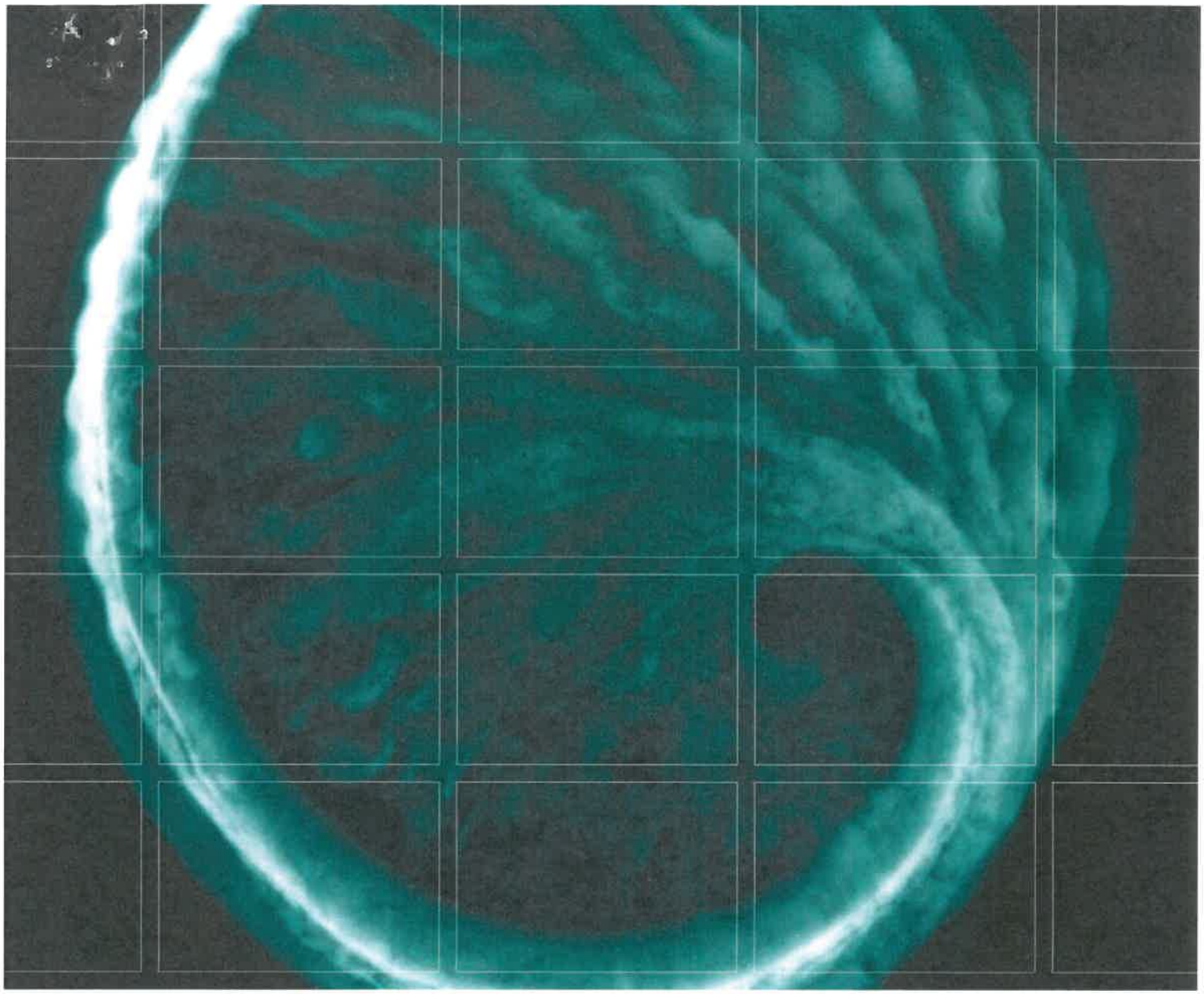

Marine Mammal Impact Assessment New Caledonia Basin

Energy Holdings Offshore Limited

Final
December 2015

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Marine Mammal Impact Assessment

New Caledonia Basin

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Approved by:	Alison Lane
Position:	Project Manager
Signed:	
Date:	8 December, 2015
Approved by:	Tracey Ryan
Position:	Partner Director
Signed:	
Date:	8 December, 2015

ERM New Zealand Limited

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Project Summary

Energy Holdings Offshore Limited (EHOL) intends to undertake a 2-Dimensional Marine Seismic Survey in the 2015/2016 New Zealand summer to study the geology in their prospecting permit in the New Caledonia Basin (PPP 55377). The seismic data acquisition is expected to commence in late 2015 and continue for approximately four months. The survey area is located approximately 200 km offshore to the west of the Northland coast in deep water, generally in excess of 1,000 m and down to 3,000 m.

The survey vessel selected for the Project is the *Hai Yang Shi You 718*. This vessel is 79.8 m long and accommodates up to 60 personnel, including the ship's crew and the survey team. During the survey the survey vessel will be supported by a smaller support vessel (34 m long). The support vessel will assist with supplying the survey vessel with fresh food and spare parts, managing the seismic survey equipment, and liaising with any other vessels in the area where the survey is taking place.

The survey will use an array of airguns towed behind the vessel to generate an underwater sound source. The vessel will also tow a single streamer with underwater microphones (hydrophones) that will receive the sound reflected back from the seabed and from below the seabed. This information is then interpreted to map the subsurface geology. Due to the water depth, sediment thickness and the depth of the target features for which data is required, the seismic source will be a single source 4,750 cubic inch (In^3) array.

Under the *2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations'* (hereafter "the Code"), the planned survey is classified as a "Level 1" survey. In accordance with the Code, seismic operators must provide a Marine Mammal Impact Assessment (MMIA) to the Department of Conservation (DOC) prior to commencement of the survey.

Methodology

An MMIA involves identifying the nature and scale of potential impacts from the seismic survey activities on the environment. While a large focus of the assessment is on marine mammals, including whales, dolphins, seals and sea lions, other environmental, social and cultural features are also taken into account. Where potential impacts are identified, management measures are developed to avoid, remedy or mitigate these.

The methodology used in the MMIA includes the following steps:

- Identify the conservation values, including physical, environmental, social and cultural features in the area of the seismic survey;

- Determine the sensitivity of the conservation values;
- Identify the mitigation measures that are a fundamental part of the seismic survey design;
- Assess the potential for impacts from the seismic survey on the environment;
- Identify additional measures that would avoid, remedy or mitigate the impacts; and
- Assess any residual impacts after mitigation efforts.

As part of the MMIA process, EHOL consulted with communities, organisations and experts who may be affected by the activity or who were able to contribute technical information on the area and its values. Advice from these groups has been incorporated into the MMIA.

When considering how much impact may occur on any particular species or environmental feature, the assessment considered the conservation status of the species (for example, whether it is threatened or endangered), as well as how abundant the species is likely to be in the area influenced by the survey. The magnitude of the possible impact was then assessed based on the degree of disturbance, how this relates to natural variation, and the timeframes for recovery from any disturbance. To determine the overall impact rating, both the sensitivity of the environmental feature and the magnitude of the impact were considered.

Summary of Findings

The assessment identified a total of 31 marine mammals species that may occur in the survey area based on the normal distribution of these animals in New Zealand waters. However, historic records and marine mammal observations undertaken in 2014 suggest that the numbers of whales and dolphins in the area is likely to be small and to consist of individuals that are moving through the area. This is also consistent with the paucity of plankton (a measure of biological productivity) present in the permit area. Whilst the sensitivity of marine mammals to impacts from the seismic survey was assessed as medium, due to their conservation status, the potential for impacts was assessed as minor.

Other environmental features of relevance were identified in the assessment, including benthic (seabed) habitats, plankton, fish, seabirds and marine reptiles. The assessment also considered commercial fishing and other shipping activities that may be active in the area. The potential impact from the survey on these environmental features and activities was considered to be negligible or minor in all cases.

The aspects of the survey identified as having the potential for impacts on the environment were:

- The physical presence of the vessels and equipment (such as lighting and seismic equipment in the water);
- Underwater noise generated by the airguns;
- Normal operational discharges from the vessels; and
- Accidental events such as fuel spills or vessel collisions.

The most significant potential impact from this seismic survey is considered to be the introduction of human-produced noise. This impact will be mitigated through a range of standard measures which will be strictly adhered to during the entire duration of the survey, including:

- Two Marine Mammal Observers (MMOs) will be present on the vessel and maintaining watch during daylight hours as per the 2013 Code. They will be responsible for:
  - Monitoring seismic activity and ensuring that operations are carried out in a safe manner for marine mammals in the area;
  - Conducting pre-start observations before any seismic activity commences;
  - Delaying the start of operations for marine mammals within their respective mitigation zones as specified in the 2013 Code;
  - Ensuring the power of acoustic array is increased gradually to allow for animals to leave the area before operations reach full power ('soft starts'); and
- Ensuring there are shut-downs of operations if marine mammals identified as Species of Concern come within specific distances of the acoustic source.
- Two Passive Acoustic Monitoring System (PAMS) Operators will be present on board the seismic vessel throughout the survey to conduct acoustic monitoring for marine mammals. This acoustic monitoring will provide 24-hour cover, allowing MMOs time off during the hours of darkness and low visibility.
- Notification at the first possible instance to the Director-General of DOC if Species of Concern are encountered in unusually high numbers.

To further minimise any potential impacts, additional mitigation measures will be put in place for the duration of the survey, including:

- The shot point distance has been increased from the standard shot interval of 25 m up to 37.5 m, decreasing the overall number of shots required for the survey by approximately 30%.

- Based on a review of whale prevalence during the EHOL NCB 2014 MBES survey and current geological understanding of the basin, an operational decision has been made to remove the Bellona Trough from the survey area;

- If any Hector's dolphins or Maui's dolphins are sighted at any time during the survey (including transits), the Director-General of DOC will be informed at the first possible instance;

- Wherever practicable, at least one MMO will be on the watch during transits or at any times of increased vessel speed (i.e. above usual survey speed). If any baleen whales are sighted in the vicinity ahead of the vessel and if it is judged by the MMO that the animal/s is/are not responsive (i.e. during times of resting, feeding, socialising), the vessel's course will be altered to avoid collision with the animal/s;

- Opportunistic use of the support vessel (when available) to report any observations of marine mammals ahead of the seismic vessel when entering the survey area; and

- Increasing the soft-start period when starting or re-starting the survey in deep intra-basin waters.

Control measures were also identified for all other potential impacts from both planned activities and unplanned accidents. These include:

- Managing equipment to avoid any loss and to facilitate recovery if equipment is lost;

- Measures to prevent or treat any waste discharges from the vessels; and

- Measures such as timing, location and notification of the survey in order to avoid impacts on commercial fishing activities or shipping in the region.

Based on the assessment of sensitivity, impact magnitude and with the application of control measures, the MMIA concluded that all potential impacts from planned activities were either negligible or minor. For unplanned accidents, all risks were found to be as low as reasonably practicable (ALARP). *Table 1* below summarises the findings of the MMIA.

Table 1 ***Impacts from the Project's Planned Activities and Unplanned Events, Impact Receptors and Significance***

Impact Source	Resource/Receptor - Residual Impact Significance
Impacts from Planned Project Components	
Physical presence of the seismic and support vessel	• Marine mammals - Negligible
On board vessel lighting	• Seabirds - Negligible
In-water equipment	• Commercial fishing - Negligible • Shipping - Negligible
Underwater noise from airgun arrays	• Marine mammals - Minor • Fish and Invertebrates - Negligible • Commercial fishing - Negligible
Deck drainage and bilge water discharge	• Water quality - Negligible • Fish - Negligible
Sewage, grey water and food discharges	• Water quality - Negligible • Fish - Negligible
Impacts from Unplanned Events	
Minor spills of fuels, oils and chemicals	• ALARP
Collisions	• ALARP
Loss of streamers and associated equipment	• ALARP
Introduction of invasive marine species	• ALARP

ABBREVIATIONS AND GLOSSARY OF TERMS

Term	*Definition*
Code	2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals for Seismic Survey Operations
CTD	Conductivity/Temperature/Depth
DOC	New Zealand Department of Conservation
ECS	Extended Continental Shelf
EEZ	Exclusive Economic Zone
EHOL	Energy Holdings Offshore Limited
Hz	Hertz
IUCN	International Union for Conservation of Nature and Natural Resources
KHz	Kilohertz
MBESS	Multi-Beam Echo Sounding Survey
MEC	New Zealand Marine Environmental Classification
MMIA	Marine Mammal Impact Assessment
MMMP	Marine Mammal Management Plan
MMO	Marine Mammal Observer
NABIS	New Zealand Ministry for Primary Industries National Aquatic Biodiversity Information System
NCB	New Caledonia Basin – in this report the basin is limited to the area within New Zealand waters
NIWA	National Institute of Water and Atmospheric Research
NZPAM	New Zealand Petroleum and Minerals
PAM	Passive Acoustic Monitoring
PPP	Petroleum Prospecting Permit
s twt	seconds two-way-time
SBO	Seabird Observer
TEARA	Te Ara – The Encyclopaedia of New Zealand
2D	Two dimensional

1 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

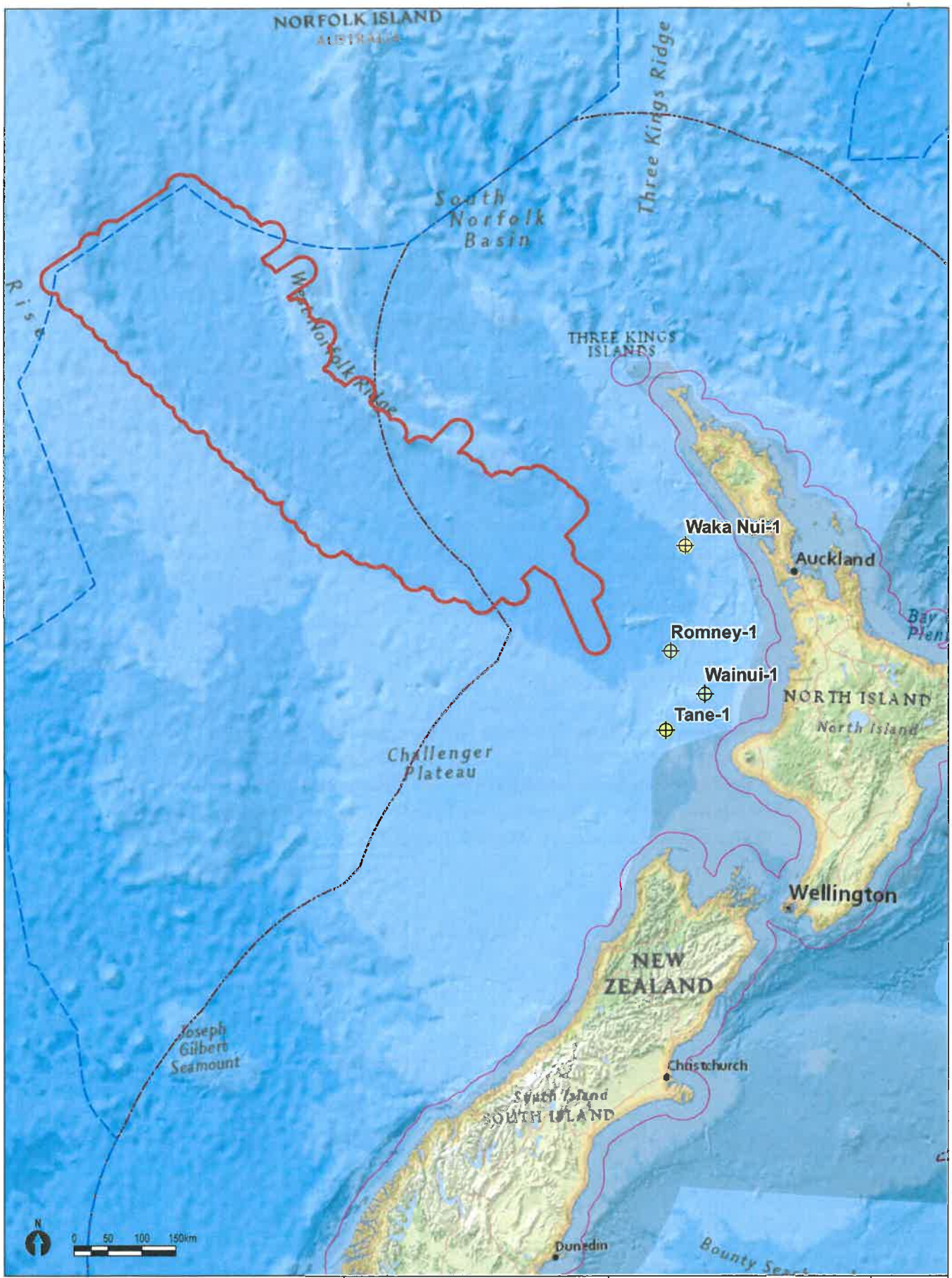
This Marine Mammal Impact Assessment (MMIA) has been prepared to inform the Department of Conservation (DOC) about potential environmental issues and proposed mitigation measures relating to the proposed 2-dimensional (2D) seismic survey within New Zealand Petroleum Prospecting Permit (PPP) 55377 in the New Caledonia Basin, off the west coast of New Zealand's North Island (the Project).

This MMIA has been developed in accordance with the regulatory requirements of New Zealand's *Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012* (the EEZ Act) and the Department of Conservation (DOC) *Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Activities 2013* (the Code).

A key objective of the impact assessment process applied to this MMIA is to ensure that potential direct and indirect effects, particularly environmental, social and economic impacts, are fully examined and addressed through a rigorous process.

