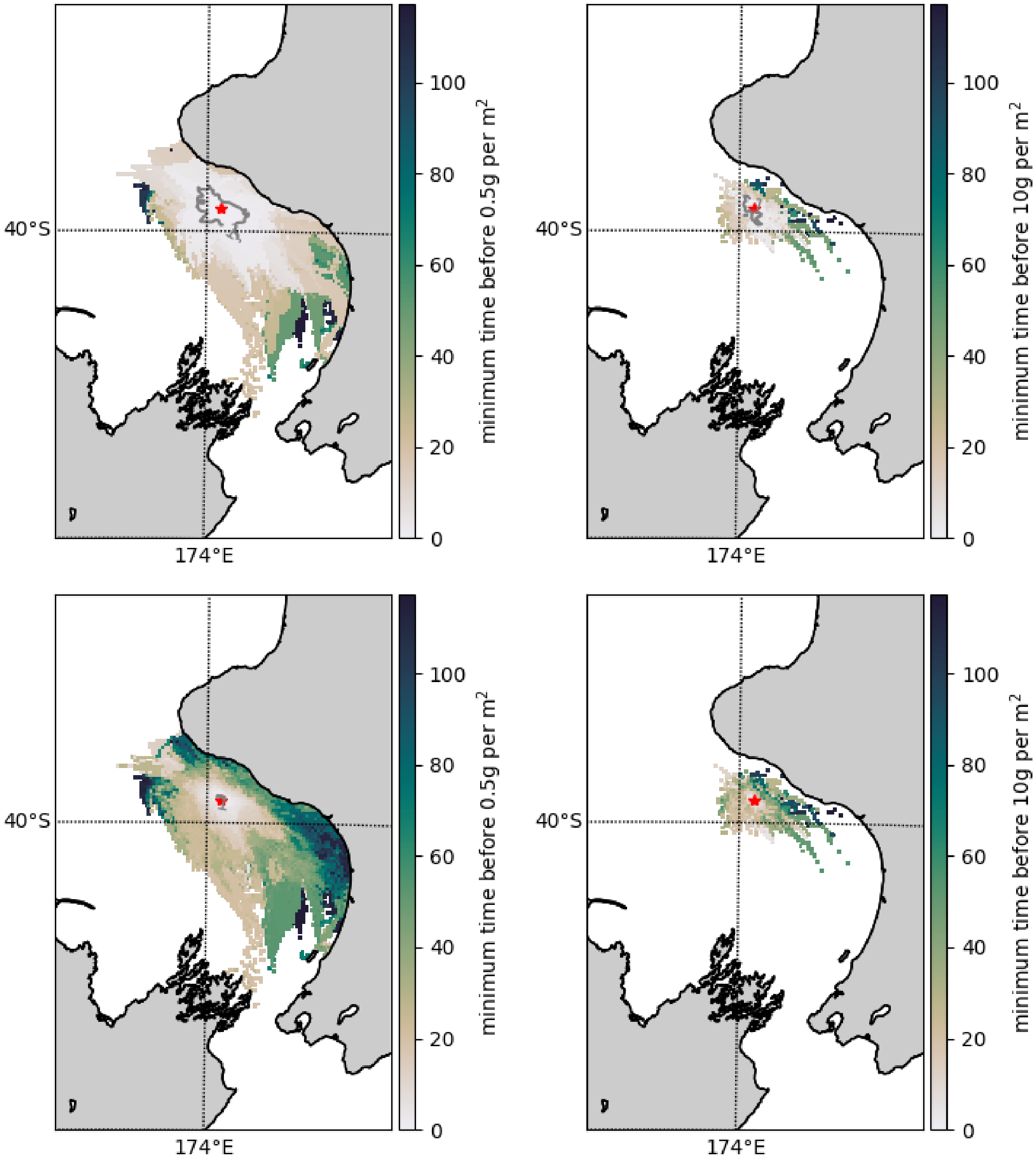


Figure 3.16 The minimum (top) and median (bottom) amount of time (in days) until the surface concentration reached 0.5 g.m^{-2} (left) and 10 g.m^{-2} (right) in Winter.

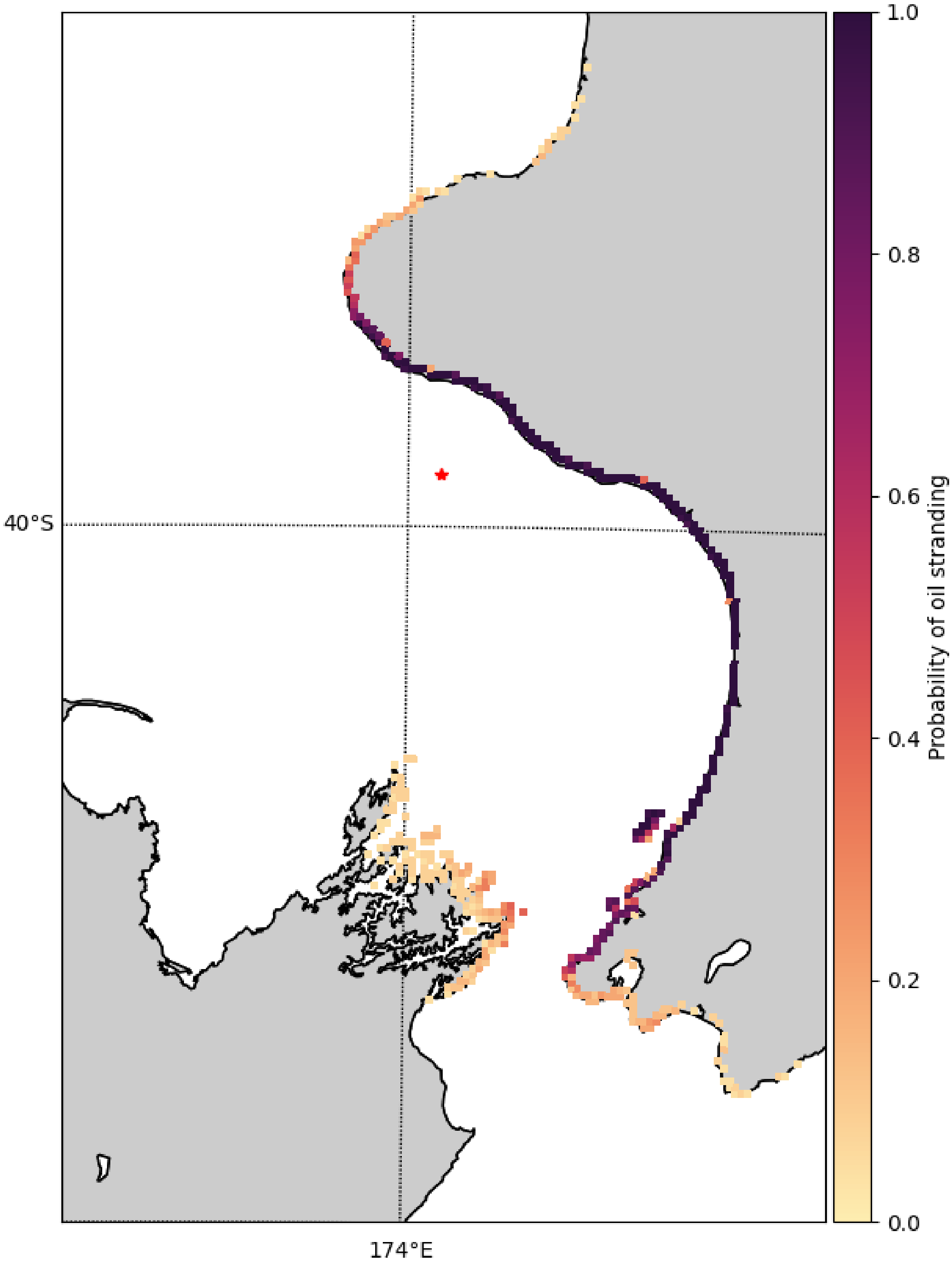


Figure 3.17 Probability for condensate being beached on the coast from any of the 25 simulated spills starting in Winter. A probability of 1 represents 100 % chance of beaching.

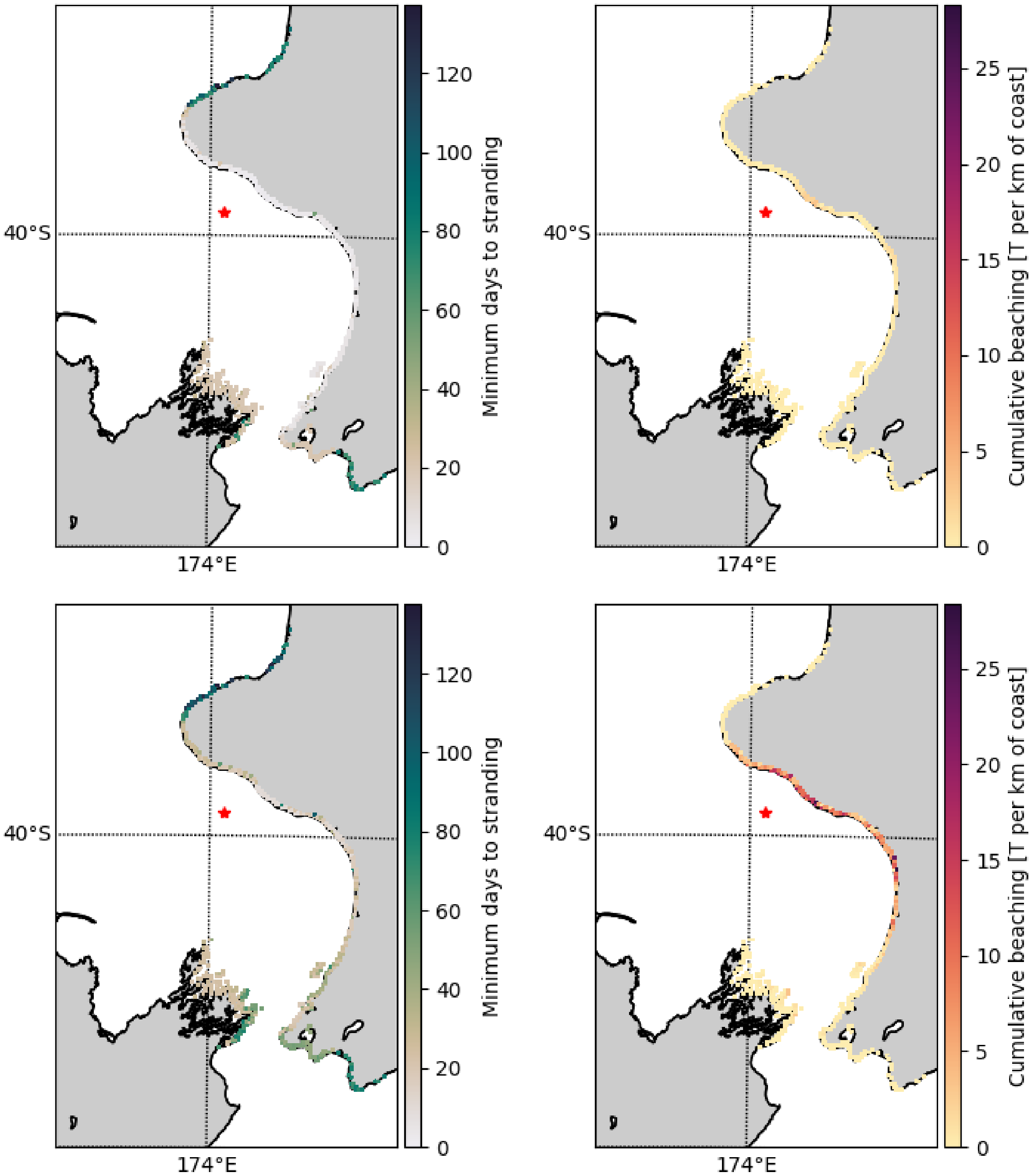


Figure 3.18 Overall minimum (top left) and median (bottom left) of the minimum time (in days) before beaching occurs, from the start of a spill. Overall median (top right) and 99th percentile (bottom right) of the total mass of oil beached during the 25 simulations starting in Winter.

3.5. Spring simulations

Statistics for the fate of condensate spills that start during Spring months (SON) are presented in Table 3.7 (averages) and Table 3.8 (maxima). On average, around 1.3% of the spilled volume can be expected to beach, while the worst outcome from the simulations has around 3.3% beaching. The maximum volume of condensate reaching the shore from any one event is 3355 m^3, and the highest shoreline loading is 47 T/km.

Most of the condensate is expected to evaporate (average 33%) or become dispersed within the water column (average 65%). After 150 days, it is probable that none of the spilled volume will remain on the sea surface. The minimum time between spill and beaching is 1.5 days.

Table 3.6 Average distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Spring.

	1 day	2 days	7 days	31 days	100 days	150 days	200 days
Surface	0.10	0.14	0.39	0.20	0.21	0.00	0.00
Submerged	0.21	0.19	0.13	0.12	0.08	0.00	0.00
Evaporated	0.22	0.51	2.39	9.91	27.64	33.31	33.31
Dispersed	0.57	1.34	4.63	21.09	55.05	65.39	65.39
Beached	0.00	0.00	0.01	0.15	0.94	1.31	1.31

Table 3.7 Maximum distribution (in %) of condensate after 1,2,7,31,100,150 and 200 days for the 25 spills starting in Spring.