1.2 OVERVIEW OF THE PROJECT

In May 2014, Energy Holdings Offshore Ltd (EHOL) was awarded Petroleum Prospecting Permit (PPP) 55377 to carry out preliminary scientific research in the New Caledonia Basin (NCB). The PPP is valid until December 2016 and requires EHOL to undertake a Multi-beam Echo Sounding Survey (MBESS) and a 2D seismic survey. *Figure 1.1* shows the location of PPP 55377.



Legend

- Operational Area
- NZ Territorial Limit
- NZ Exclusive Economic Zone
- NZ Extended Continental Shelf
- Area of Ecological Importance
- Historic Well Site

Client:	Energy Holdings Offshore Ltd		
Drawing No:	0267364s_IA_G001_R1.mxd		
Date:	30/11/2015	Drawing Size: A4	
Drawn By:	GC	Reviewed By: EW	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 1.1 - Location of Operational Area

New Caledonia Basin Marine Mammal Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM

1.2.1 *The New Caledonia Basin*

The New Caledonia Basin is an elongated bathymetric feature that extends northwest from New Zealand past New Caledonia in the Pacific Ocean. The basin covers approximately 666,000 square kilometres (km^2).

The NCB is approximately 200 kilometres (km) from the west coast of New Zealand. The basin is in deep water at a depth of approximately 1,000 metres (m) closest to New Zealand, deepening to around 3,300 m at the edge of the New Zealand Extended Continental Shelf (ECS). The basin is bounded by two elevated ridges; the Challenger Plateau/Lord Howe Rise to the south and the West Norfolk Ridge to the north. These ridge lines, at depths of between 500 to 1,000 m, are considerably shallower than the basin.

1.2.2 *PEP 55377 Exploration History*

A history of seismic and drilling activity exists within the NCB. The National Institute of Water and Atmospheric Research (NIWA) reports that one well has been drilled within the PPP - Deep Sea Drilling Programme (DSDP) Well 206. This well was completed to a sub-surface depth of 734 m, (water depth 3,196 m). Three petroleum wells have been drilled in the region - Tane-1, Wakanui-1 and Wainui-1.

1.3 *PROJECT APPLICANT*

1.3.1 *Energy Holdings Offshore Limited*

EHOL is the operator of the permit on behalf of the Joint Venture companies: Energy Holdings Offshore Limited (37.5%), CNOOC International Ltd (37.5%), and Anadarko New Zealand Company (25%).

1.3.2 *Shell's HSSE Policy and Commitment*

EHOL, a Shell New Zealand (2011) Ltd company (Shell), is the operator of permit PPP 55377. The Shell group of companies operates under a common set of business principles, supported by polices and business controls. Health, Safety, Security, the Environment and Social Performance (HSSE & SP) is managed in accordance with the Shell HSSE & SP Control Framework, which is a single source for Shell-wide requirements covering health, safety, security, the environment and social performance.

Shell has global internal requirements for undertaking impact assessments (IA). These are detailed in Shell's HSSE & SP Control Framework. The intention of these standards is to produce internationally consistent levels of impact assessment that maintain best practice regardless of the location of the operation.

1.4 PROJECT RATIONALE AND ALTERNATIVES

1.4.1 *Project Rationale*

Developing energy resources remains a cornerstone of the New Zealand Government's plan for economic growth, which places a high value on the oil and gas estate and, through its Energy Strategy 2011-2021, is committed to developing its potential (MED, 2011). The immediate focus is on increasing exploration activity and on improving the knowledge of New Zealand's petroleum basins.

Conditions of PPP 55377 require that EHOL completes a minimum of 10,000 line kilometres of 2D seismic survey within 26 months of the permit being granted on 15 April 2014.

1.4.2 *Alternative Methods*

Alternative methods that are being considered are largely technology related, including the type of seismic vessel and associated seismic equipment and the size of the acoustic source. Alongside suitability for the Project objectives, all alternatives are being considered based primarily on environment and safety, with cost being a secondary but necessary consideration. These alternative methods are discussed below.

Seismic Vessel

The seismic vessel selected via Tender for the Project will be the *Hai Yang Shi You 718*. This vessel is suitable for the remote area of the survey and conforms with EHOL specifications. The vessel has dual propulsion for redundancy and sufficient endurance to remain at sea for at least five weeks before crew change and bunkering in port. More information on the vessel can be found in *Section* 2 of this MMIA.

Acoustic Source

There are several different sound sources that can theoretically be deployed. These are:

- Water guns (20-1500 Hz);
- Airgun (100-1500 Hz);
- Sparkers (50-4000 Hz);
- Boomers (300-3000 Hz); and
- Chirp Systems (500 Hz-12 kHz, 2-7 kHz, 4-24 kHz, 3.5 kHz, and 200 kHz).

Lower frequencies tend to better characterise structure at depth, while higher frequencies tend to provide greater resolution near the surface. Almost all marine seismic surveys for hydrocarbons conducted worldwide now use airguns as the structure at depth is key to determining whether there is potential for a working hydrocarbon system.

The Code specifies that the lowest practicable power levels for the sound (acoustic) source should be used to achieve the geophysical objectives.

Due to the water depth, sediment thickness, and the depth of the target geophysical objects the seismic source will be a single source 4,750 cubic inch (In^3) array. This is considered to be the lowest practicable source level taking into account the very deep water in the New Caledonia Basin in PPP 55377 (over 3,000 m), the sediment thickness of over 5,000 m, and the thickness of the stretch target of the Moho formation where the basin sediment is thinnest at a depth of approximately 16,000 m below the seabed.

The seismic source will be fired at intervals of 37.5 m as the vessel travels along the survey lines. This shot point distance has been increased from the standard shot interval of 25 m, decreasing the overall number of shots required for the survey by approximately 30%.

More information on the sound source is included in *Section 2.4.5*.

Type of Survey

The selection of the Marine Seismic Survey (MSS) type for the current survey is based on the data acquisition requirements for the Project. Seismic surveys are typically either 2-Dimensional (2D) or 3-Dimensional (3D). 2D and 3D surveys are used primarily for prospecting, exploration and characterisation of undeveloped resources. 2D surveys are typically conducted over wide areas with survey lines spaced at 2 km to 20 km intervals and data collected by hydrophones in a single towed streamer. 2D seismic surveys provide a broad overview of submarine geology. 3D surveys are conducted across smaller spatial extents with survey lines paced at circa 300 to 500 m apart and with data collected by multiple seismic streamers. These surveys provide sufficient data to construct a 3D model of the submarine strata.

The current Project will involve the collection of 2D data due to the need for a general geological overview across a larger spatial extent. More information on the survey can be found in *Section 2* of this MMIA.

1.4.3 *Do Nothing Option or Alternative Locations*

As part of the work programme for the PPP, EHOL is required to execute exploration activities, including a 2D seismic, thereby furthering knowledge of the resource potential of the PPP and the wider New Caledonia Basin. If EHOL were to not to undertake the MSS they would need to surrender the

PPP back to the Crown as the seismic requirement of the PPP will not be met and it is not conceivable to effectively and responsibly conduct exploration drilling without prior geophysical investigation. The 'do nothing' option is therefore not considered to be a viable alternative.

The potential resource which the Project is investigating is located within PPP 55377. The location of the resource and the extent of the PPP are definitive, thus alternative locations for the survey are not possible.

1.5 *CONSULTATION AND ENGAGEMENT ACTIVITIES*

Consultation is an integral part of EHOL's project development process. It informs business decisions and identifies issues that require action. EHOL as a Shell New Zealand Company has internal policies and processes which outline the requirements of consultation. These are underpinned by Shell's General Business Principles, which govern how the Shell companies that make up the Shell Group conduct their affairs (see *Section 1.3.2*).

EHOL's approach to consultation is a systematic process, starting with developing understanding of the issues, identifying interested parties developing an Engagement Plan and then creating and maintaining interested party relationships and partnerships using a variety of engagement methods. Consultation is a two-way process, designed to ensure interested parties are able to understand, absorb, respond and interact within appropriate timeframes.

An Engagement Plan was developed in May 2014 to assist EHOL in effectively communicating with interested parties regarding the Project and soliciting feedback, which is captured in an internal issues register. The Engagement Plan is modified to evolve with the Project as well as when new information and variables arise requiring a change in plan. The Engagement Plan is a living document capable of adapting to the changing needs of the Project and interested parties.

All interested parties identified through consultation and discussions with DOC were mapped to determine the level of engagement required and/or desired in order to tailor communications and interactions to their specific needs. Due to the significant distance from shore, coverage of a wider geographical area of interested parties was implemented. These groups were comprised of individuals and organisations including local government, iwi, deep sea fishing, environmental groups and tertiary education institutions. *Table 1.1* lists the organisations consulted with as part of this project and the nature and outcomes of that consultation.

Regular consultation with the Project's identified interested parties will continue throughout the lifespan of EHOL's NCB interest, ensuring that queries and concerns raised are addressed and, where feasible, appropriate responses are built into the design and / or management plans.

Table 1.1 Consultation Undertaken with Respect to the NCB MMS

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
Ngāti Kuri Iwi Trust Board	29th July 2014 - Call, email and info sheet 25th August 2014 -Email 23rd July 2015 - Letter and info sheet 14th August 2015 - Call	No comments received from 2014 or 2015 correspondence. Please refer also to comments below from Te Aupouri representative.	
Te Runanga Nui o Te Aupouri Trust	30th July 2014 - Call, email and info sheet 25th August 2014 - Email 29th August 2014 - Email 5th September 2014 -Email 9th October 2014 - Email 9th December 2014 - Presentation to Northland iwi leaders 23rd July 2015 - Letter info sheet 14th August 2015 - Call	In July 2014, a request was made on behalf of Te Hiki iwi CEs and Chairs for Shell and other operators to refrain from actively engaging with Northland iwi until the governing iwi group reply with joint suggestions as to the best way to engage. Specific comments received from CE of the Trust on 29 August 2014 – *"In light of the events at the recent meeting between Statoil and iwi I've been trying to work out how this can best be addressed. The Statoil meeting showed that there are a number of Te Hiku iwi members who are not prepared to listen to what's being proposed and would prefer immediate confrontation. At the same time, iwi organisations are criticised for meeting industry representatives without notifying these as public meetings.*	Shell replied acknowledging their perspective and will take their steer on engagements moving forward. Shell offered to share its 100+ year NZ story and how we engage with iwi and hapu/runanga in Taranaki, Otago and Southland regions.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
		As you will know there are a number of industry groups attempting to meet with the various Te Hiku iwi. Given that the Crown has already issued permits it is my preference (and that of other iwi managers and governors) to meet with industry to attempt to find ways to mitigate any potential risks to the environment, including iwi cultural and spiritual values. I will be discussing this with other iwi CEs and Chairs at a meeting due to be held on Saturday 6 September and hope to get back to you after that with our joint suggestions." No comments received from 2015 correspondence.	
Ngā Taonga o Ngāitakoto Trust	4th August 2014 - Call, email and info sheet. 6th August 2014 - Email 9th December 2014 - Presentation to Northland iwi leaders 23rd July 2015 - Letter info sheet 14th August 2015 - Call	Please see comments above from Te Aupouri representative. In 2014, Ngāi Takoto identified they would welcome the opportunity to discuss the project and would like a collective meeting with Te Hiku Iwi.	In 2014, Shell replied with our willingness to meet with Te Hiku Iwi at a time convenient to them.
Te Rūnanga o Te Rarawa	4th August 2014 - Email and info sheet 25th August 2014 -Email 9th December 2014 - Presentation to	No comments received. Please see comments from Te Aupouri representative.	

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
	Northland iwi leaders 23rd July 2015 - Letter and info sheet 14th August 2015 - Call	Request for information also from independent iwi member. Requested information on current seismic activity which there was none. No comments received on 2015 correspondence	
Te Rūnanga A Iwi O Ngāpuhi	25th July 2014 - Call, email and info sheet 29th July 2014 - Call 1st August 2014 - Call 7th August 2014 - Meeting 14th August 2014 - Call 21st August 2014 - Email 23rd July 2015 - Letter and info sheet 14th August 2015 - Call	Key issues around our operations are environment, foreshore and seabed. Fishing interests also important. It is important for Shell to meet with hapu members to inform them of its activities in the NCB. In addition, please see comments from Te Aupouri representative. Acknowledged email but no comments received	Shell provided information about our requirements under the DoC Code of Conduct and our mitigation measures and commitments in place. Examples given of recent GSB 2D Seismic Survey. Shell offered to supply independent marine mammal observation information if interested. Shell talked about the MMO training undertaken by two hapu members from Southland and Taranaki and our desire for them to be independent observers on our NCB survey. Shell showed where deep sea fishing operations are (along the ridges of the permit) and only in the winter time. A request pending for contacts of all Nga Puhi contacts to engage in the future

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
			Shell to work with PEPANZ to host Northland iwi and council delegates on their Taranaki onshore tour to learn more about our industry in NZ.
Te Roroa Whatu Ora Trust	29th July 2014 - Call, email and info sheet 25th August 2014 - Email 23rd July 2015 – Letter	No comments received. Please see comments from Te Aupouri representative.	
Te Uri o Hau Settlement Trust	29th July 2014 - Call, email and info sheet 26th August 2014 - Call and email 10th September 2014 - Email and info sheet 12th September 2014 - Meeting 16th September 2014 - Email 24th September 2014 - Email and NCB presentation 23rd August 2015 – Letter and info sheet 1st September 2015 - Call	Impact on Marine Mammals. Request for presentation to send on to its members. Request for overview of MMO and bird observations at conclusion of MBES work.	Shell provided information about our requirements under the DoC Code of Conduct and our mitigation measures and commitments in place. Examples given of recent GSB 2D Seismic Survey. Shell offered to supply independent marine mammal observation information if interested. Shell talked about the MMO training undertaken by two hapu members from Southland and Taranaki and our desire for them to be independent observers on our NCB survey. PDF copy of presentation sent 24/09. Final reports from NIWA are not expected until December.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
Ngā Maunga Whakahii o Kaipara Development Trust	29th July 2014 - Call, email and info sheet 25th August 2014 - Email 27th August 2014 - Email 29th August 2014 - Email 1st September 2014 - Email 5th September 2014 - Email and info sheet 18th September 2014 - Email and call 7th August 2015 – Letter and info sheet 28th October 2015 - meeting	Would welcome a visit to discuss the project as per message below - *"Nga Maunga Whakahii o Kaipara Development Trust is the legal entity that governs the operations and management of Ngati Whatua o Kaipara we have responsibilities to uphold the cultural heritage and values of Ngati Whatua o Kaipara that is embodied in the ethics of kaitiakitanga.* *Thank you for your email and we welcome you and your organisation to present us with the intent of your activities. Could you please come back to us with tentative dates and we will respond. "*	Meeting originally scheduled for November 2015. This meeting was eventually held on 28th October 2015. Shell provided information about our requirements under the DoC Code of Conduct and our mitigation measures and commitments in place. Examples given of recent GSB 2D Seismic Survey. Shell offered to supply independent marine mammal observation information if interested. There were no questions specific to the seismic survey activities.
Te Kawerau a Maki	9th October 2014 - Call, email and info sheet 23rd July 2015 – Letter and info sheet	The iwi authority thanked Shell for the information and stated they would respond hey have considered the email.	
Ngāti Whātua o Orakei	29th July - Call, email and info sheet 25th August - Email 8th October 2014 - Email and info sheet 10th October 2014 - Email	The scheduled meeting for 30 October has been moved by the iwi to early 2015. No comments received.	Shell provided information about our requirements under the DoC Code of Conduct and our mitigation measures and commitments in place. Examples given of recent GSB 2D Seismic Survey.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
	15th October 2014 - Email 17th October 2014 - Email and info sheet 24th October 2014 - Email and call 28th October 2014 – Requested meeting moved to another date. 18th August 2015 – Email 7th September 2015 – Email 28th October 2015 - Meeting		Shell offered to supply independent marine mammal observation information if interested. There were no questions specific to the seismic survey activities.
Ngāti Te Ata Claims Support Whānau Trust	1st July 2014 - Email and info sheet 25th August 2014 - Email 8th October 2014 - Email and info sheet	No comments received.	

Local councils

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
Far North District Council	3th July 2014 - Call, email and info sheet 7th August 2014 - Meeting 22nd August 2014 - Email 6th August 2014 - Email 8th September 2014 - Email 17th September 2014 - Email 24th September 2014 – Call 23rd July 2015 – Letter and info sheet 30th July 2015 – Letter received noting a response from the appropriate council department within 20 days. No follow up correspondence received.	No comments to make since the proposed area is out of their jurisdiction. Request from planning department for information around onshore exploration.	Shell offered to supply marine mammal sighting information to the council if interested. Shell supplied industry information on onshore exploration in NZ. Shell to work with PEPANZ to host Northland iwi and council delegates on their Taranaki onshore tour to learn more about our industry in NZ.
Whangarei District Council	4th July 2014 - Call, email and info sheet 7th August 2014 - Meeting 11th August 2014 - Email	No comments to make since the proposed area is out of their jurisdiction. Information requested on independent MMO training.	Shell offered to supply marine mammal sighting information to the council if interested. Shell supplied relevant information for MMO training.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
	21st August 2014 - Email 22nd August 2014 - Email and info sheet 26th August - Email 30th July 2015 – Letter and info sheet		Shell to work with PEPANZ to host Northland iwi and council delegates on their Taranaki onshore tour to learn more about our industry in NZ. This action was completed in December 2015.
Northland Regional Council	14th July 2014 - Call, email and info sheet 7th August 2014 - Meeting 22nd August 2014 - Email 28th August 2014 – Email 14th September 2014 – Email 30th July 2015 – Letter and info sheet 11th September 2015 – Meeting	No comments to make since the proposed area is out of their jurisdiction.	Shell offered to supply marine mammal sighting information to the council if interested. Shell to work with PEPANZ to host Northland iwi and council delegates on their Taranaki onshore tour to learn more about our industry in NZ. In addition to the notes above, in the 2015 meeting Shell provided information on social investment themes, and that MMO training for Ngāti Kuri iwi member. Offered to look at other social investment proposals council wished to put forward.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
	14th September 2015 – email		
Auckland Council	16th July 2014 - Call, email and info sheet 25th August 2014 - Email and info sheet 29th September 2014 - Email and info sheet 7th August 2015 – Letter and info sheet 23rd August 2015 - Letter received requesting we make contact with the Biodiversity and Coastal Strategy team. 3rd September 2015 – email 4th September 2015 – email	No comments received. No comments to make since the proposed area is out of their jurisdiction	Shell provided information about our requirements under the DoC Code of Conduct and our mitigation measures and commitments in place. Examples given of recent GSB 2D Seismic Survey. Shell offered to supply independent marine mammal observation information if interested.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
Kaipara District Council	16th July 2014 - Call, email and info sheet 22nd August 2014 - Email and info sheet 8th October 2014 - Email and info sheet 9th October 2014 – Email 7th August 2015 – Letter and info sheet 14th August – call 18th August – call	No questions at this stage from the council. No questions at this stage from the council.	