	1 day	2 days	7 days	31 days	100 days	150 days	200 days
Surface	0.52	0.77	1.81	1.23	0.98	0.00	0.00
Submerged	0.36	0.33	0.26	0.25	0.19	0.00	0.00
Evaporated	0.57	1.23	4.05	13.68	34.90	40.98	40.98
Dispersed	1.01	2.03	6.82	25.20	60.25	70.98	70.98
Beached	0.00	0.00	0.23	0.68	2.71	3.33	3.33

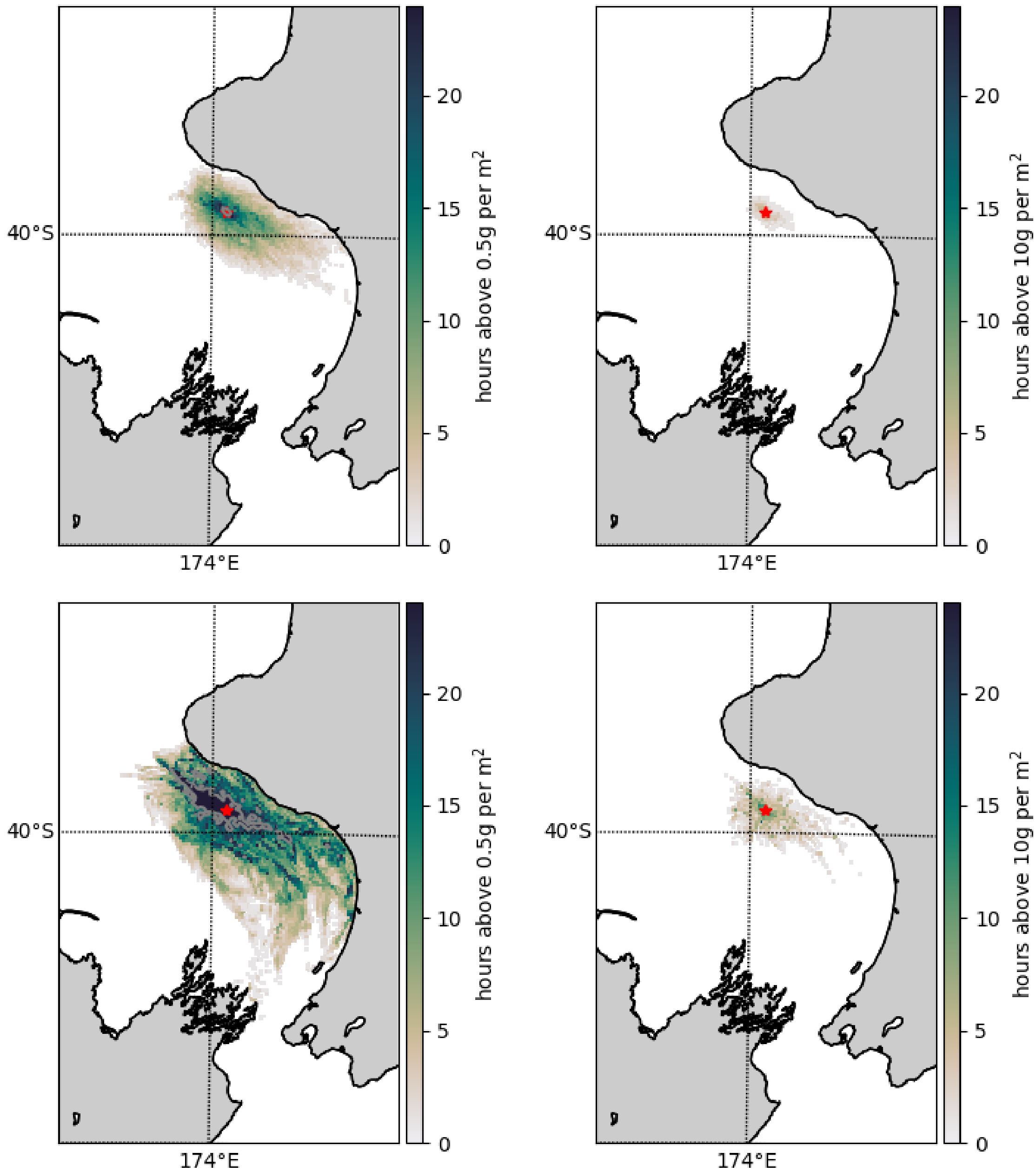


Figure 3.19 The median (top) and 99th percentile (bottom) amount of time (in days) that the surface concentration exceeds 0.5 g.m-2 (left) and 10 g.m-2 (right) in Spring.

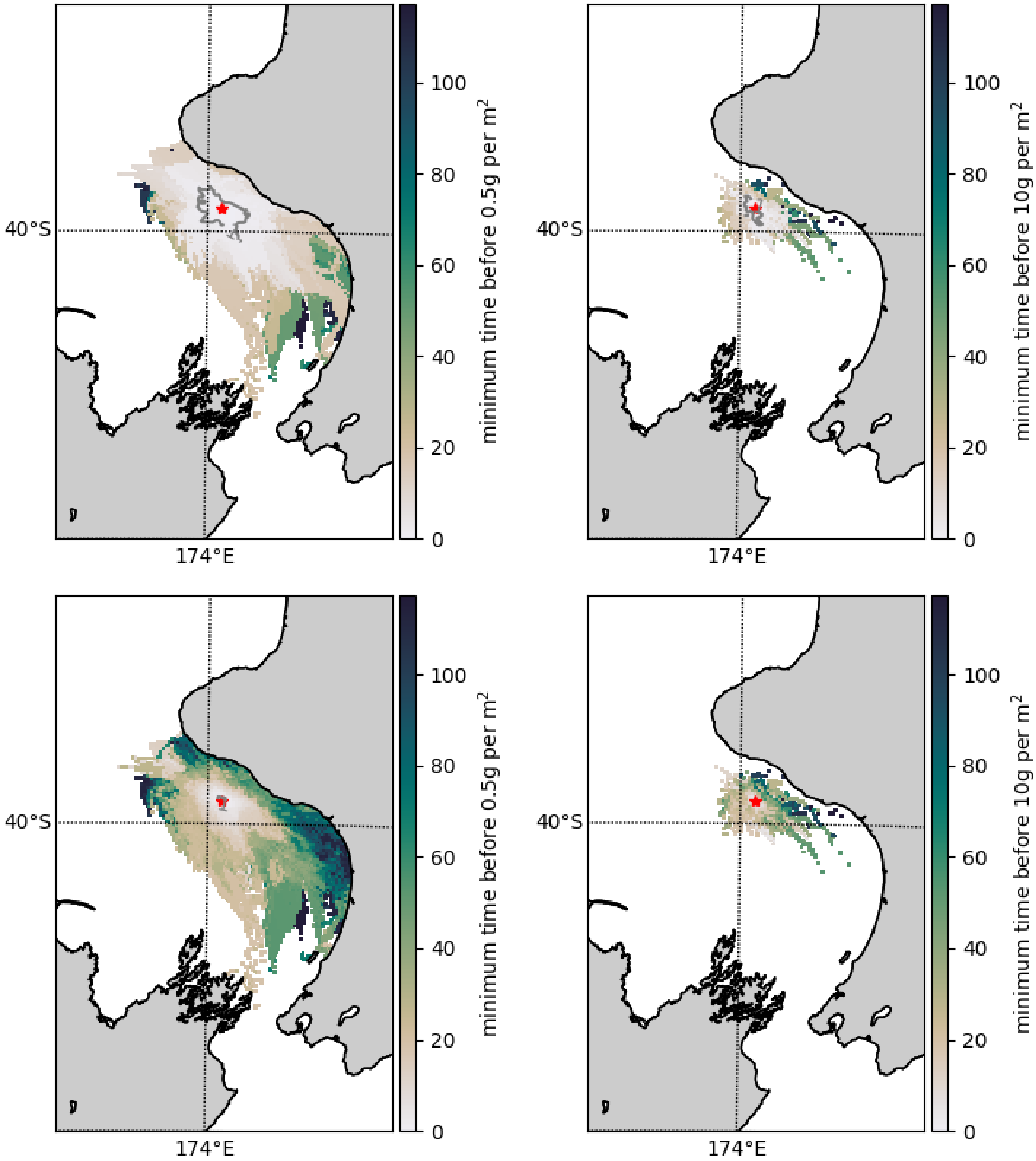


Figure 3.20 The minimum (top) and median (bottom) amount of time (in days) until the surface concentration reached 0.5 g.m⁻² (left) and 10 g.m⁻² (right) in spring.

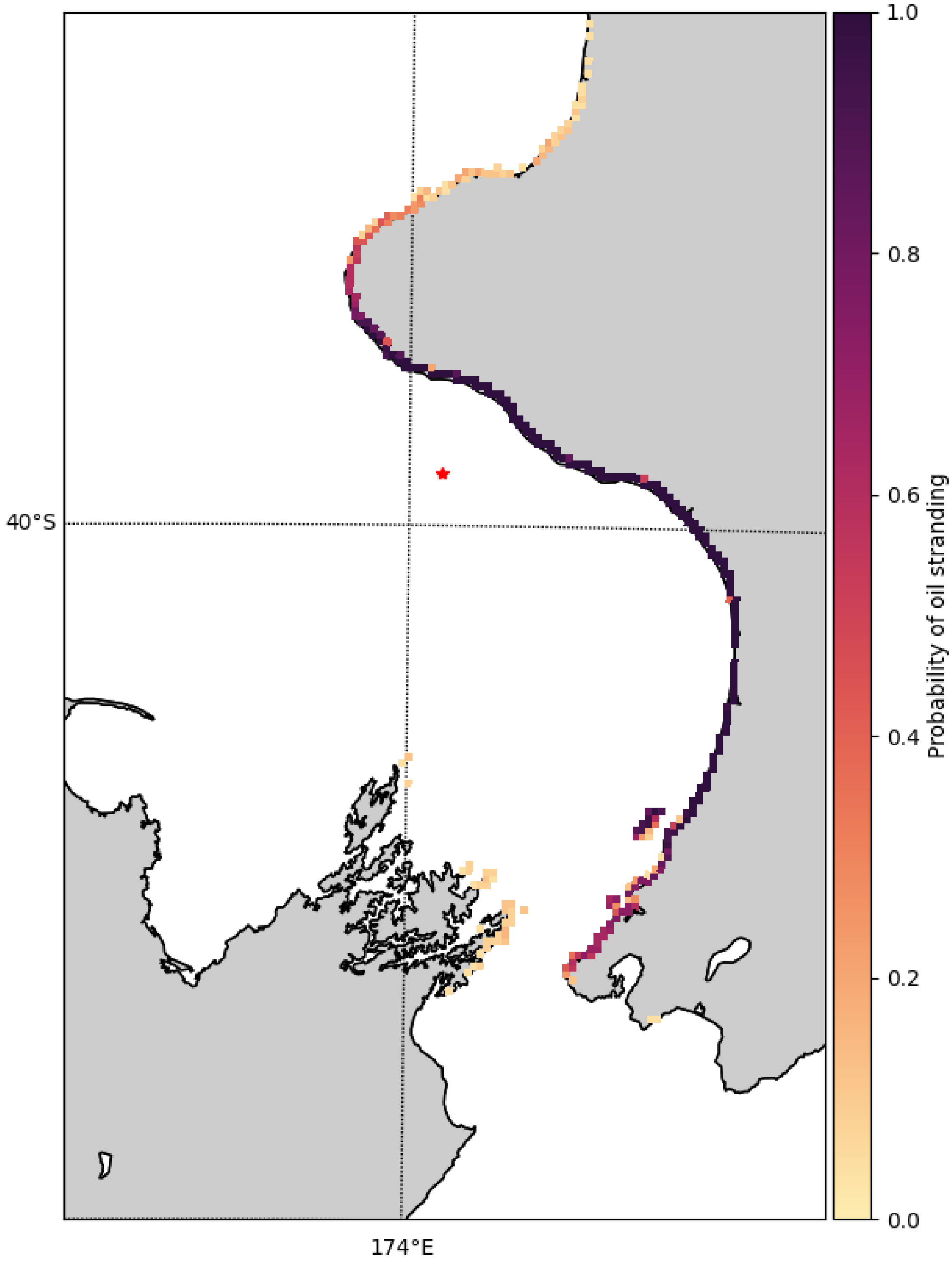


Figure 3.21 Probability for condensate being beached on the coast from any of the 25 simulated spills starting in Spring. A probability of 1 represents 100 % chance of beaching.