Deep sea fishery groups

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
Deep Water Fisheries Group, Sealord, Southern Inshore	21st July 2014 - Meeting 22nd July 2014 - Email and info sheet 10th August – Email and info sheet 11th August - Email	Deep water fishing in the NCB area only occurs during the winter season and on the ridges which lie outside the basin.	No concerns with the proposed activities. However, DWFG did request that we notify them prior to our activities taking place so they could notify their members From the 2015 correspondence. "My view is that there is no change in situation so our previous views stand but I shall give it a few days and confirm to you any feedback." No additional feedback received.
Sanford Fisheries	9th July 2014 – Email 10th August 2015 – Email and info sheet 18th August – Phone call and follow up email.	Sanford showed an initial interest in meeting. However, a meeting date has not yet been achieved. Phone call in August 2015 resulted in specific questions regarding vessel movements and timing, and effects on fish.	Information provided in response to questions raised during phone call as follows – *" **Re: supplying an advanced schedule of vessel movements** LINZ will send out a public Notice To Mariners of the vessels movements 2 – 4 weeks ahead of the survey, which should be received by Sanfords.* ***Re: is there flexibility of the travel plans?** Whilst we have a survey design, the general schedule for acquisition sequencing won't be finalized until we discuss this with the successful Tenderer. We can certainly inform you about this in the coming months. It should be noted that the acquisition schedule*

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
			can change on a daily basis to align with the metocean (wave) conditions. ***Question: In regards to Tuna fishing*** *Based on the information received from MPI and discussions with Sealord and the Deep Water Fisheries, our current understanding is that the New Caledonia Basin (NCB) is not used very much for commercial fishing activities – only for Orange Roughy on the flanks, which occurs during the winter months (not during our seismic survey over summer).* *Do your vessels fish for Tuna within the deepwater NCB survey area? Or is it through where the vessel travels between the Basin and Port Taranaki?* *If it is while travelling to/from the Port, then yes we are happy to communicate our vessel movements and plan.* *While in transit no array or sources will be deployed, it will just be like any vessel transiting along the NZ coast and we can advise the master(s) to stay well clear of fishing vessels.* ***Article on Seismic Surveys and Fish:*** *Attached is an article from the International*

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
			Association of Geophysical Contractors. *Please do not hesitate to contact me if you have any questions. In addition, Grant and I are happy to speak with you in person when you return next month."*

Relevant government departments, NGOs and Academics

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
Kaitaia and Whangarei Department of Conservation	14th July 2014 - Email 25th July 2014 - Email 4th August 2014 - Email and info sheet 13th August 2014 - Call and email 18th August 2014 - Email 20th August 2014 - Email 1st September 2014 - Meeting 3rd September 2014 - Call 18th September 2014 - Email and NCB presentation	Appreciated the overview of the Code of Conduct. Request for copy of the presentation. May request another presentation for their frontline staff who field general enquiries from the community. Remarked about the benefits. iwi would receive by knowing more about our activities and the Code. Unfortunately the disrupted meetings of another operator have prevented this from happening. Remarked that the humpback whale migratory path was down the East	PDF copy of presentation sent 18/09. Shell provided a regulatory overview for the oil and gas industry and DoC's role in relation to the Code of Conduct, together with the mitigation measures there-in. Shell talked about its willingness to engage, however we have received advice from Te Hiku Iwi to refrain from doing so at this time. Shell shared its 100+ year NZ story and how we engage with iwi and hapu/runanga in Taranaki, Otago and Southland regions. This information to be added to the

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
	30th July 2015 – Letter and info sheet 8th August – Call to Kaitaia office	coast to Doubtful Bay (Northland). Noted that marine mammal strandings are of community concern. Advised that we should talk with Dr Ingrid Visser (Orca Research Trust) and Dr Karen Stockin (Massey University) for input to the MMIA. Opportunity for 'local' MMOs. Sharing scientific knowledge with their services staff.	MMIA. Discussed potential to voluntarily support necropsy on a holistic scientific basis Both have been contacted for their input. Shell talked about the MMO training undertaken by two hapu members from Southland and Taranaki and our desire for them to be independent observers on our NCB survey. Shell will look at local opportunities in the future. Shell happy to share any non-commercially sensitive information.
University of Auckland – Dr Rochelle Constantine	22nd August 2014 - Call, email and info sheet 26th August 2014 - Email 5th September 2014 - Email	Dr Rochelle Constantine advised that she could not provide additional help beyond what EHOL appeared to already have in place.	In response, Shell offered to talk through the MMO findings at the conclusion of its activities if interested.
Massey University – Dr Karen Stockin	4th September 2014 - Email and info sheet 8th September 2014 - Email 22nd September 2014 - Email	Very little marine mammal research on the West Coast of New Zealand. Relative absence of marine mammals during the MBES survey could be seasonal. In addition, surprised we did not see more common dolphins and	Shell willing to share marine mammal observation data and acoustic data f that may assist research interests. Provided preliminary information on sightings during the bathymetric survey in the NCB.

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
	6th October 2014 – Meeting 24th August 2015 – Letter and info sheet	with the range of the fur seals.	Agreement to keep in touch on potential collaborative opportunities in the future.
University of Otago – Prof Ewan Fordyce	29th September 2014 - Email and info sheet	Shell enquired about the ear bone examination results from two whale strandings off the Northland Coast in August 2014. Shell indicated its interest in including the information in its NCB MMIA. Note: no seismic surveys were undertaken during this time.	Prof Fordyce kindly declined to provide the feedback after consulting with his colleague.
Orca Research – Dr Ingrid Visser	2nd September 2014 - Email and info sheet 8th October 2014 - Email and info sheet	No comments received.	
Project Jonah – Daren Grover	31st August – email 10th August – Letter 10th September - Meeting	Appreciated the overview of how seismic surveys are conducted under the 2013 Code of Conduct. A specific question was raised about the potential presence of deep diving beaked whales within NCB and whether the pre-start observation period was adequate and whether the	Advised that there were very few observations of beaked whales in the DOC marine mammal data base and none during the 2014 MBES survey, so unlikely that the presence or absence would be ascertained. To extend the observation/pre-warning period, EHOL has agreed to

Name of organisation	Date of correspondence / contact	Comments received	Outcomes
		support vessel could precede the seismic vessel when entering the area to make observations.	• Opportunistic use of the support vessel (when available) to report any observations of marine mammals ahead of the seismic vessel when entering the survey area; and • Increasing the soft-start period when starting or re-starting the survey in deep intra-basin waters.

2 PROJECT DESCRIPTION

2.1 OVERVIEW

The subject activity of the MMIA is a 2D MSS in PPP 55377 of the NCB, north-west of New Zealand's North Island. The survey is anticipated to commence in late 2015 and has an expected duration of four months.

2.2 PROJECT LOCATION

The operational location for the NCB 2D MSS is within the NCB from approximately 200 km from the west coast of New Zealand to the edge of the New Zealand Extended Continental Shelf (ECS) (refer to *Figure 1.1 Location of PPP 55377 in the New Caledonia Basin*). This area is sometimes also referred to as the Aotea Basin, and is bounded by the Challenger Plateau/Lord Howe Rise to the south and the West Norfolk Ridge to the north. In this report the NCB refers to that area of the basin that falls within New Zealand waters.

The survey will take place over an operational area of approximately 205,000 km^2 situated mostly within PPP 55377 in the NCB. Lines are generally programmed to the edge of the permit boundary and some data will be acquired into adjacent areas to provide tie lines. Tie-lines are required to establish a reference point for the seismic data collected. The ties are usually to areas covered by previous seismic surveys or marine drilling programmes. The operational area is therefore comprised of the following:

- A survey acquisition area of 2D seismic lines within which seismic acoustic emissions will occur for the purposes of acquiring data within the PPP;
- A surrounding buffer area (of approximately 20 km width) in which the seismic source may be discharged at or below full capacity for the purpose of seismic line turns (run-ins and run-outs), source testing and soft starts; and
- Extension areas encompassing tie-lines to legacy seismic grids or wells.

2.3 PROJECT TIMING

The seismic survey is planned to be undertaken in the summer window of 2015/2016. The survey is proposed to commence in late 2015 and with a duration of approximately four months. The exact duration is dependent on the operating conditions encountered during the survey.

2.4 MARINE SEISMIC SURVEYS

Seismic surveys are routinely conducted in New Zealand. The objective of the seismic survey is to map the subsurface strata to understand the geology and help determine the presence or absence of hydrocarbons. Seismic surveys use mechanically generated sound waves, which reflect off different subsurface strata to produce a picture of the geology beneath the seabed.

Figure 2.1 shows a graphical representation of a 2D seismic survey. The sound waves are generated by airguns towed at the rear of the vessel (approximately 200 m from the stern of the vessel. The airguns use compressed air to generate sound waves that penetrate through the water and substrata, and then reflect back to the surface, where it is recorded by hydrophones (the acoustic receivers located in streamers). The time taken for the sound wave to return to the hydrophones is influenced by the density of the underlying seafloor. Interpreting this information can provide valuable detail on the presence of gases or possible fluids beneath the seafloor.

The following sections provide more detailed descriptions of the various activities involved in conducting 2D MSS.

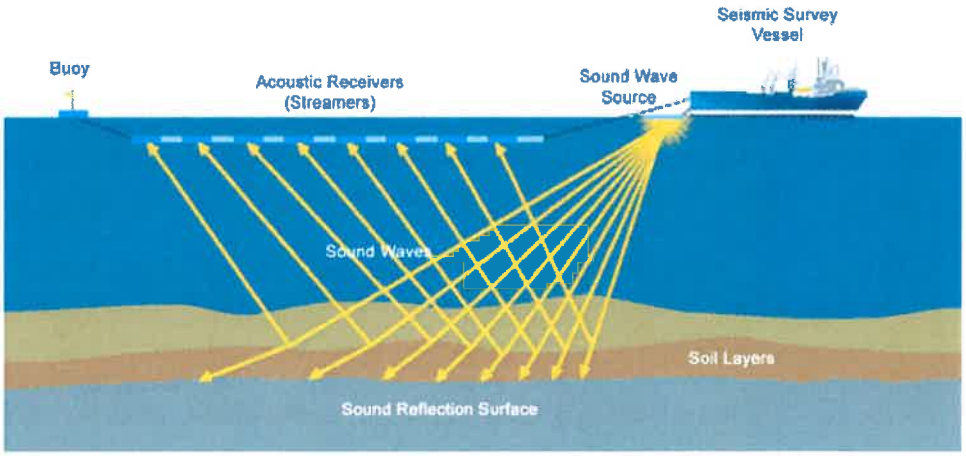


Figure 2.1 ***Graphical Representation of a Marine Seismic Survey***
Source: http://fishsafe.eu/media/7477/seismic_surveys_02.gif

2.4.1 *Crewing and Logistics*

It is anticipated that a crew of approximately 50 personnel will be required to operate the vessel and seismic equipment throughout the Project, working on a crewing rotation of approximately five weeks. Therefore, every five weeks the seismic vessel will return to Port Taranaki in New Plymouth, where it will conduct the crew change and resupply the vessel.

Bunkering of the vessel with marine gas oil is intended to occur within Port Taranaki during crew changes and resupply, with no fuel transfers planned to take place at sea.

The survey area is outside of helicopter operating range from mainland New Zealand. However, the survey vessel will have a serviceable helideck that could be used for medevac if required. In this case, the survey vessel would be required to sail towards shore to meet the helicopter within its operational range (approximately 300 km).

2.4.2 *Seismic Vessels*

The seismic vessel selected for the Project is the *Hai Yang Shi You 718*. This vessel is 79.8 m long and accommodates up to 60 crew (including the ship's crew and survey team) (see *Figure 2.2*). A New Zealand maritime crew of approximately 19 people will help to operate the vessel.

Figure 2.2 ***Seismic Vessel Hai Yang Shi You 718***

The seismic vessel will be accompanied by a support vessel. The support vessel will be the *PT Fortitude*, which will be mobilised from Brisbane, Australia. The *PT Fortitude* is 34 m long and will have a crew of approximately eight (8), although the vessel has berths for up to 15 personnel. This vessel will provide a supply run service to the seismic vessel with fresh food and spare parts and when on station with the survey vessel will undertake seismic chase boat duties: acting as a standby vessel during in sea maintenance and guarding the towed equipment from vessel traffic (if any). The support vessel is discussed further in *Section 2.4.8*.

2.4.3 *Data Acquisition*

During seismic acquisition the vessel will steam at approximately four to five knots in a straight line on predetermined survey lines. At the end of each line, the vessel will undertake a wide, slow turn to align the seismic equipment with the next line. During this time the acoustic sources are not normally in operation; however they will generally be left in the water to reduce the time and hazards associated with retrieving and redeploying them.

2.4.4 *Mobilisation of the Vessels to the Marine Seismic Survey Area*

Vessels will be mobilised from Port Taranaki, New Plymouth, New Zealand. The vessels will be fully provisioned and bunkered before sailing to the project area.

Table 2.1 ***Summary Table of Seismic Survey Vessel and Equipment Specifications***

Vessel Size	79.8 m
Duration of Survey	Approximately four months
Survey Area	Approximately 205,000 km^2
Total Seismic Source Size	Up to 4,750 cubic inches
Peak to peak in bar-m	150 - 165
Zero to peak in bar-m	74 - 80
RMS pressure in bar-m	254 -256
Number of Streamers	One
Length of Streamers	Approximately 10,000 m
Towing Depths of the Source and Streamer	Source ~ 8 m (± 1 m); Streamer -50 m (maximum)
Towing Speed	Approximately 4 - 5 knots

2.4.5 *Sound Source*

The objectives of the seismic survey are to map the sediments above the basement and to detect the Moho formation, both of which are critical to understanding the basin's prospectively. The Code specifies that the lowest practicable power levels for the sound (acoustic) source should be used to achieve the geophysical objectives.

The sources strength has been selected to enable the objectives to be achieved taking into account water depth in the permit area (over 3,000 m), sediment thickness (over 5,000 m) and the depth of the Moho target formation (approximately 16,000 m). The seismic source will be a single source 4,750 In^3 array. This source is smaller than that used during the 2010 New Zealand Petroleum and Minerals Pegasus/Bounty Trough/Great South Basin survey (5,400-6,000 In^3) and similar to sources used recently in the Taranaki Basin (4,400 In^3) and Great South Basin (4,230 In^3). This is considered to be the lowest practicable source level due to the requirement to image structure down to and beyond the basement.

Airgun arrays are formed of 20 - 30 individual airguns. Each airgun is comprised of two high pressure chambers. Compressed air is supplied to the airgun via a hose to the upper chamber. From the upper chamber the compressed air bleeds into the lower chamber, charging the airgun. To operate the airgun a solenoid is actuated, releasing the triggering piston (between the upper and lower chambers). The piston is pushed into the upper chamber allowing the compressed air to be released through ports in the airgun *(Figure 2.3)*. Compressed air in the upper chamber then forces the piston back to the armed position.

The seismic source will be fired at intervals of 37.5 m along each survey line. This shot point distance has been increased from the standard shot interval of 25 m. This reduces the overall number of shots required for the survey by approximately 30%.

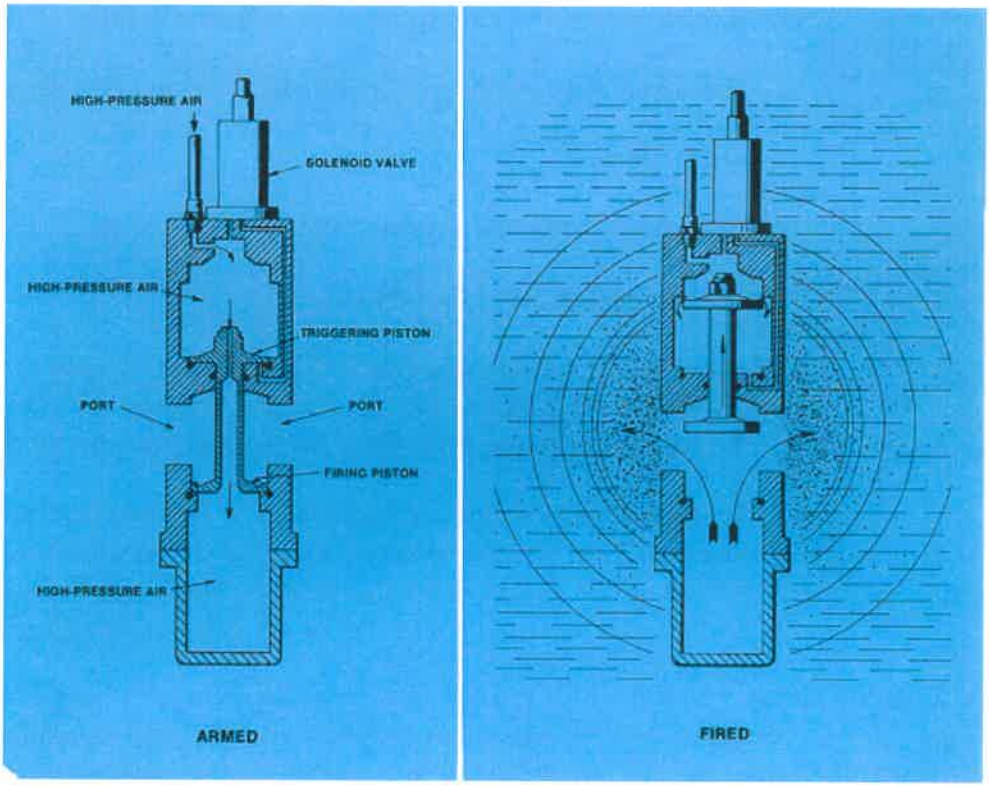


Figure 2.3 *Schematic of Airgun Firing*
Source: www.bolt-technology.com

2.4.6 Streamer

The returning sound waves are recorded by a series of receivers attached to a streamer towed by the seismic vessel. The receivers (hydrophones) on the streamer convert the reflected sound waves into electrical pulses that are returned to the vessel for digitising and future onshore processing.