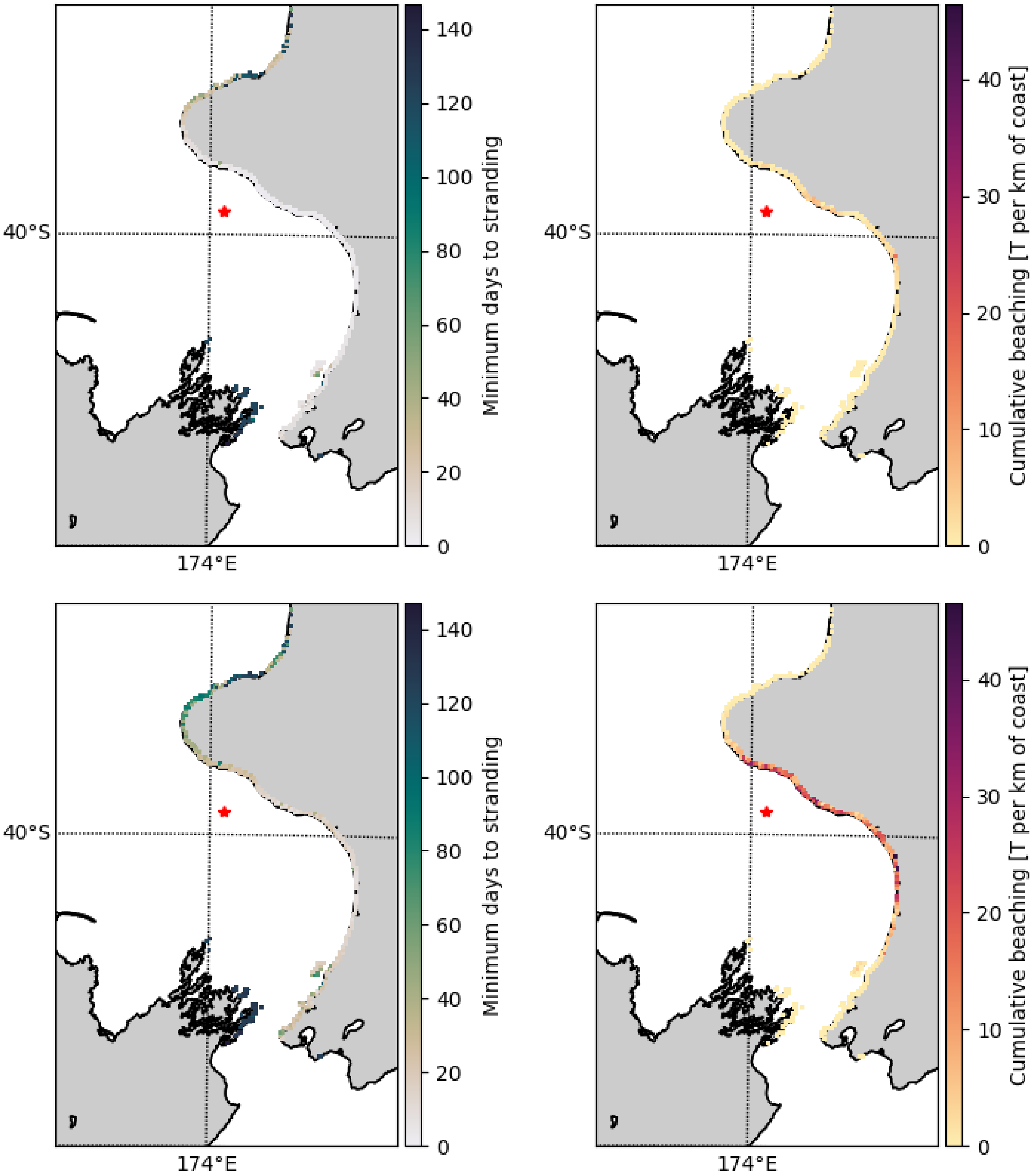


Figure 3.22 Overall minimum (top left) and median (bottom left) of the minimum time (in days) before beaching occurs, from the start of a spill. Overall median (top right) and 99th percentile (bottom right) of the total mass of oil beached during the 25 simulations starting in spring.

3.6. Worst-case beaching simulation

3.6.1. Maximum beaching

The worst beaching event identified from the 100 random simulations occurred from a spill that started on 20th of October 2010 and gave rise to a shoreline loading of up to 33 tonnes of condensate per km of coast. In total, some 3.3% of the spilled volume was beached. The trajectory is shown on Figure 3.23, which displays the 99th percentile for surface concentration from the 200-day simulation. Snapshots of sea surface concentration during the event are provided in Figure 3.24.

Localised concentrations of up to 33 tonnes per km of coast were observed in the simulation, while the average was 5 tonnes per km. In total, some 2,624 tonnes (i.e., 3355 m^3) of condensate were beached during this event. The fate and mass budget for the spill event is provided as a time series graph in Figure 3.25.

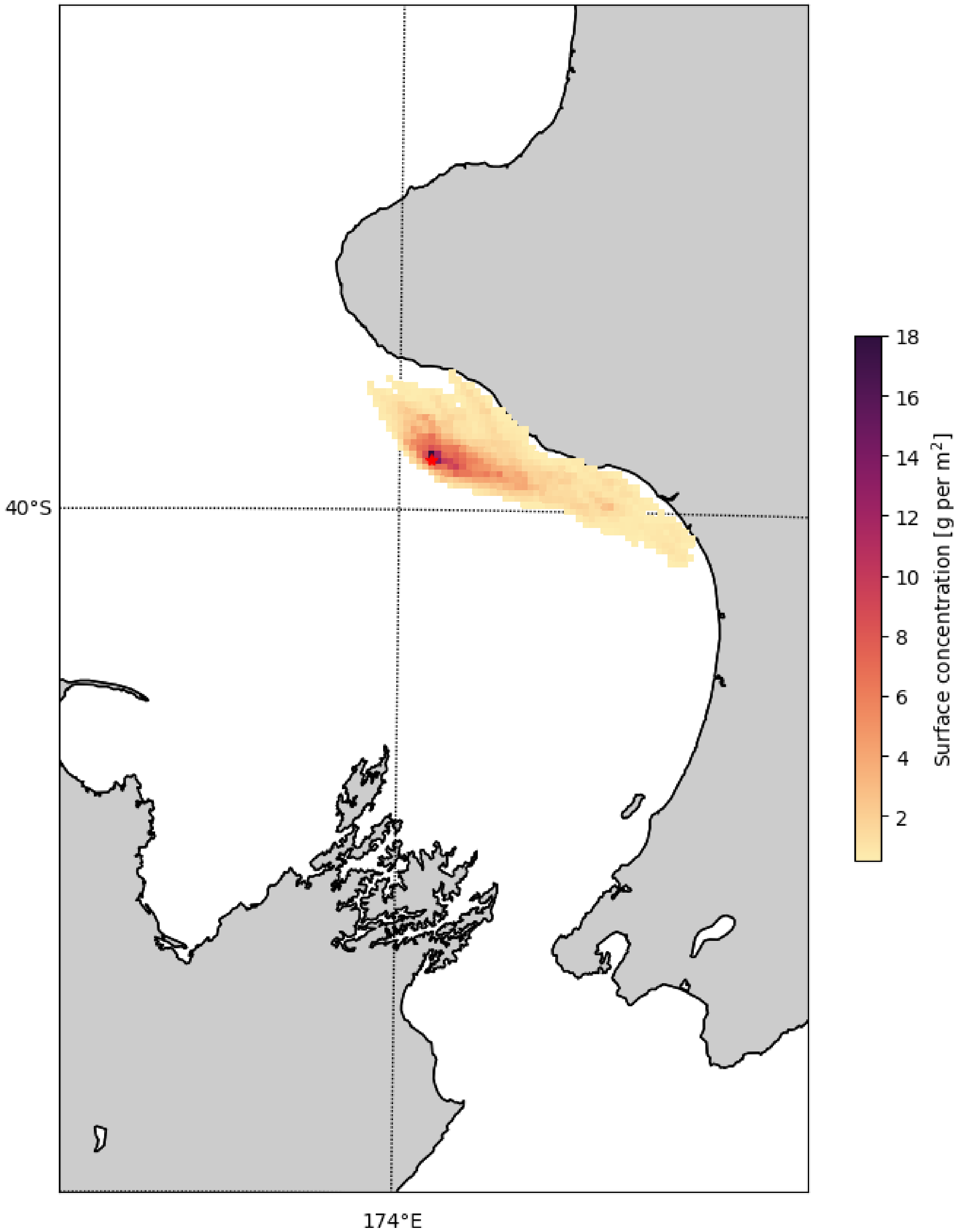


Figure 3.23 The 99th percentile of surface concentration (in $g.m^{-2}$) during the worst event. Note a minimum value of 0.5 $g.m^{-2}$ was applied