In 2D MSS only one streamer is deployed from the rear of the vessel. The length of the streamer determines the amount of data recorded and the depth and angle of the reflected sound wave from the source. The depth of penetration is approximately one and half to two times the length of the streamer.

The streamers in use for the Project will be modern Sentinel solid streamers. Solid streamers have lower environmental impact when damaged at sea compared to legacy kerosene filled fluid streamers. A solid streamer is commonly made-up of the following components:

- Acoustic receivers (hydrophones). These are usually spaced approximately 1 m apart and coupled into groups with a spacing of 12.5 m along the streamer;
- Electronic modules and electrical transmission system;
- Stress members that provide additional strength to the streamer;
- Foam filling;
- Protective skin for the streamer; and
- Streamer depth controllers (birds).

The streamer is usually divided into sections or lengths of approximately 100 to 150 m. This allows the removal and replacement of any damaged or malfunctioning components without having to replace the whole streamer.

At the rear of the streamer is a tailbuoy. The tailbuoy is towed at the surface and has a GPS so the end of the streamer can be accurately mapped. This is important in the future digitising of the seismic results as the streamer is normally offset from the vessel due to the streamer length and the effects of winds, tides, and currents on the cable.

Streamer depth is dependent on the geophysical objectives of the Project. The streamer may be deployed in a flat or slanted depth profile. The current Project is expected to use a flat streamer profile for the majority of the survey. The depth is controlled by a series of 'birds' that are attached at intervals along the submerged streamer. These birds have fins or wings that are used by the operator to maintain the determined depth during the survey.

2.4.7 *Planned Operational Discharges from Seismic Vessel*

The key planned operational discharges from the seismic vessel will be:

- Sewage wastes;
- Garbage wastes; and
- Deck drainage.

Sewage generation rates will be in the region of 200 litres (L) per person per day. Based on an anticipated crew of 50 persons, volumes generated and discharged to sea will consequently be approximately 10,000 L per day over the duration of the proposed seismic survey.

Garbage wastes can similarly be estimated to be generated at a rate of approximately 100 kilograms (kg) per day (assuming a 2 kg per person per day average). *Table* 2.2 summarises garbage disposal restrictions under the *International Convention for the Prevention of Pollution from Ships* (MARPOL) to which the seismic vessel will adhere.

Table 2.2 ***Garbage Wastes and MARPOL***

Garbage Type	Appropriate Disposal Route
Plastic – including synthetic ropes, fishing nets, packaging materials and plastic bags	Should be compacted and stored onboard for transfer to shore for disposal at an appropriate disposal facility.
Paper, rags, glass, metal, crockery and similar refuse	Flammable items should be separated and burned if incinerator available. All others items should be stored onboard until disposal in a controlled facility onshore is possible.
Maintenance and operational waste: rags, oil soaks, used oil, batteries	Flammable items should be separated and burned if incinerator available. All others items should be stored onboard until disposal in a controlled facility onshore is possible.
Food waste	If biodegradable, then can be discharged offshore. Processing as required under Marine Protection Rules Part 170.
Sewage	Should be treated by the ship's sewage treatment facility in accordance with national and international standards, based on the year of manufacture.

Deck drainage consists of water from rain and deck washings. Any water that is contaminated by machinery will go to the oily water treatment system, with uncontaminated deck drainage being discharged overboard.

2.4.8 Support Vessel

A single support vessel will be utilised during the survey. This vessel will be the PT Fortitude, which has a length of 34 m and will be manned by a crew of approximately eight (8) personnel.

It is anticipated that the support vessel will generally spend up to a week in transit to and from Port Taranaki and the survey location. It will remain with the survey vessel for one to two weeks on each trip depending on the need for it to return for more supplies. *Figure* 2.4 below shows the support vessel.

Figure 2.4 ***PT Fortitude***
Source: Pacific Tug

3 ADMINISTRATIVE FRAMEWORK

3.1 INTRODUCTION

Offshore oil and gas activities in New Zealand are managed under a number of Acts and Regulations. In relation to MSS, the governing Act is the *Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012* (the EEZ Act).

Under this Act, marine seismic surveys are considered to be a permitted activity (*Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013*), as long as the survey complies with the *2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations* (the Code).

Further detail on these Acts and Regulations, as well as an overview of international conventions and regulations is provided in the following sections.

3.1.2 *National Legislation*

The Marine Mammal Protection Act 1978 and the Marine Mammal Protection Regulations 1992

The Marine Mammal Protection Act 1978 provides for the protection of all seals, sea lions, dolphins and whales, making it an offense to harass, disturb, injure or kill marine mammals. The Act is administered by the Department of Conservation, and sets out principles for conservation management strategies and plans including the establishment of Marine Mammal Sanctuaries (five of which include provisions that regulate the conduct of seismic activities within their boundaries). The Act also establishes a requirement for reporting of any accidental death or injury of marine mammals (Section 16 (2)).

The Marine Mammals Protection Regulations 1992 make provisions for protection, conservation and management of seals, sea lions, whales and dolphins by regulating human contact or behaviour by commercial operators and others that may interact with marine mammals. Of particular relevance to the MSS are the requirement to endeavour to operate vessels and aircraft so as not to disrupt the normal movement or behaviour of any marine mammal (Regulation 18 (a)). The Regulations also specify approach distances for whales.

The Exclusive Economic Zone and Continental Shelf (Environment Effects) Act 2012 (the EEZ Act)

The proposed seismic survey activities will be undertaken outside the 12 nautical mile limit of New Zealand's territorial waters, and partially within New Zealand's EEZ, with the majority of the survey area being outside the EEZ but over the Extended Continental Shelf. The primary piece of national legislation that seeks to manage the environmental impacts of activities in this area is the EEZ Act. The EEZ Act was developed to fill the jurisdictional and functional gaps present in the management of offshore activities within New Zealand's EEZ and continental shelf that existed prior to its enactment. The EEZ Act seeks to manage the environmental effects of activities in New Zealand's oceans and to protect them from the potential environmental risks.

The EEZ Act came into force on 28 June 2013 when the *Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013* (the Regulations) were promulgated. These regulations prescribe the activities that are to be permitted activities for the purposes of s.20 of the EEZ Act and the conditions for undertaking these permitted activities. Under s.7 of the Regulations, seismic surveys are prescribed as permitted activities, subject to compliance with the Code (see below).

The 2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations (the Code)

The Code was developed by the DOC and came into effect on 1 August 2012. Shell New Zealand voluntarily signed up to the Code on its introduction and the Code has since been updated and a revised 2013 version of the Code is now a regulatory requirement under the EEZ Permitted Activities Regulations. The objective of the Code is to minimise acoustic disturbance to marine mammals from seismic survey operations. The guidelines outlined aim to minimise potential impacts without unduly affecting normal operations.

Within the Code, the size or energy of the acoustic source is considered when determining the appropriate mitigations required to minimise potential effects on marine fauna. The proposed seismic survey would be classified as a Level 1 survey with a total combined operational capacity of the acoustic source exceeding 427 cubic inches. Of each of the three survey classifications within the Code, Level 1 surveys are subject to the most stringent requirements for marine mammal protection (DOC, 2013). The key requirements of a Level 1 survey are:

- Pre-survey planning including notification of DOC and the submission of an MMIA;
- Requirements for two qualified MMOs and two qualified PAM operators on board the survey vessel;

- Specific operational requirements around pre-start observations, delayed starts and shutdowns; and

- Recording and reporting of marine mammal observations and any mitigation measures implemented during the survey.

The Code provides guidance on the information required by DOC in an MMIA. The requirements of the Code, and where the information can be found in this MMIA, are detailed in *Table 3.1*:

Table 3.1 ***MMIA Requirements and Location of Material in this MMIA***

Describe the activities related to the proposed marine seismic survey;	*Section 2 – Project Description*
Describe the state of the local environment in relation to marine species and habitats, with particular focus on marine mammals, prior to the activities being undertaken;	*Section 5 – Existing Environment*
Identify the actual and potential effects of the activities on the environment and existing interests, including any conflicts with existing interests;	*Section 6 - Screening and Scoping Results,* *Section 7 – Impact Assessment Results*
Identify the significance (in terms of risk and consequence) of potential negative impacts and define criteria used in making each determination;	*Section 4 – Methodology* *Section 7 – Impact Assessment Results*
Identify persons, organisations or tangata whenua with specific interests or expertise relevant to the potential impacts on the environment;	*Section 1.5 – Consultation and Engagement Activities* *Section 5.4 – Cultural, Social and Economic Environment*
Describe any consultation undertaken with persons described above and specify those who have provided written submissions on the proposed activities;	*Section 1.5 – Consultation and Engagement Activities*
Include copies of any written submissions from the consultation process;	*Section 1.5 – Consultation and Engagement Activities*
Specify any possible alternative methods for undertaking the activities to avoid, remedy or mitigate any adverse effects;	*Section 1.4.2 – Alternative Methods* *Section 7.6 and 7.7 – Impact Assessment Results*
Specify a monitoring and reporting plan; and	*MMMP (to be submitted)*
Specify means of coordinating research opportunities, plans, and activities relating to reducing and evaluating environmental effects."	*Section 7.6 and 7.7 – Impact Assessment Results* *MMMP(to be submitted)*

Additionally, the Code specifies that *"An MMIA will contain sufficient information to enable the Director-General to understand the nature of the proposed marine seismic survey activities and their effects on the environment, in such detail as corresponds to the scale and significance of the effects that the activities may have. Information will be provided on risks of negative impacts on the particular*

environmental sensitivities of the proposed area of operations, and consideration will be given to the timing, duration and intensity of the survey."

Areas of Ecological Importance

Areas of Ecological Importance (AEI) are marine areas under the protection of the New Zealand government for their importance to marine mammals and other important marine species.

The Project Area of Influence does not overlap with an AEI (see *Figure 1.1*) and therefore there is no requirement to conduct Sound Transmission Loss Modelling (STLM).

Other National Legislation

While the Project is also subject to the following pieces of national legislation they are of lesser influence to this MMIA than those outlined above:

- *Maritime Transport Act 1994*, and the associated Marine Protection Rules and Advisory Circulars under the *Maritime Transport Act 1994*, plus Maritime Rules. These pieces of legislation regulate navigation, safety and pollution prevention requirements for all vessels in New Zealand waters, including the vessels engaged in MSS;
- *Biosecurity Act 1993*, as amended, including the New Zealand Import Health Standard for Ballast Water from all Countries. This piece of legislation is relevant to MSS vessels coming to New Zealand from foreign ports;
- *Continental Shelf Act 1964*;
- *Territorial Sea, Contiguous Zone, and Exclusive Economic Zone Act 1977*; and
- *Wildlife Act 1953.*

3.1.3 *International Conventions, Treaties, Agreements, and Programs*

The following international agreements and conventions may affect seismic activities in marine waters off New Zealand.

Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)

The Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) was adopted by the United Nations Educational, Scientific, and Cultural Organization General Conference on the 16 November 1972. The World Heritage Convention aims to promote cooperation among nations to protect heritage around the world that is of such outstanding universal value that its conservation is important for current and future generations. New Zealand ratified the convention in 1984. There

are three World Heritage sites in New Zealand including Tongariro National Park, Te Wāhipounamu - South West New Zealand, and the subantarctic islands.

International Convention for the Prevention of Pollution from Ships (MARPOL), 1973 as Modified by the Protocol of 1978

MARPOL is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. MARPOL is a combination of two treaties adopted in 1973 and 1978 respectively and regularly amended by the International Maritime Organization since that time. New Zealand is party to four of the annexes of MARPOL, specifically Annex 1 - Oil, Annex 2 - Noxious Liquid Substances Carried in Bulk, Annex 3 - Harmful Substances Carried in Packaged Form and Annex V - Garbage.

The provisions of the MARPOL convention are given effect within the *Resource Management Act 1991*, the *Maritime Transport Act 1994* and the Marine Protection Rules. Specifically, these national regulations specify the measures for pollution prevention and waste management practices on board the vessels that will be engaged in the MSS. Additionally, the seismic vessel and any support vessels are bound by all MARPOL Annexes to which their flag state is Party.

International Regulations for the Prevention of Collisions at Sea, 1972

The International Regulations for the Prevention of Collisions at Sea (COLREGS) specify the conduct of vessels on the high seas, and provides a standard set of operational expectations and navigation procedures for maritime vessels. New Zealand ratified the COLREGS in 1972.

The COLREGS are implemented in New Zealand under the *Maritime Transport Act 1994*. These regulations specify the navigational and operational measures that must be implemented by the vessels engaged in the MSS, including those specifically relevant to vessels with restricted navigational capacity such as during active surveys when in-water equipment limits the manoeuvrability of the vessel.

United Nations Convention on the Law of the Sea, 1982

The objective of the United Nations Convention on the Law of the Sea (UNCLOS) is to set up a comprehensive legal regime for the sea and oceans; including rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment.

New Zealand ratified UNCLOS in 1996, and it is in force in New Zealand via a number of statutes including the *Crown Minerals Act 1991* (through which petroleum exploration permits are awarded) and the *Maritime Transport Act 1994* and Rules made under the *Maritime Transport Act 1994*.

Convention on Biological Diversity, 1992

The objective of the Convention on Biological Diversity is the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. New Zealand ratified the convention in 1993.

The Convention on Biological Diversity is implemented in New Zealand through the New Zealand Biodiversity Strategy. The strategy identifies a desired outcome for coastal and marine biodiversity by 2020 including maintenance of marine habitats and ecosystems in a healthy functioning state, the protection of rare and threatened marine species from human threats, and no establishment of undesirable introduced species.

The 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972

The objective of Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Convention) is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. In 1996, the London Protocol was agreed to further modernize the London Convention and, eventually, replace it. Under the London Protocol all dumping is prohibited, except for possibly acceptable wastes on the so-called "reverse list".

In New Zealand, dumping standards within and outside the 12 nautical mile limit are derived from the 1996 Protocol and are implemented under the new Exclusive Economic Zone and Continental Shelf (Environmental Effects) – Discharge and Dumping Regulations 2015. A consent is required for any intentional dumping of waste in the marine environment and the Environmental Protection Authority is responsible for issuing these consents in the EEZ.

4 IMPACT ASSESSMENT METHODOLOGY

4.1 INTRODUCTION

This MMIA was conducted over a series of stages, with each stage providing increased layers of rigour, and included:

- Project Screening;
- Project Scoping;
- Project and Baseline Definition; and
- Impact Assessment.

EHOL works in accordance with Shell global internal requirements for undertaking impact assessments. These are detailed in Shell's internal Health Safety Security Environment and Social Performance Control Framework, and have been incorporated into this MMIA. Shell's standards are similar to the International Finance Corporation Guidelines for Social and Environmental Impact Assessment (*Figure 4.1*). The intention of these standards is to produce internationally consistent levels of impact assessment that maintains best practice regardless of the location of the operation.

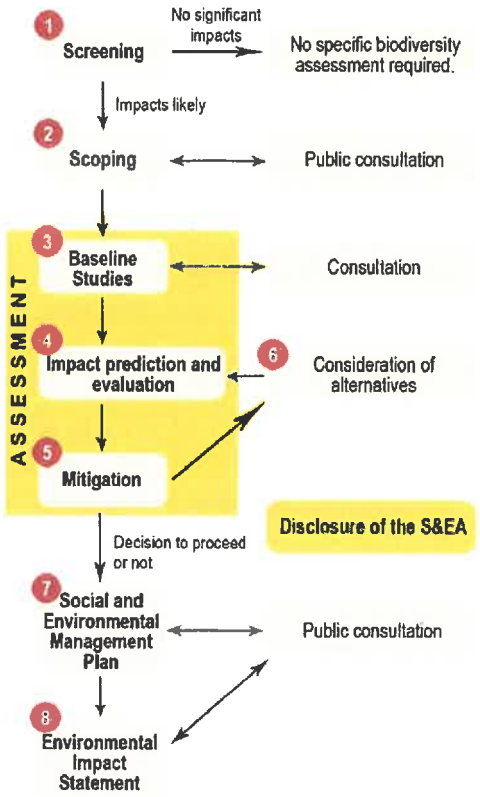


Figure 4.1 *IFC IA Steps*
Source: IFC, 2006

4.2 *IMPACT ASSESSMENT SCREENING*

Screening is a high-level assessment of whether an impact assessment is required based on the location, scale and duration of project activities. It also assesses the presence of significant biodiversity value or potential impacts to ecosystem services.

Screening was conducted by EHOL to identify impact assessment requirements for the Project under the Code and Shell internal standards. The process assessed all legislative and internal corporate regulations and standards to determine if the proposed development requires an impact assessment. If an impact assessment is deemed to be required, the level of assessment is determined at this early stage.

The level of assessment is divided into three categories:

Category A: A proposed project is classified as Category A if under normal and abnormal operations it is likely to have significant adverse impacts, that are sensitive, diverse or unprecedented.

A potential impact is considered 'sensitive' if it may be irreversible (e.g. lead to loss of a major natural habitat), affect vulnerable groups of ethnic minorities, involve involuntary displacement and resettlement, or affect significant cultural heritage sites.

Category B: A proposed project is classified as Category B if its impacts under normal and abnormal operations are site specific, and few if any are irreversible. Potential adverse impacts are less adverse than those of Category A projects or the project is proposed to take place in a context that is less sensitive to the intended operation or activity.

Category C: A proposed project is classified as Category C if its impact and footprint under normal and abnormal operations are limited and negative impacts are likely to be minimal. In addition, the project is proposed to be undertaken in an environment that is well known, not considered to be sensitive to the operation or activity and for which a best operating practice exists. Category C projects are up-rated to Category A or B if regulatory authorities require an impact assessment.

A screening assessment undertaken by EHOL in May 2013 determined that the Project falls under Category B. It was considered that the impacts of a 2D MSS under normal and abnormal operations were site specific, and few if any were irreversible.

It was not considered to be a Category C project, as the environment is not well known in the NCB and there is no conclusive data to determine whether the area is sensitive or not. As a Category B project, the Impact Assessment goes through an internal Technical Assurance process within Shell.

4.3 IMPACT ASSESSMENT SCOPING

Scoping is a desktop process that determines what information is available and identifies gaps that need to be addressed during the impact assessment process. Scoping reviews the available baseline (physical, biological and social) data and determines whether there are any significant gaps based on the activities proposed.

These gaps are then addressed through further research, baseline surveys and consultation, to ensure that the assessment is as comprehensive as possible.

A simple scoping assessment was undertaken by EHOL in June 2014, where it was determined that there was a lack of baseline information in the permit area.

EHOL commissioned NIWA to undertake a baseline investigation into all available scientific data in the region of the survey, the report of which was produced in July 2014 (NIWA, 2014). In addition, EHOL commissioned two marine observers; one marine mammal observer and one seabird observer to accompany the MBESS in August and September 2014. The findings from this survey and the NIWA study have been included in the baseline section of this MMIA.

In addition to the scoping assessment conducted by EHOL in June 2014, further scoping was undertaken by ERM in accordance with ERM's standard methodology. This scoping exercise documented the resources and receptors potentially present within the Area of Interest (AOI) (refer to *Section 4.3.2*), and assessed which of these the Project activities may interact with and potentially effect.

4.3.1 *Identifying the Project Activities*

To initiate the scoping process, the MSS activities were described based on information provided by EHOL. This stage of the MMIA entailed gathering information from the engineering, geotechnical and environmental teams to define the Project design as far as possible given the early stages of the Project timeline. This Project design was then broken down into a series of discrete activities which could more readily be assessed for impact against the receiving environment.

4.3.2 *Establishing the Area of Interest*

Throughout the impact assessment process, the extent of the AOI took into account the specific aspect and the types of effects considered and may therefore vary between aspects.

The AOI for the Project has been defined to include all that area within which it is likely that significant impacts could result. This takes into account:

- Project operational area: the site of the Project, being the physical extent of the area where seismic acquisition and line turns will take place;
- Associated activities: activities that are essential to, but are not developed as part of, the Project (e.g. support vessel). Again, the areas in which aspects of the environment could experience significant impacts due to these activities are also included;
- Potential areas affected by impacts from unplanned events resulting from the Project (i.e. loss of equipment); and
- The nature of the affected resource or receptor, the source of impact and the manner in which the resultant effect is likely to be propagated beyond the project operational area.

For the purposes of this MMIA the AOI where it is considered that significant impacts may occur is defined as the extent of the seismic lines, with a conservative 20 km turnaround buffer to allow for the full extent of the streamer to pass through each end of the line. The extent of the AOI is shown below in Figure 4.2.

Figure 4.2 Area of Influence (AOI) for the Project

4.3.3 *Assessing Project: Resource/Receptor Interactions*

The nature and availability of baseline environmental and Project information, as well as stakeholder input, is such that the identification of the potential interactions between the Project and resources/receptors within the AOI could be undertaken to a high level of confidence. Professional judgement was used to assess whether interactions have the potential to result in impacts that could lead to negative or positive effects greater than negligible (refer to *Table 4.6 Categories of Impact Significance*). In addition the current regulatory requirements and industry best practices, as well as the views of stakeholders consulted to date, were considered.

Once potential interactions were identified, they were charted using a colour-coded matrix (see *Table 4.1* below as an example). The different colours within the matrix indicate the level of potential impact based on the following criteria:

- An interaction is not reasonably expected (white);
- An interaction is reasonably possible but none of the resulting impacts are likely to lead to effects that are greater than negligible (grey); or
- The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is greater than negligible (black).

All potential interactions were considered regardless of the probability of occurrence.

Table 4.1 Example of a Scoping Matrix

	Receptor # 1	Receptor # 2	Receptor # 3	Receptor # 4	Receptor # 5	Receptor # 6
Project Activity						

4.3.4 *Environmental, Social and Health Baseline Definition*

To assess and define the Project components and the environmental baseline, two steps were undertaken:

- Collection of relevant Project (and Project alternative) information; and
- Collection of baseline data for the AOI or considered to be adequately representative of the area.

A range of information was reviewed by ERM and incorporated into the MMIA including data from the following sources:

- Data provided by government agencies (the Ministry of Primary Industries (MPI), and DOC) including:
  - MMO sighting data from previous seismic surveys around the area;
  - Stranding data from the region of northland; and
  - Fisheries catch data.
- Stakeholder engagement and consultation details, provided by EHOL;
- Cultural impact data compiled by EHOL;
- MSS technical specifications and project details provided by EHOL;
- Internet websites;
- Primary literature;
- A desktop study on the Aotea Basin (report WLG2014-45) prepared by NIWA, 2014, incorporating data collected during an MBESS in the PPP in August and September 2014; and
- Field data for the NCB collected in September 2014 (comprising MMO, marine observer and seabird observer reports, and MBESS data).

Each data set was assessed for completeness, sufficiency and applicability for use in the MMIA.

4.4 IMPACT ASSESSMENT

This section describes the MMIA methodology adopted for identifying and assessing impacts from the Project on the environment. This methodology takes account of guidance provided by DOC in *the Guide to Preparing Your Environmental Impact Assessment (EIA) for Concession Applications* and includes consideration of the activities, the physical and social conservation values affected by the activities, potential effects, and measures to avoid, remedy or mitigate adverse effects.

4.4.1 *Phase One - Identification of Impacts*

Environmental impacts arise as a result of project activities interacting with the environment. These interactions can result in impacts on one or more aspects of the environment either directly or indirectly as well as cause secondary impacts or contribute to a wider cumulative impact. Impacts may be described and quantified in a number of ways. The types of impacts that may arise from project activities and the terms used in this assessment are shown below.

Table 4.2 *Types of Impacts Considered within this Study*

Type of Impact	Definition
Nature of Impact	
Negative	An impact that is considered to represent an adverse change from the baseline, or to introduce a new undesirable factor.
Positive	An impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.
Type of Impact	
Direct (or Primary)	Impacts that result from a direct interaction between a planned Project activity and the receiving environment.
Secondary	Impacts that follow on from the primary interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. disturbance resulting in changes in the distribution of prey species).
Indirect	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on natural resources).
Cumulative	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.
Duration of Impact	
Temporary	Impacts are predicted to be of short duration and intermittent/occasional in nature, such as during a transit of the seismic vessel through a particular site.
Short-term	Impacts that are predicted to last only for a limited period (e.g. the duration of the seismic survey) but will cease on completion of the activity, or as a result of mitigation/reinstatement measures and natural recovery.
Long-term	Impacts that will continue over an extended period. These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period (e.g. repeated seasonal disturbance of species as a result of monitoring activities).
Permanent	Impacts that cause a permanent change in the affected receptor or resource that endures substantially beyond the Project lifetime.
Scale of Impact	
Local	Impacts that affect locally important environmental resources or are restricted to a single habitat or biotope. In the context of the current MMIA this would include resources occurring only within the NCB.
Regional	Impacts that affect regionally important environmental resources or are experienced at a regional scale e.g. as determined by administrative boundaries, habitat type or ecosystem. In the context of the current MMIA, this is considered to include resources occurring within the EEZ to the west and north of the New Zealand North Island.
National	Impacts that affect nationally important environmental resources, affect an area that is nationally important, protected or have macro-economic consequences.
International	Impacts that affect internationally important resources such as areas protected by International Conventions.

Impacts that may result from both planned activities and unplanned events relating to the project were assessed and impacts from external influences on the Project were also considered. Where unplanned events were assessed, associated risk was considered by taking into account both the consequence of the event as well as the likelihood of its occurrence.

4.4.2 *Phase Two – Evaluating Impacts*

Following the identification of potential environmental impacts (Phase One), impact significance was assessed, taking into account mitigation measures fundamental to the design of the Project.

For the purposes of this MMIA, the following definition of significance has been adopted:

> *An impact is significant if, in isolation or in combination with other impacts, it should, in the judgment of the MMIA team, be taken into account in the decision-making process, including the identification of mitigation measures and consenting conditions.*

This definition is considered to be consistent with that contained in the DOC *Guide to Preparing Your Environmental Impact Assessment (EIA) for Concessions Application:*

> *A **'significant effect'** is an impact that is outside the limit of acceptance which then must be avoided, remedied or mitigated back below this 'acceptable limit'.*

Assessing the level of significance requires consideration of the likelihood and magnitude of the environmental effect, taking account of the geographical scale and duration of the impact in relation to the sensitivity of the key receptors and resources. Criteria for assessing the significance of impacts stem from the following key elements:

- The magnitude (including nature, scale and duration), as defined in *Table 4.3* of the change to the natural environment (for example, loss or damage to habitats or an increase in noise), which is expressed in quantitative terms wherever practicable.

- The nature of the impact receptor, which may be physical, biological, or human, and its sensitivity as defined in *Table 4.4*. Where the receptor is physical (e.g. a water body) its quality, sensitivity to change and importance are considered. Where the receptor is ecological its sensitivity to the impact and its importance (for example its local, regional, national or international importance) are considered. For a human receptor the sensitivity of the community or wider societal group is considered along with its ability to adapt to and manage the effects of the impact.

- The likelihood (probability) that the identified impact will occur is estimated based upon experience and/or evidence that such an outcome has previously occurred. Categories of likelihood are defined in *Table 4.7*.

For this assessment, four impact significance categories have been applied being: *Negligible, Minor, Moderate* and *Major*. These categories of significance for environmental receptors are defined in *Table 4.6*.

Impact predictions have been made using available data, but where significant uncertainty remains, this is acknowledged and an indication of its scale was provided.

Impacts from Planned Activities

For impacts from planned activities, each level of significance and magnitude was defined using a prescribed set of criteria. These criteria were defined for each component of the marine and social environment and are provided in *Table 4.3* and *Table 4.4*.

Table 4.3 The Criteria for Assessing the Magnitude of Impacts

	Seawater and Air Quality	Ecology	Social and Health
Negligible	Immeasurable, undetectable or within the range of normal natural variation.	Immeasurable, undetectable or within the range of normal natural variation.	Change remains within the range commonly experienced within the household or community.
Small	Slight change in quality expected over a limited area with quality returning to background levels within a few metres; and / or Discharges are well within benchmark discharge limits	Affects a specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Medium	Temporary or localised change in quality with quality returning to background levels thereafter; and / or Occasional exceedance of benchmark discharge limits.	Affects a portion of a population and may bring about a change in abundance and/ or distribution over one or more generations, but does not threaten the integrity of that population or any population dependent on it.	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Large	Change in quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on ecological or human receptors; and / or Routine exceedance of benchmark discharge limits.	Affects an entire population or species in sufficient magnitude to cause a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Positive	A beneficial impact occurs at any scale		

Table 4.4 The Criteria for Assessing Sensitivity

	Seawater and Air Quality	Ecology	Social and Health
Low	Existing quality is good and the ecological resources and human receptors that it supports are not sensitive to a change in quality.	Ecological receptors are abundant, common or widely distributed and are generally adaptable to changing environments Species are not endangered or protected.	Minimal areas of vulnerabilities; consequently with a high ability to adapt to changes brought by the Project. Any positive impacts will result in benefits, but only at a minor level.
Medium	Existing quality already shows some signs of stress and/ or supports ecological resources and human receptors that could be sensitive to change in quality.	Some ecological receptors have low abundance, restricted ranges, are currently under pressure or are slow to adapt to changing environments. Species are valued locally / regionally and may be endemic, endangered or protected.	Some, but few areas of vulnerabilities; but still retaining an ability to at least in part adapt to change brought by the Project. Any positive impacts will result in benefits at a moderate level.
High	Existing quality is already under stress and/ or the ecological resources and human receptors it supports are very sensitive to change (secondary ecological or health impacts are likely).	Some ecological receptors in the area are rare or endemic, under significant pressure and / or highly sensitive to changing environments. Species are valued nationally /globally and are listed as endangered or protected.	Profound, or multiple levels of vulnerabilities that undermine the ability to adapt to changes brought by the Project. Any positive impacts will result in major benefits.

The significance of impacts is then defined, based on the sensitivity of the receptor and the magnitude of impact as shown in *Table 4.5*. These significance categories are described in *Table 4.6*.

Likelihood has been considered for the assessment of all unplanned events (e.g. spill), but only after the impact of the event is determined using the IA matrix shown in *Table 4.6*.

Table 4.5 ***Impact Assessment Matrix used for the Project***

		Sensitivity of Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major
	Positive	Minor	Moderate	Major

Table 4.6 ***Categories of Impact Significance***

Impact Significance	Definition
Negligible	A resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Minor	A resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
Moderate	Within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
Major	An accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of this IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e ALARP has been applied). In such circumstances it is the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

Impacts from Unplanned Events

For impacts from unplanned events, the approach adopted in this assessment considered the likelihood of an unplanned event occurring and if it does, the likely consequence on the environment and public health and safety. A qualitative approach to impact prediction was adopted. Criteria to assess the likelihood and severity of impacts from unplanned events are presented in *Table 4.7* and *Table 4.8*.

Table 4.7 Likelihood Categories

Likelihood	Definition
Extremely Unlikely	The unplanned event is extremely unlikely to occur under normal operating conditions but may occur in exceptional circumstances.
Unlikely	The unplanned event is unlikely but may occur at some time during normal operating conditions.
Possible	The unplanned event is likely to occur at some time during normal operating conditions.
Likely	There is a high probability that the unplanned event could occur during normal operating conditions.

Table 4.8 Severity Criteria for Unplanned Events

Severity	Definition
Low	• Some damage to the environment/very localised • No sensitive resources impacted • Rapid degradation of spilled materials and rapid recovery of affected resources
Medium	• Localised environmental damage • No sensitive resources impacted • Degradation of spilled materials and full recovery of affected resources
High	• Severe environmental damage • Sensitive resources impacted • Recovery of affected resources is very slow

The overall significance was then determined through a matrix of severity vs. likelihood as shown in *Table 4.9*. Where risks are identified, mitigation measures are progressively applied to reduce the severity of an unplanned event from unacceptable until it is considered to be tolerable, and is As Low As Reasonably Practicable (ALARP).

ALARP is defined as the point where the cost (in time, money and effort) of further risk reduction is grossly disproportionate to the risk reduction achieved. For example, where an event is already extremely unlikely to occur, the implementation of any control measures other than not undertaking the activity would not further reduce the risk associated with the event.

In addition, risks must be tolerable in that they are within the bounds that society as a whole is willing to live with, based on confidence that the risk is worth taking and is properly controlled, in order to secure the benefits associated with the activity.

This does not necessarily mean that everyone will find the risk acceptable. The concept of ALARP is illustrated in *Figure 4.3*. For the purposes of this assessment, where the overall impact significance is negligible, or cannot be further reduced, it is considered to be ALARP.

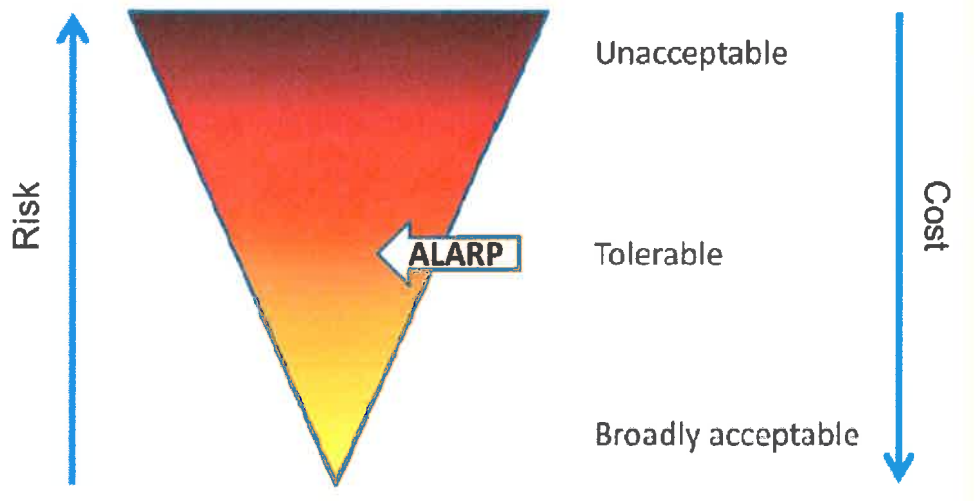


Figure 4.3 *ALARP Concept Illustration*

Table 4.9 *Unplanned Event Impact Significance Matrix*

		Severity of Impact		
		Low	Medium	High
Likelihood	Extremely Unlikely	Negligible	Negligible	Negligible
	Unlikely	Negligible	Minor	Moderate
	Possible	Minor	Moderate	Major
	Likely	Moderate	Major	Major

4.4.3 *Phase Three – Developing Mitigation Measures*

A key component of the MMIA process, and a requirement of the Code, centres on exploring practical ways of avoiding or reducing potentially significant impacts of the proposed MSS activities. These mitigation measures are aimed at preventing, minimising or managing significant negative impacts to ALARP as well as optimising and maximising any potential benefits of the Project.