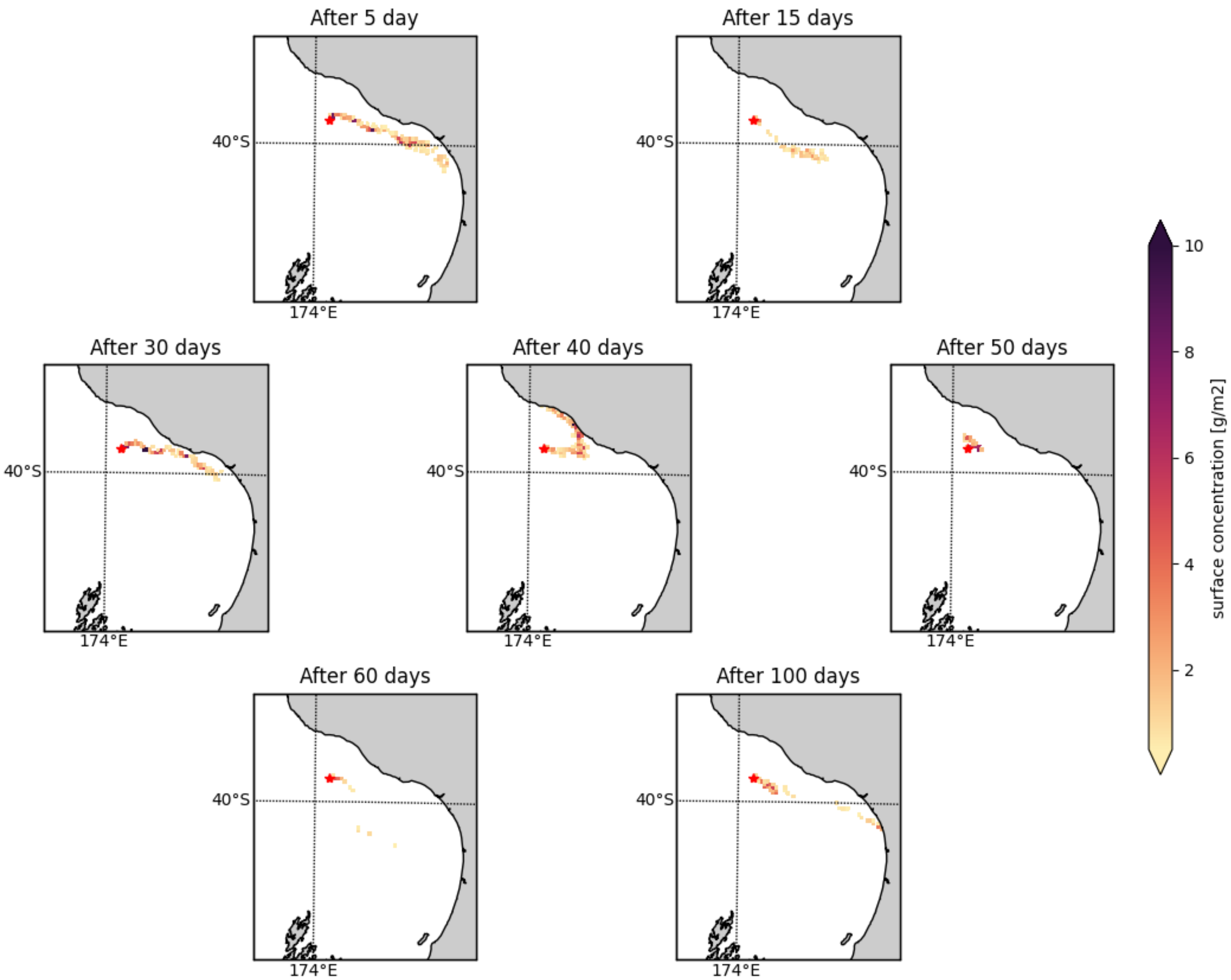


Figure 3.24 Surface concentration (in g.m^{-2}) time series plots showing trajectory over the first 100 days following the 132-day spill. Note a minimum value of 0.5 in g.m^{-2} was applied

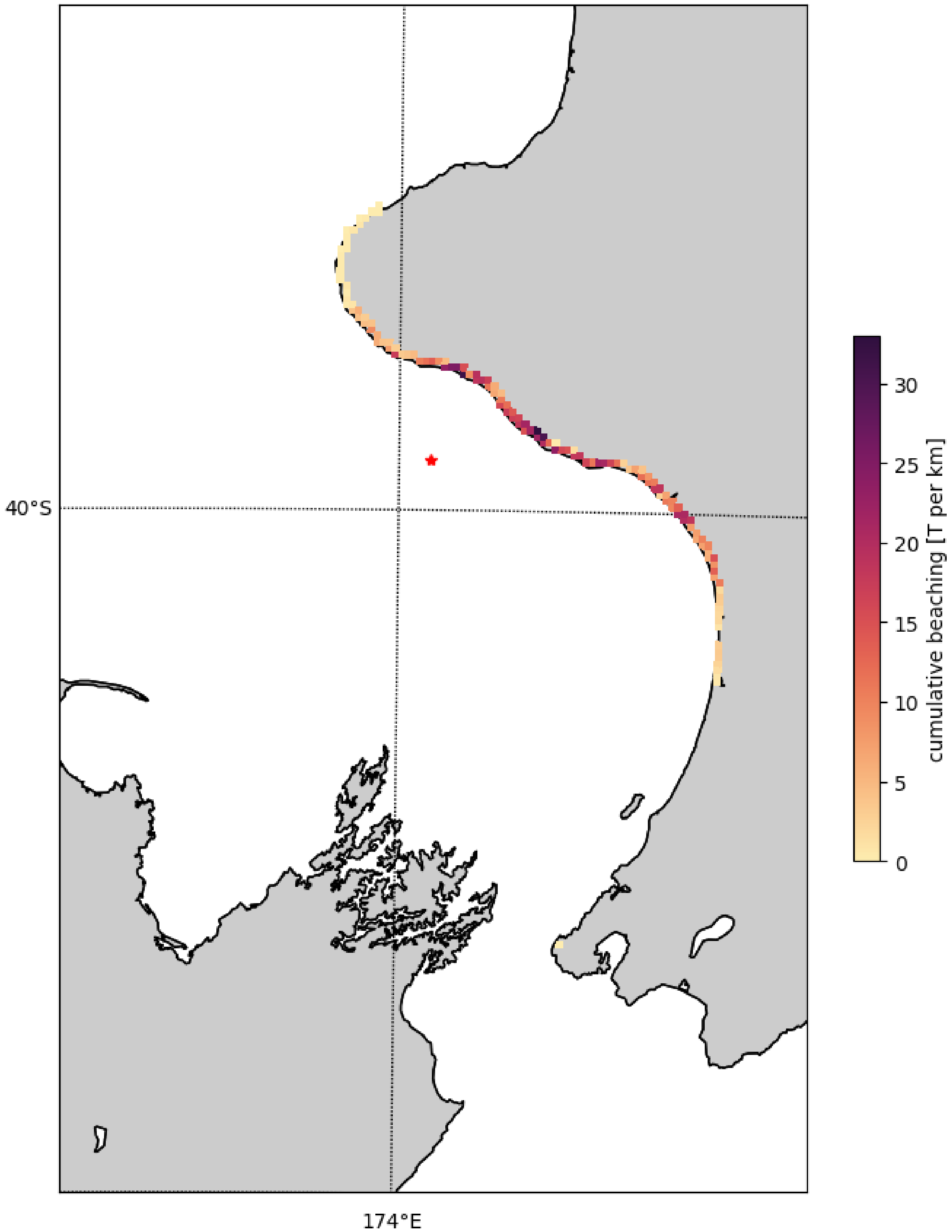


Figure 3.25 Total mass of oil (in tonne per km of coast) beached during the worst beaching scenario. Note, a minimum value of 0.1 T km (equals to 10 $g.m^{-2}$ assuming a coastline width of 10m) was used. Up to 33 T/km was observed at the coast immediately NW of the well site.