The approach taken to identifying and incorporating mitigation measures into the Project was based on a typical hierarchy of decisions and measures, as described in *Figure 4.4*. Generally speaking, this hierarchal approach is aimed at ensuring that wherever possible potential impacts are mitigated at source, rather than mitigated through restoration after the impact has occurred. Thus, the majority of mitigation measures fall within the upper two tiers of the mitigation hierarchy and were effectively incorporated into the Project.

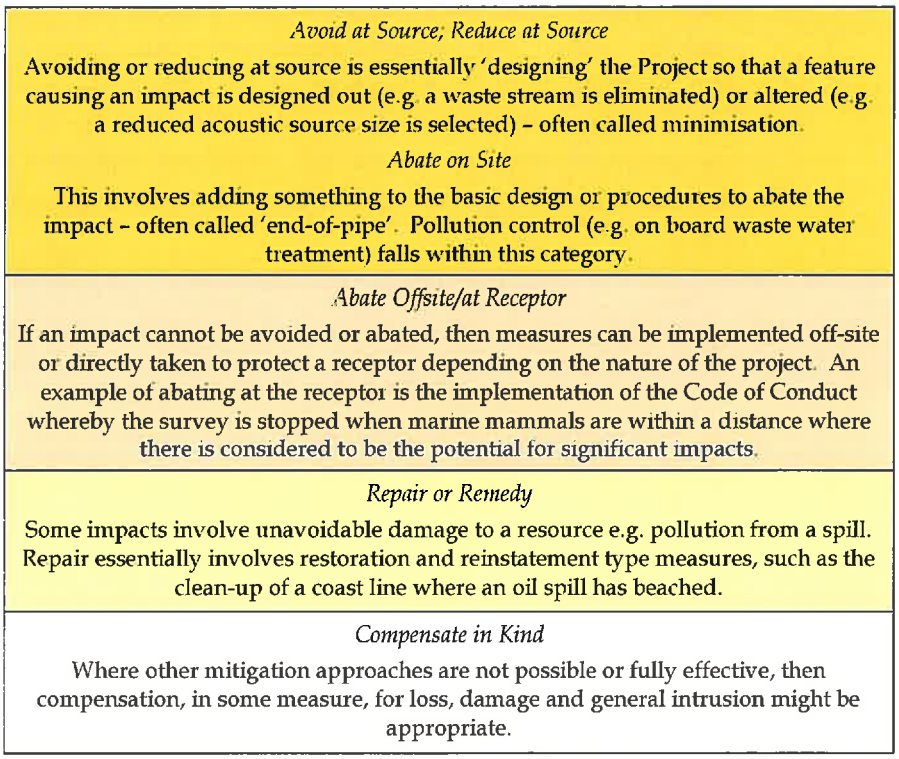


Figure 4.4 ***Mitigation Hierarchy for Planned Project Activities***

4.4.4 *Phase Four – Re-evaluating Significant Residual Impacts*

In some instances the mitigation measures applied to the Project reduced impacts to negligible or ALARP. However, the impacts were not eliminated entirely. These remaining impacts are termed residual impacts and the significance of these residual impacts was further assessed using he methodology described in Phase 2.

If residual impacts were assessed to be of moderate or greater significance additional mitigation measures have been proposed to further reduce their significance. This process was iterative and was repeated until residual impacts were found to be negligible or ALARP.

4.5 *LIMITATIONS*

Any impact assessment is a process that interprets activities which are yet to unfold thus there is an inevitably uncertainty that arises between the predictions made and what will actually happen during the course of the Project. However, MSS are widely practiced and the sources of impacts are well-understood. The Project is comparable to many previous surveys conducted around the globe so where uncertainty exists, inferences can be made through prior experience. Impact predictions have been made using available data, but where significant uncertainty remains, this is acknowledged and an indication of its scale was provided. Where the sensitivity of a resource to any particular activity is unknown and the magnitude of impacts cannot be predicted, the MMIA team has used professional experience to judge whether a significant impact is likely to occur or not.

5 EXISTING ENVIRONMENT

5.1 OVERVIEW

The New Caledonia Basin (NCB) is an elongated bathymetric feature that extends northwest from New Zealand past New Caledonia in the Pacific Ocean. The basin covers approximately 666,000 km^2.

The area of interest for the NCB 2D MSS is the part of the basin that extends from approximately 200 km from the west coast of New Zealand to the edge of the Extended Continental Shelf (ECS). This area is sometimes referred to as the Aotea Basin and covers approximately 147,000 km^2. It is bounded by the Challenger Plateau / Lord Howe Rise to the south and the West Norfolk Ridge to the north. In this report NCB is used to refer to the area of the basin within New Zealand waters.

EHOL commissioned NIWA to undertake a desktop review of all available scientific data in the proposed survey area. NIWA produced a baseline report in July 2014 (NIWA, 2014). This information, along with data collected during an MBESS conducted in August and September 2014, and a range of other information sources described in *Section 4* have been used to establish the baseline environment in the proposed survey area.

This section is divided into three main sections; physical, biological and socio-economic, biological and socio-economic (cultural, social and economic) aspects.

5.2 PHYSICAL ENVIRONMENT

The physical environment description below covers the environmental conditions of the NCB including bathymetry, geology, sedimentology, and metocean features.

5.2.1 *Bathymetry*

The NCB is in deep water at a depth of approximately 1,000 m closest to New Zealand, deepening to around 3,300 m at the edge of the ECS. The basin is bounded by two elevated ridges; the Challenger Plateau / Lord Howe Rise to the south and the West Norfolk Ridge to the north. These ridge lines are considerably shallower than the basin at a depth of between 500 to 1,000 m.

Figure 5.1 (NIWA, 2014) shows bathymetric profiles (cross-sections) of the basin. The cross-sections are through the ridges on each side of the basin (numbers 1, 2 and 3) and longitudinally (numbers 5 and 6).

The figure shows that the floor of the basin is relatively flat with a gradual increase in depth. The ridges have incised gullies that extend down into the

basin. At the far northwest of the NCB is a feature that rises approximately 750 m above the floor of the basin.

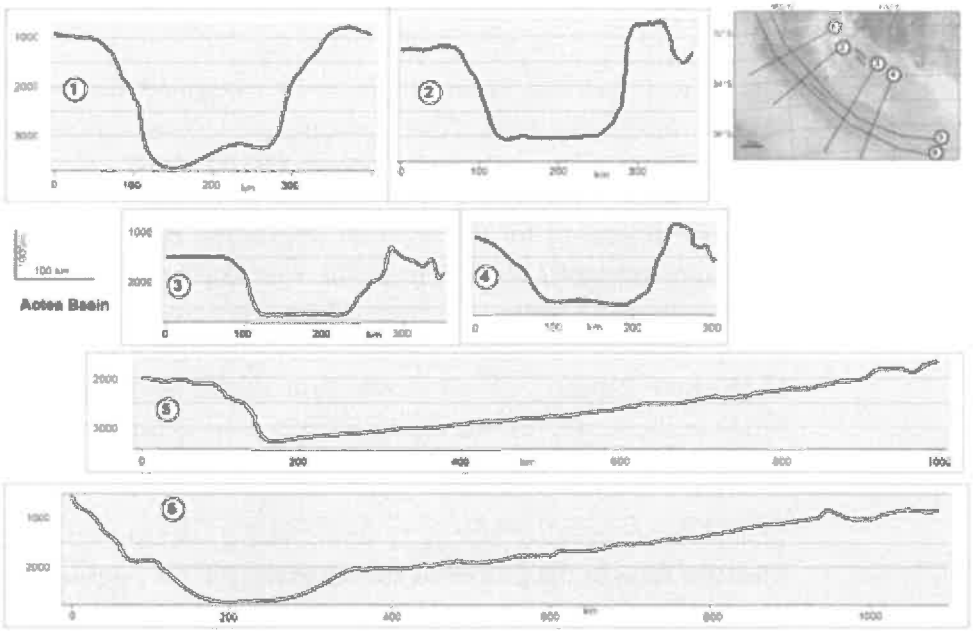


Figure 5.1 ***Cross Sections through the NCB***

5.2.1 Geology and Sedimentology

The NCB may contain up to 4,000 m of Upper Cretaceous to Recent marine and non-marine sediments, with some volcanics. The basin may have formed as a surface expression of a failed rift system. This rifting is thought to have occurred in the pre-Cenozoic or pre-Cretaceous periods and transform faults may have oblique rifting. It is thought that up to 3,000 m of sediments were deposited during rifting. The sediments are likely to consist of; Cretaceous clastics, volcaniclastics, terrigenous clays, mudstones, and authigenic limestone.

The only complete stratigraphic section in the NCB is from the Deep Sea Drilling Programme (DSDP) well 206 (*Figure 5.2* (NIWA, 2014)). Well 206 penetrated 734 m sub-surface (at a water depth of 3,196 m) and terminated in Lower Paleocene calcareous oozes. The well was tied to Wainui-1 in the Taranaki Basin which suggests that the oldest rocks in the basin are Upper Cretaceous and may include coals and other non-marine sediments.

Figure 5.3 (NIWA, 2014) shows the location of DSDP 206 and the three petroleum wells drilled in the region. The sediment thicknesses have been derived from wells and from seismic lines through the basin. The seismic lines are; Faust 3-10, Mobil 72-145, RS114-4, UNCLOS TL-1, and AstroLabe-40. The estimated sediment thicknesses shown in the figure are in seconds two-way-time (s twt).

The seismic lines indicate a domal uplift at the base of the Challenger Plateau and the formation of several large submarine volcanoes. Channels and fans are evident on the seismic data. Hydrocarbon source rocks may be present in the rift sequence, which has been buried to a depth great enough for thermal maturation. *Figure 5.4* (NIWA, 2014) shows the seismic profile from RS114-4.

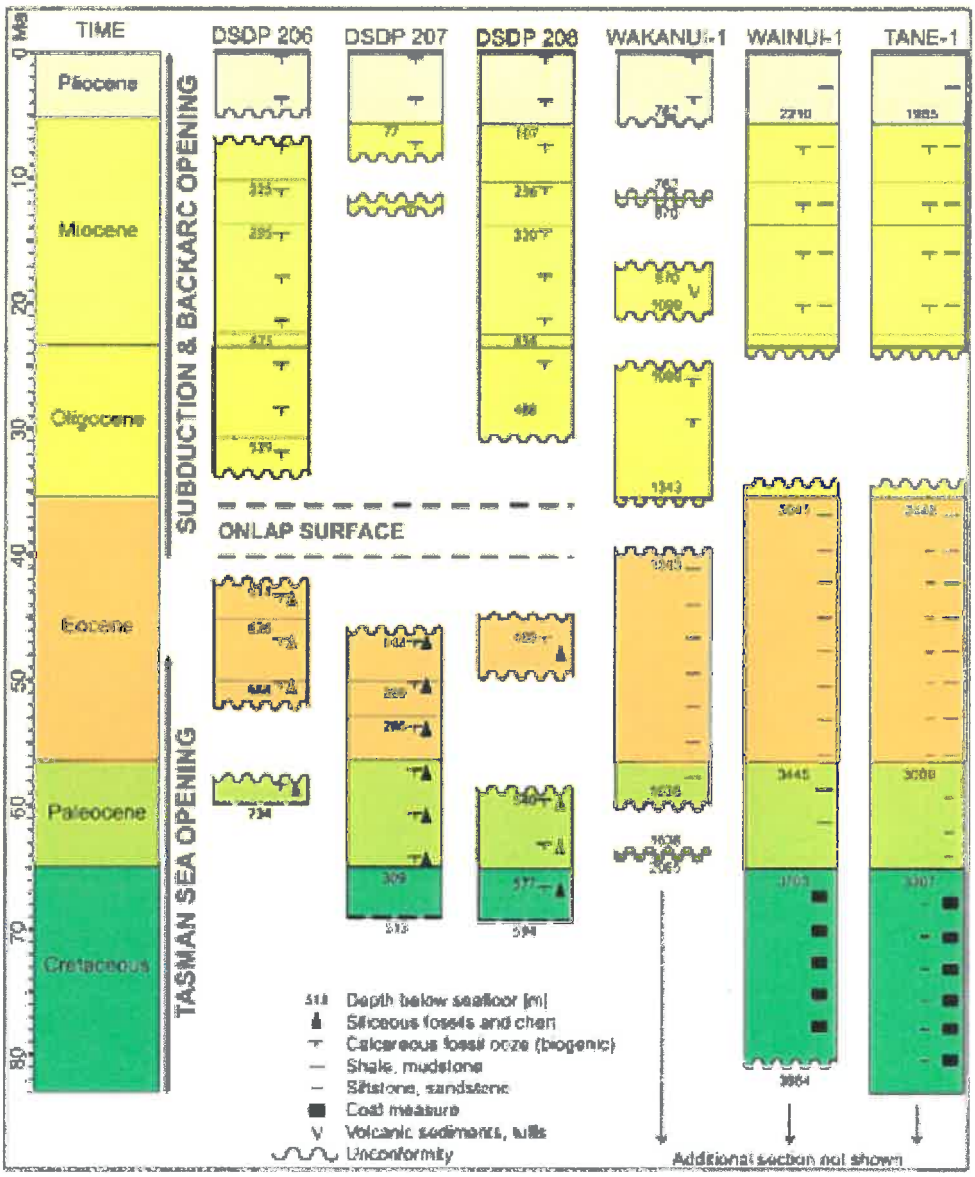


Figure 5.2 ***DSDP and Petroleum Wells in the Region***

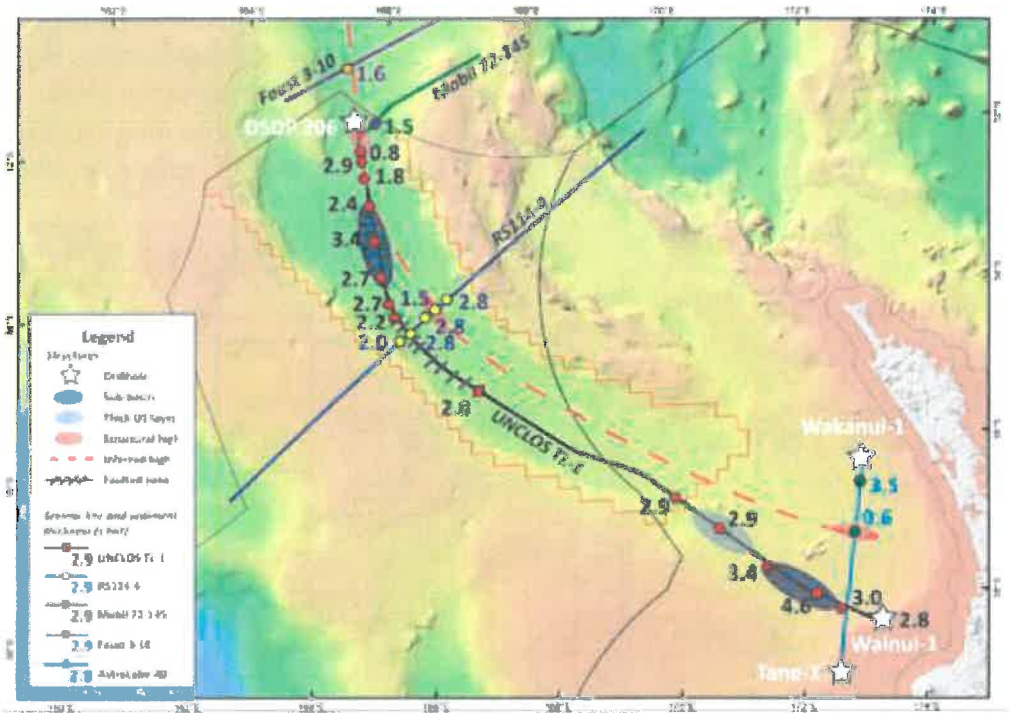


Figure 5.3 *Location of Wells and Sediment Thickness Derived from Seismic Stratigraphy*

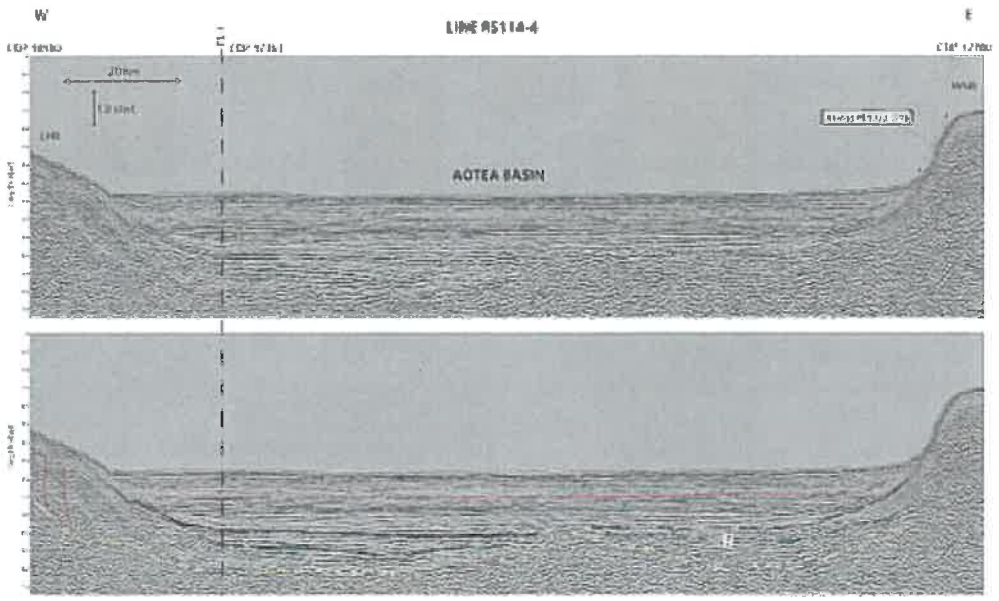


Figure 5.4 *Seismic Line through the NCB*

Surficial sediments have been collected at a number of locations within the basin using corers and dredges. The locations of these sample sites are shown in *Figure 5.5*. It can be seen that sampling has been undertaken in clusters, to the southeast and to the centre-north of the permit area.