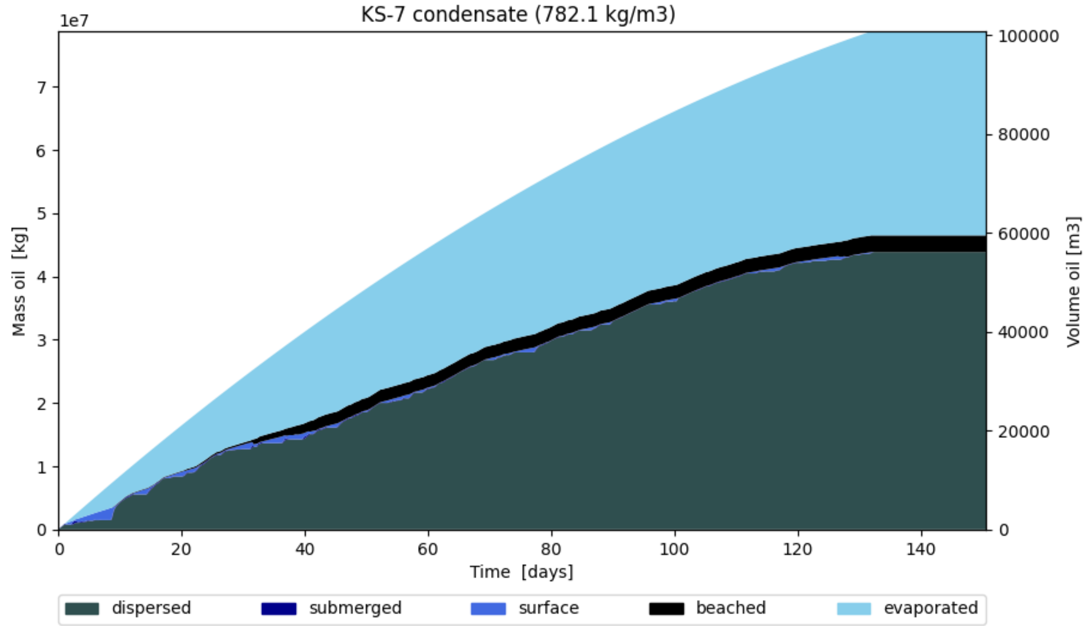


Figure 3.26 Timeseries representing the fate and mass budget of the October 2010 spill event.

3.6.1. Maximum spreading

The worst spreading event identified from the 100 random simulations occurred from a spill that started on 25th of July 2009 and gave rise to 370 km of contaminated shoreline. In total, some 0.3% of the spilled volume was beached. The trajectory is shown on Figure 3.23, which displays the 99th percentile for surface concentration from the 200-day simulation.

Localised concentrations of up to 6 tonnes per km of coast were observed in the simulation, while the average was 0.5 tonnes per km. In total, some 201 tonnes (i.e., 257 m^3) of condensate were beached during this event. The fate and mass budget for the spill event is provided as a time series graph in Figure 3.25.

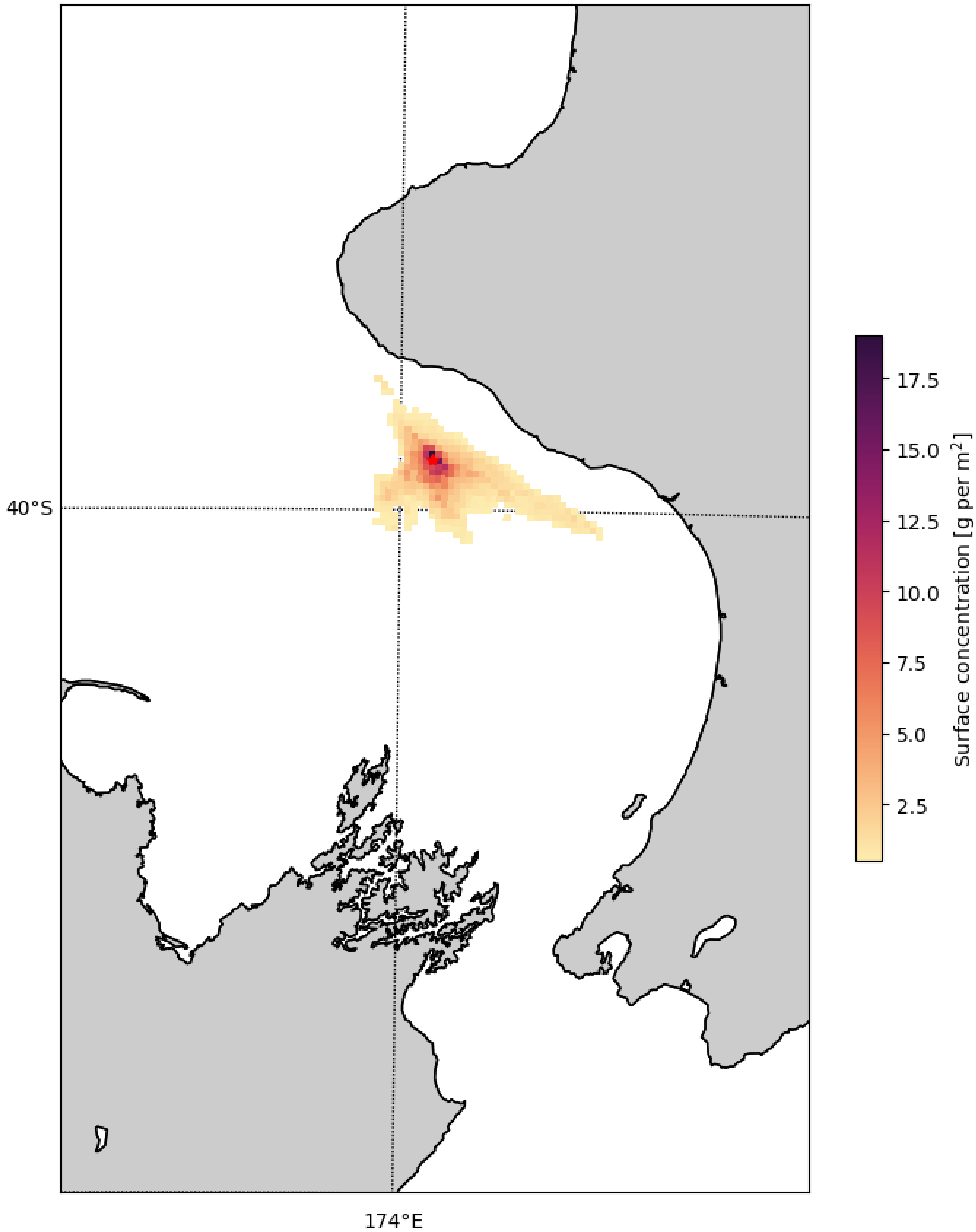


Figure 3.27 The 99th percentile of surface concentration (in g.m^{-2}) during the worst event.