The sediments collected consisted of mainly sandy mud or carbonate (foraminiferal) ooze, with the minor sand fraction comprising ~10% of the sediment. The carbon content of the sediment is between 60 - 80 %.

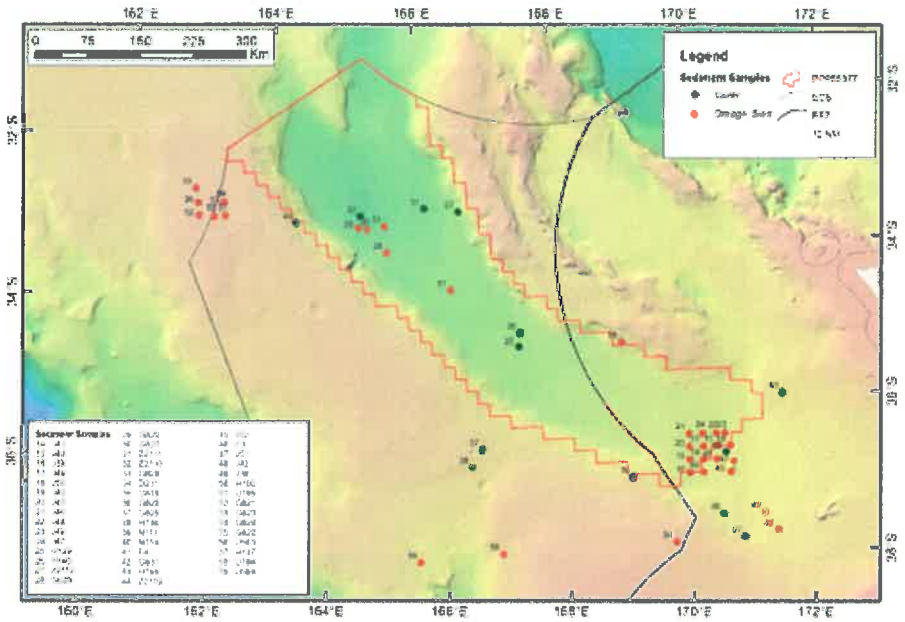


Figure 5.5 ***Sediment Sampling Locations (NIWA, 2014)***

At location 32 sediment depth was recorded as being approximately 30 cm of foraminiferal ooze.

During the sediment sampling surveys, a number of seafloor images were taken. The locations of these seafloor images are shown in *Figure 5.6* (NIWA, 2014). The images are shown in *Figure 5.7* and *Figure 5.8* for locations 1, 2, 3 and 4 within the basin, and location 13 just outside the southern boundary of the permit area. The images clearly show the muddy composition of the seafloor. The species seen in the images are discussed more in the biological section of this report (*Section 5.3*).

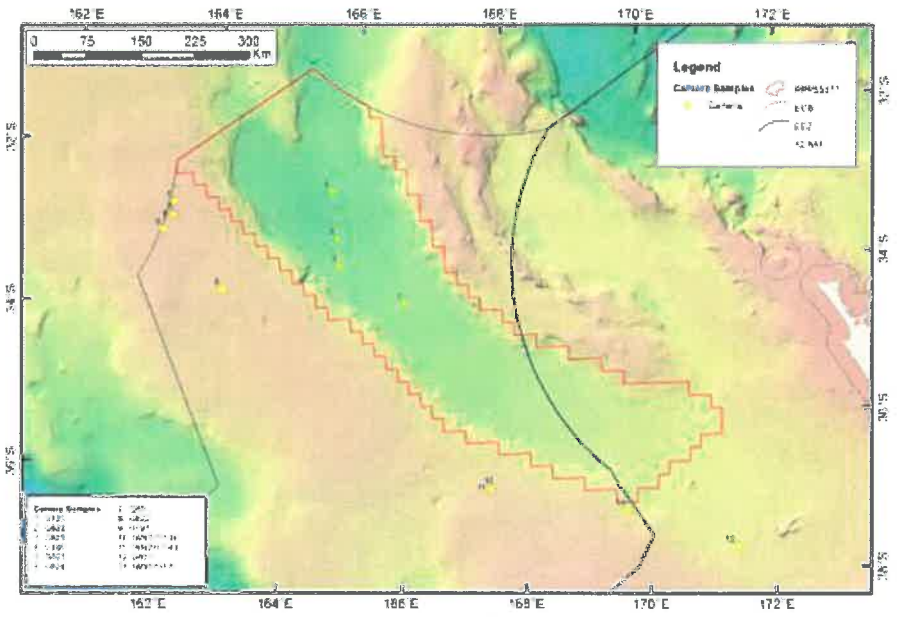


Figure 5.6 ***Seafloor Image Locations (NIWA, 2014)***

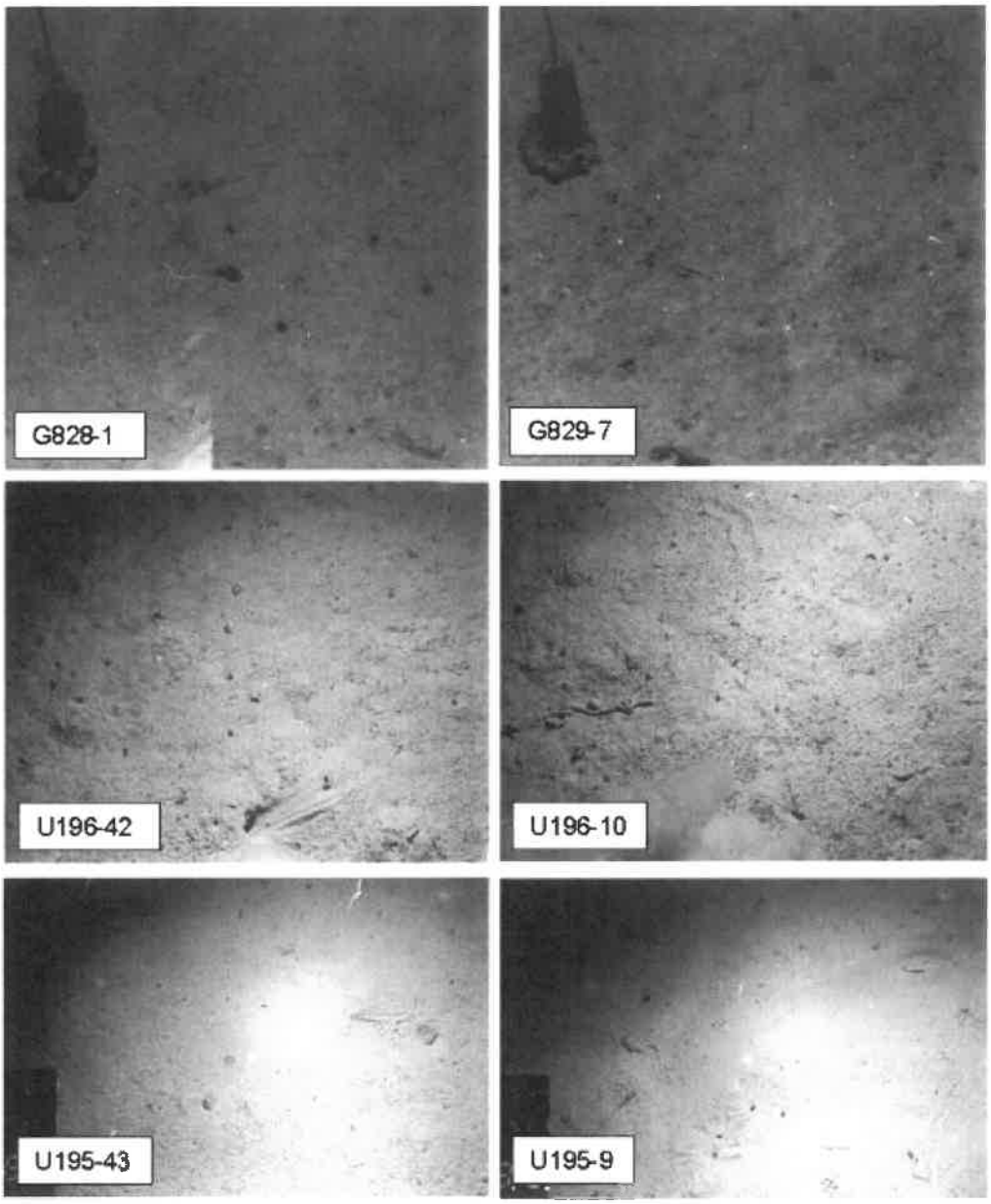


Figure 5.7 ***Images from Locations 1, 2, 3 & 4 within the Permit Area (NIWA, 2014)***

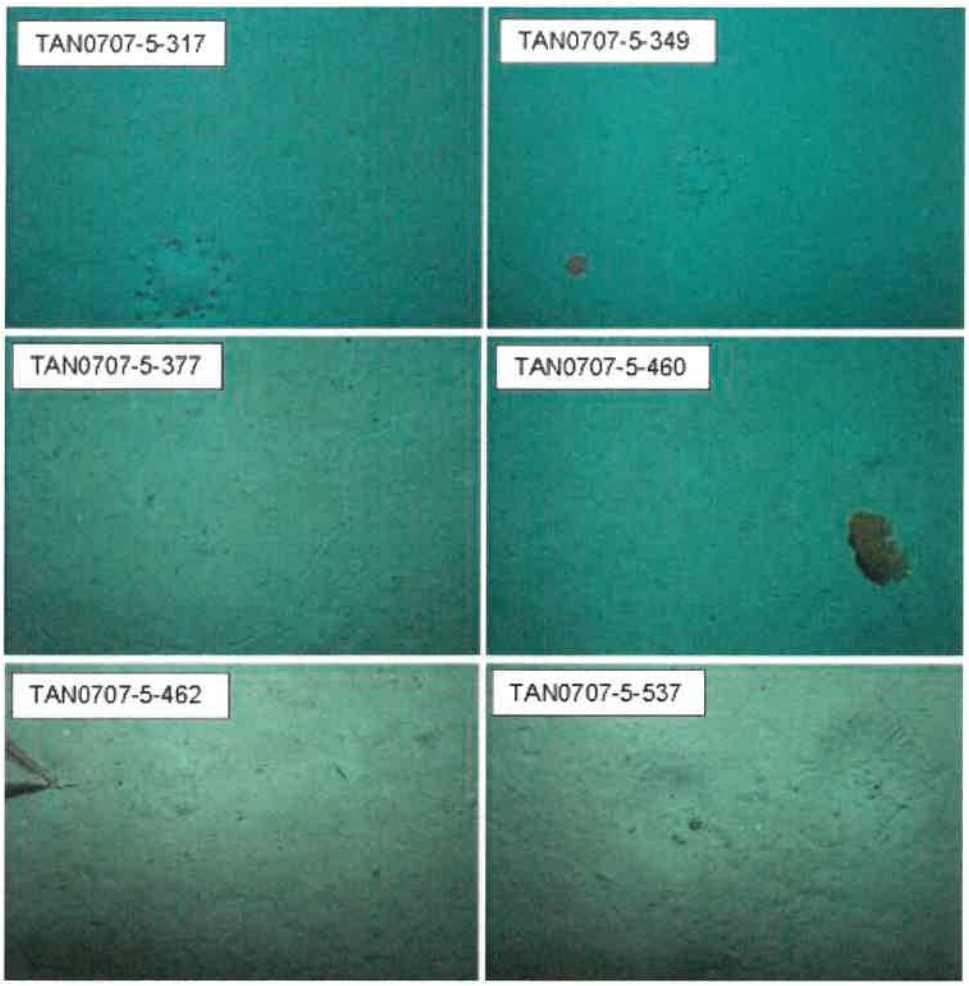


Figure 5.8 ***Images from Location 13 Just to the South of the Permit Area (NIWA, 2014)***

5.2.2 *Metocean Conditions*

The NCB is located in the Tasman Sea, to the north and west of the North Island of New Zealand. The predominant current is the Tasman Front. *Figure 5.9* shows historical analyses of current data and includes a south-easterly current; the West Auckland Current (WAUC); however, investigations by NIWA indicate that this current does not exist. NIWA postulate that there is a south-eastward drift beyond the 1,000 m depth contour. Inshore of this there is a north-westward mean flow.

Mean surface currents have been estimated by NIWA based on the mean dynamic topography (*Figure 5.10*). This shows weaker currents to the south of the basin with stronger currents through the middle of the permit associated with the Tasman Front. Acoustic Doppler Current Profiler readings have been undertaken off the west coast of Northland. These readings measure currents of between 20 and 30 centimetres per second (cm/s) with maximums of 60 cm/s.

Figure 5.9 *Ocean Currents around New Zealand* (*www.teara.govt.nz*)

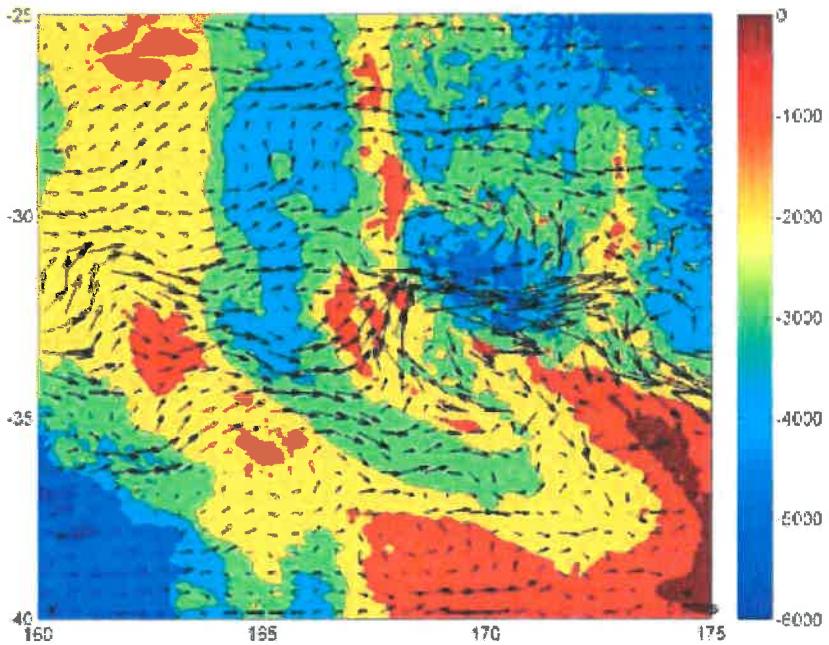


Figure 5.10 *Surface Currents from Mean Dynamic Topography* (NIWA, 2014)

In 2012 deepwater currents (currents at 1,000 m) were measured in the basin. An Argo float was used to sample currents. The trajectories from these floats were then be used to plot deepwater currents. *Figure 5.11* shows the velocity vectors from these floats.

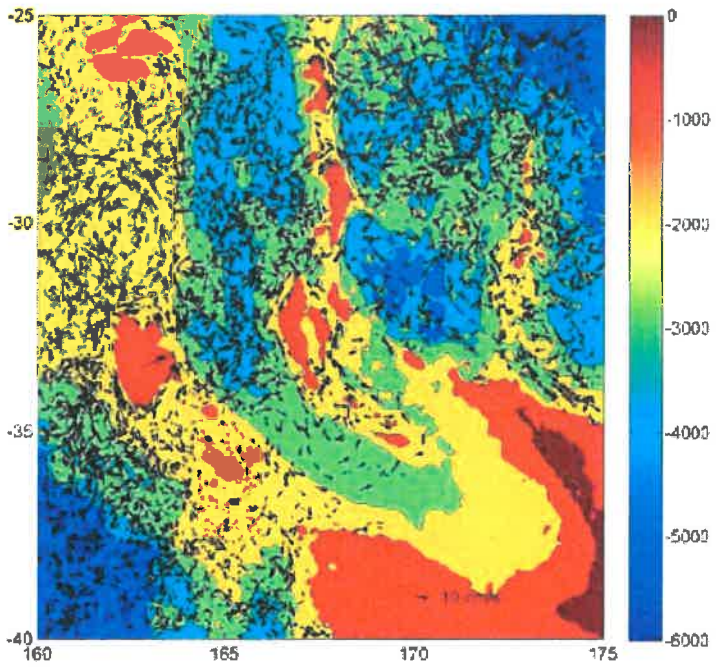


Figure 5.11 ***Velocity Vectors at 1,000 m from Argo Trajectories*** *(NIWA, 2014)*

Figure 5.11 shows that at this depth the current speed is generally weak at approximately 5 cm/s.

There are no time series measurements for tides available in the region. Barotropic tides have been estimated; however, these estimates do not include baroclinic tides.

Wind and wave data have been provided by NIWA as part of a baseline study of the NCB. The mean hindcast wind speed and the significant wave height are shown in *Figure 5.12*. This uses a 45 year study period from 1957 to 2002.