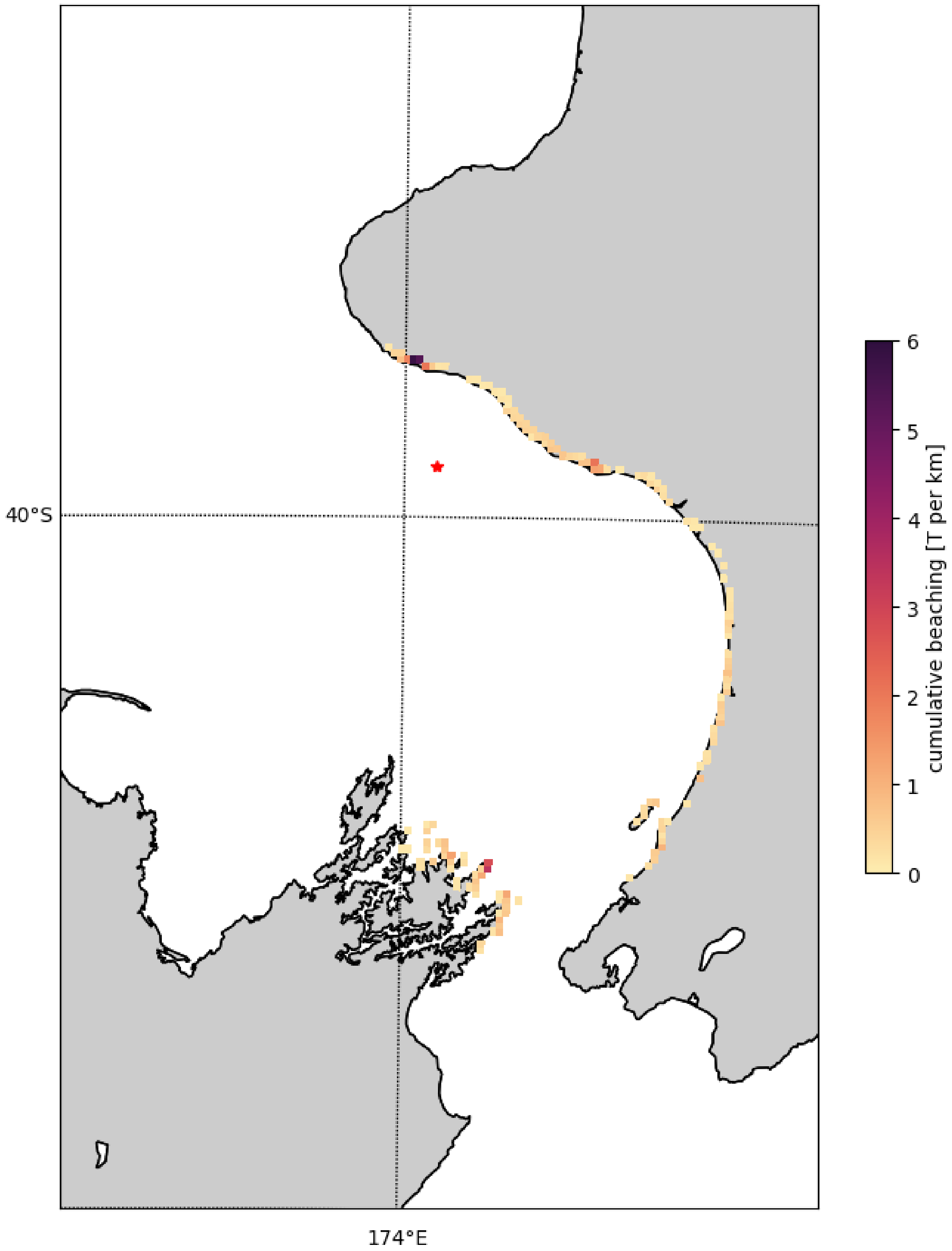


Figure 3.28 Total mass of oil (in tonne per km of coast) beached during the worst-case scenario. Note, a minimum of 0.1 T/km (equals to 10 $g.m^{-2}$ assuming a coastline width of 10m) was applied. Up to 6 T/km was observed at the coast immediately N of the well site.

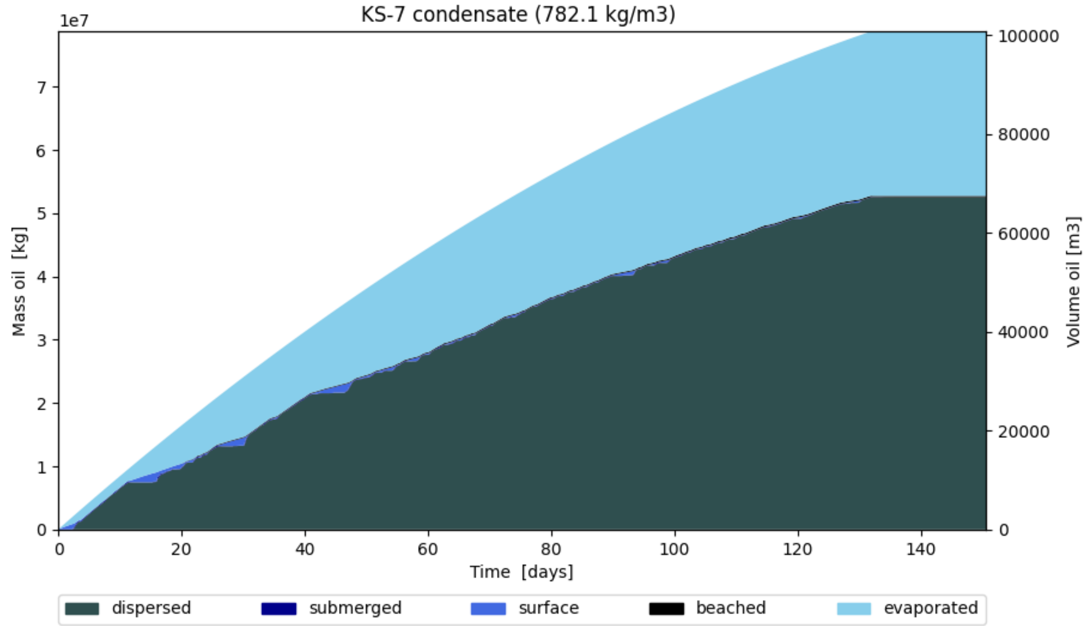


Figure 3.29 Timeseries representing the fate and mass budget of the July 2009 spill event.

4. SUMMARY

A stochastic approach has been undertaken to define the statistical probabilities related to trajectory, dispersion, weathering, and beaching patterns arising from a condensate spill from the KS-9 development well in the Kupe Field. A numerical particle model has been used to simulate oil spills for 100 randomly selected dates over a decade, applying verified hindcasts of the waves, winds, and currents to drive the model.

The spill scenario modelled was a near-seabed blowout in 34 m water depth that released between 6914 to 2687 stb/day over 132 days. The total volume released was 633,680 stb (i.e., 100,747 m^3) which was tracked by the model for 200 days. The results form a database of 100 events which were analysed to derive statistics on the fate and mass budgets, plus the probability of occurrence for specific impacts.

The results show that spilled KS-7 condensate will experience relatively high rates of evaporation, dissolution and dispersion once on the sea surface. The individual spill mass budgets are strongly influenced by weather conditions; strong winds increase the rate of evaporation while the wave conditions associated such conditions acts to mix and disperse the condensate into the upper layers of the ocean. Consequently, the day-to-day weather conditions influence the mass budgets and eventual beaching volumes.

The dominant trajectory for spilled condensate is to the east and southeast, in response to the prevailing winds and surface currents. Consequently, the coastal region that receives the highest impacts extends from Cape Egmont to Cape Terawhiti. However, applying a beaching concentration of 1 T/km as a proxy for a threshold of ecological impact, the region from Opunake in the north to Kapiti in south can be identified as having the highest risk.

The average annual beaching rate is 1.0% of the total spilled volume. However, in the worst-case modelled outcome, some 3.3% of the spill reached the shore near Patea. In this event, a total volume of 2,624 T was beached, with a local hotspot receiving 33 T of condensate per km.

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