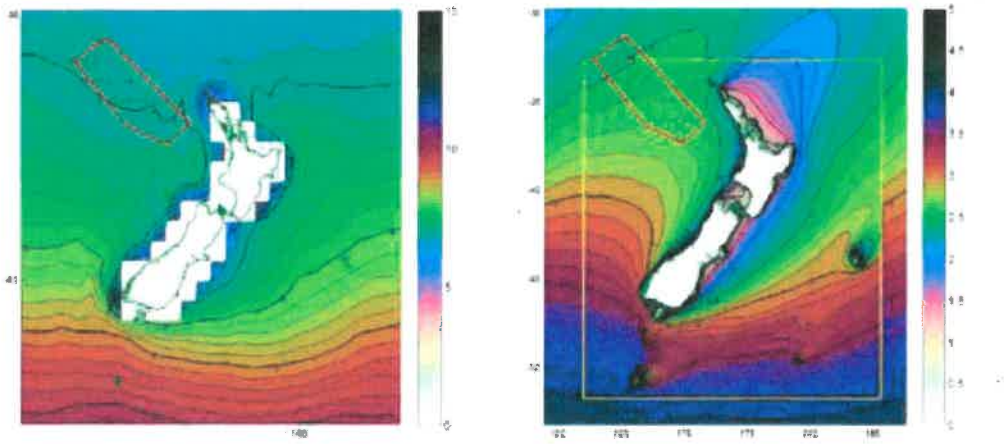


Figure 5.12 ***Mean Wind Speed in m/s (left) and Significant Wave Height (m)*** *(NIWA, 2014)*

The results indicate a band of strong winds (predominantly westerlies) to the south of New Zealand, which produce correspondingly energetic wave conditions. Wind speed and wave heights progressively decrease northwards.

Wind roses have been produced from the statistical data generated from processing global ERA-40 data. *Figure 5.13* shows the wind rose generated from approximately the centre of the permit area. The dominant wind direction is south-westerly. Due to the geographic extent of the permit, there is some variation between the north and south of the permit area. Winds to the north of the permit area have a more easterly dominance and winds to the south have a more south-westerly dominance.

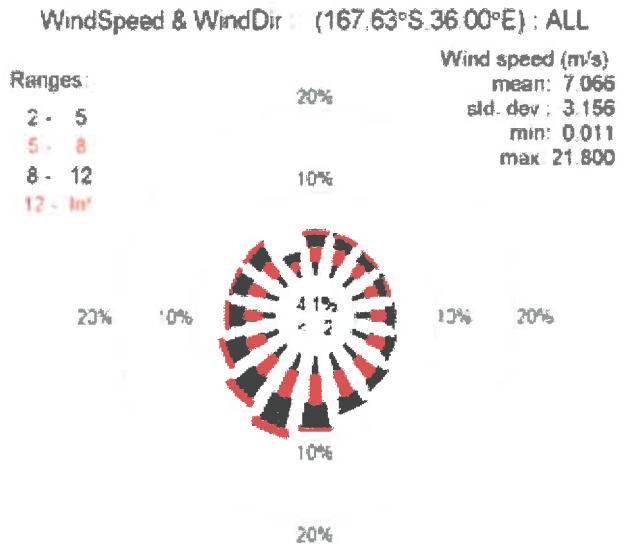


Figure 5.13 ***Wind Rose generated for the Centre of the Permit Area*** *(Adapted from NIWA, 2014)*

Wave roses were generated using the same data set. The wave rose shown in *Figure 5.14* indicates that the dominant wave direction is from the southwest. There appears to be little variation between the north and south of the permit with regards to waves.

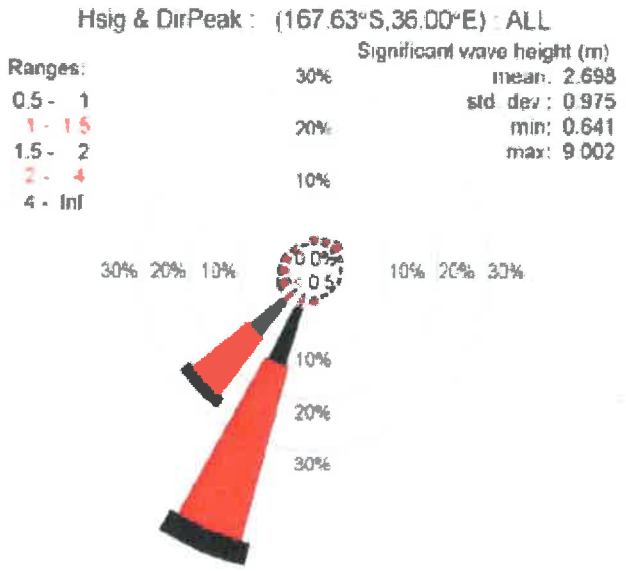


Figure 5.14 ***Wave Rose Generated for the Centre of the Permit Area*** *(Adapted from NIWA, 2014)*

Sea surface temperatures have been generated from the Reynolds' Sea Surface Temperature (CST) product (Reynolds et al. 2007). The seasonal variation in sea surface temperatures in the permit area can be seen in *Figure 5.15*. Argo data was used to estimate temperature with depth. This is shown in *Figure 5.16*. It can be seen that below approximately 300 m, temperature is not strongly affected by seasonal changes. Above 300 m there is a strong seasonal variation in temperature.

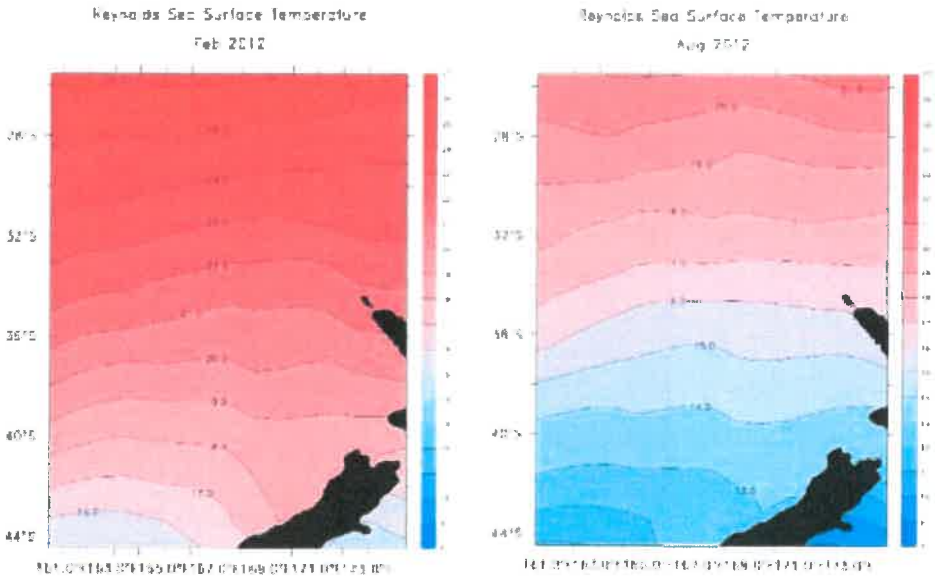


Figure 5.15 ***Sea Surface Temperature from the Reynolds' SST Product*** *(NIWA, 2014)*

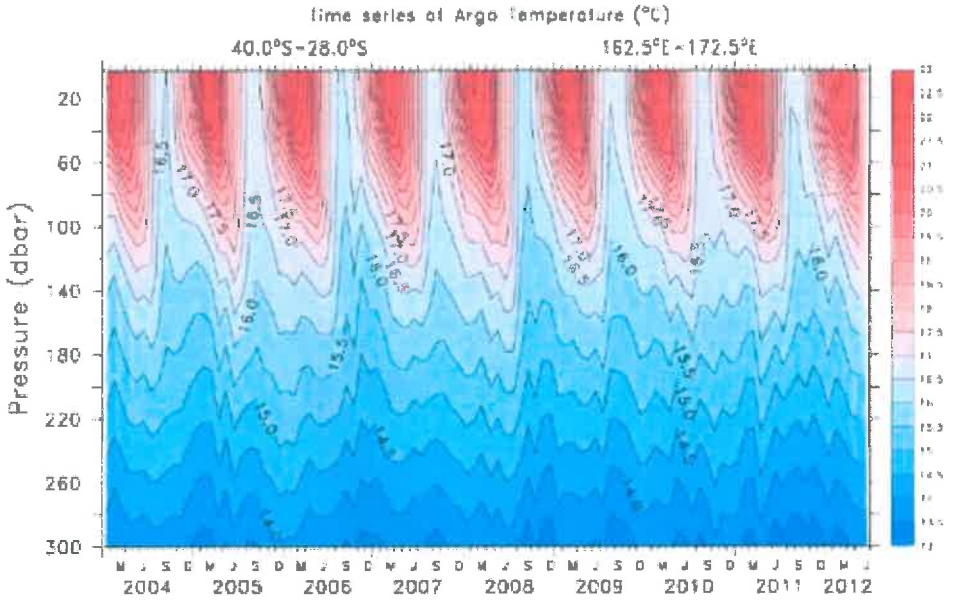


Figure 5.16 ***Variability of Temperature between the Surface and 300 m Water Depth*** *(NIWA, 2014)*

Figure 5.17 shows the location of temperature and salinity (CTD) readings within the permit area. The data collected during these sampling programmes are shown below in *Figure 5.18*. It can be seen that temperature and salinity properties are fairly constant with readings being a fact of depth.

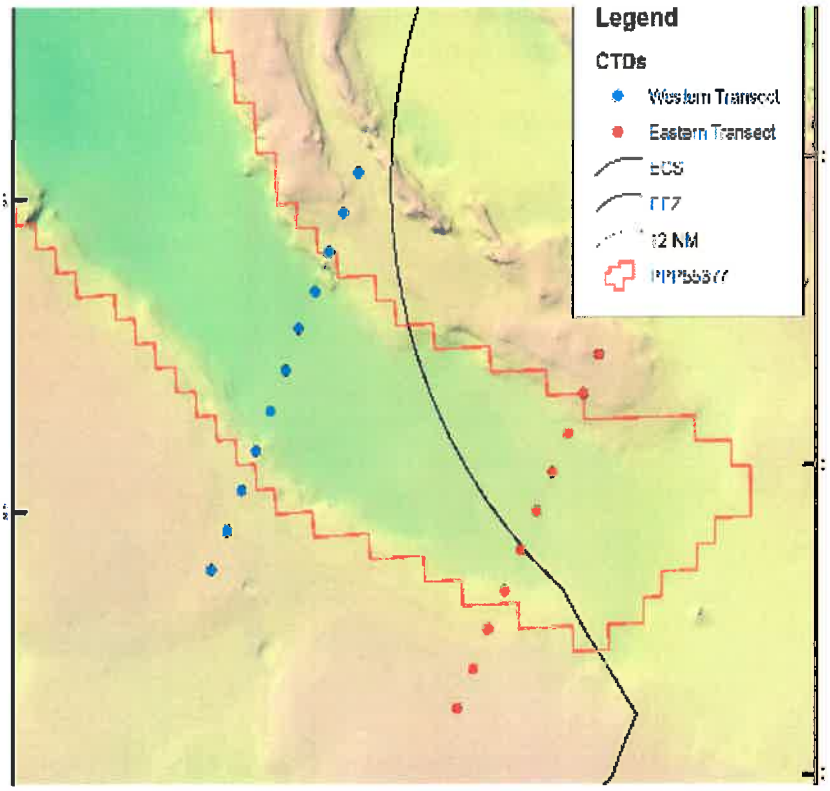


Figure 5.17 ***Locations of CTD Sampling in the Permit Area*** *(NIWA, 2014)*

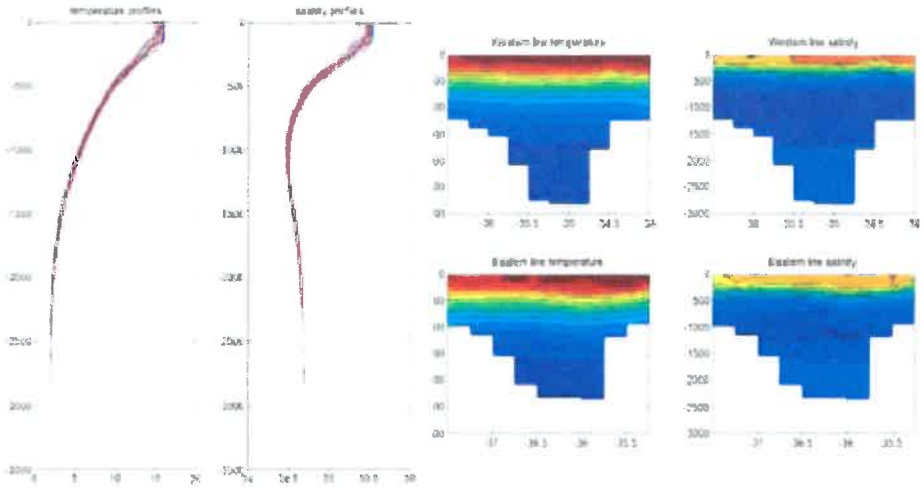


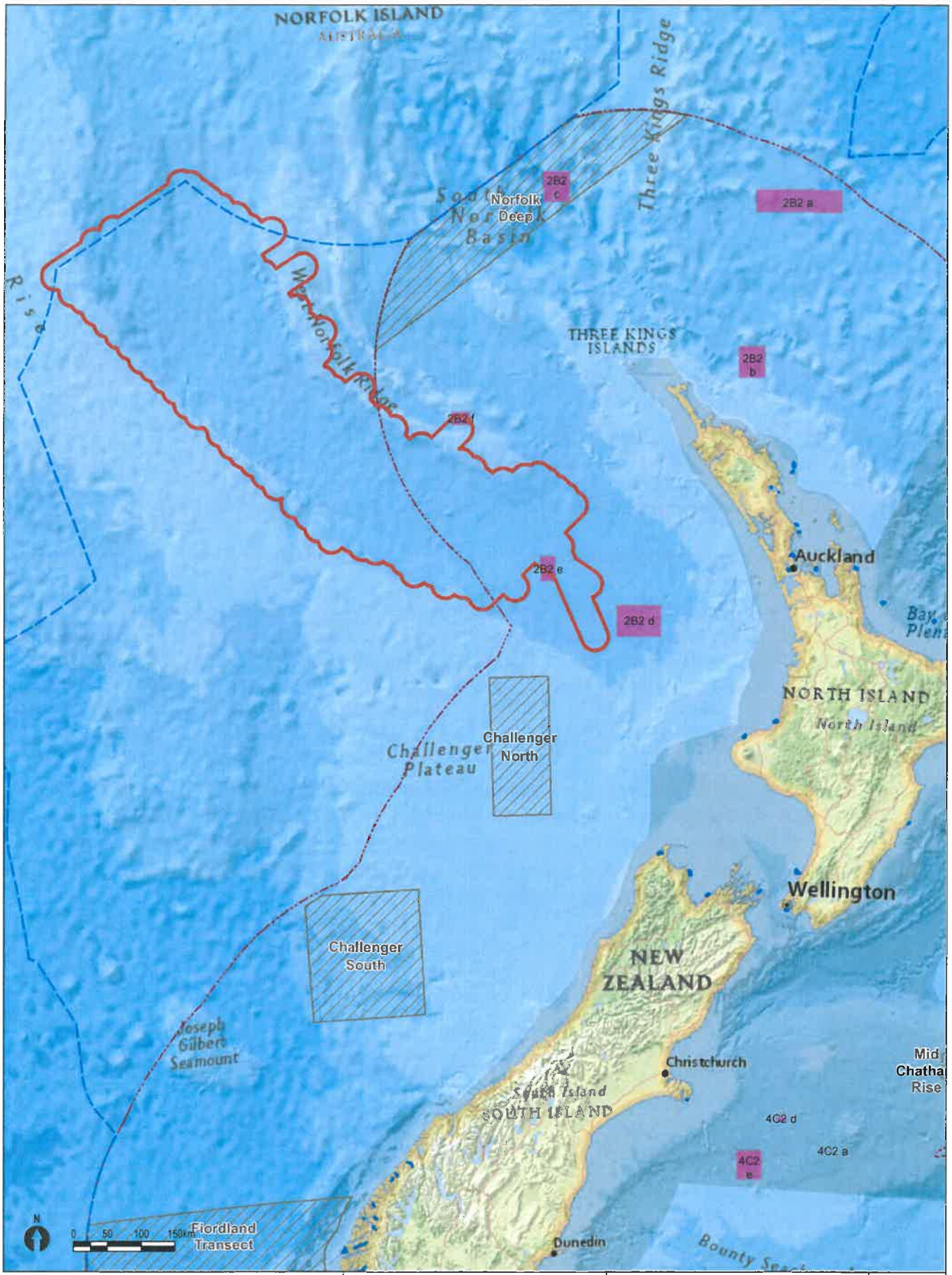
Figure 5.18 ***Temperature and Salinity Profiles within the Permit Area*** *(NIWA, 2014)*

5.2.3 Islands, Reefs and Shoals

The Three Kings Islands are approximately 200 km to the north of the AOI. Deepwater corals have been identified in the AOI, but it is not known whether these are reef-forming. The Wanganella Banks, located in the Australian EEZ, are located 98 km to the north of the survey area.

5.2.4 Marine Protected Areas

The permit area is not with any identified marine protected areas. In 2007, New Zealand established 17 Benthic Protection Areas within the Exclusive Economic Zone (EEZ) that are protected from bottom trawling and dredging. These are shown in *Figure 5.19* (adapted from MPI). The permit area is to the north of the Challenger North Benthic Protection Area.



Legend

- Operational Area
- NZ Exclusive Economic Zone
- NZ Extended Continental Shelf
- Benthic Protected
- Area of Ecological Importance
- DOC Marine Reserves
- Seamount Closures

Client:	Energy Holdings Offshore Ltd		
Drawing No:	0267364s_IA_G004_R1.mxd		
Date:	30/11/2015	Drawing Size: A4	
Drawn By:	GC	Reviewed By: AL	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 5.19 - Seamounts and Protected Natural Areas in the Vicinity of the Operational Area

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Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

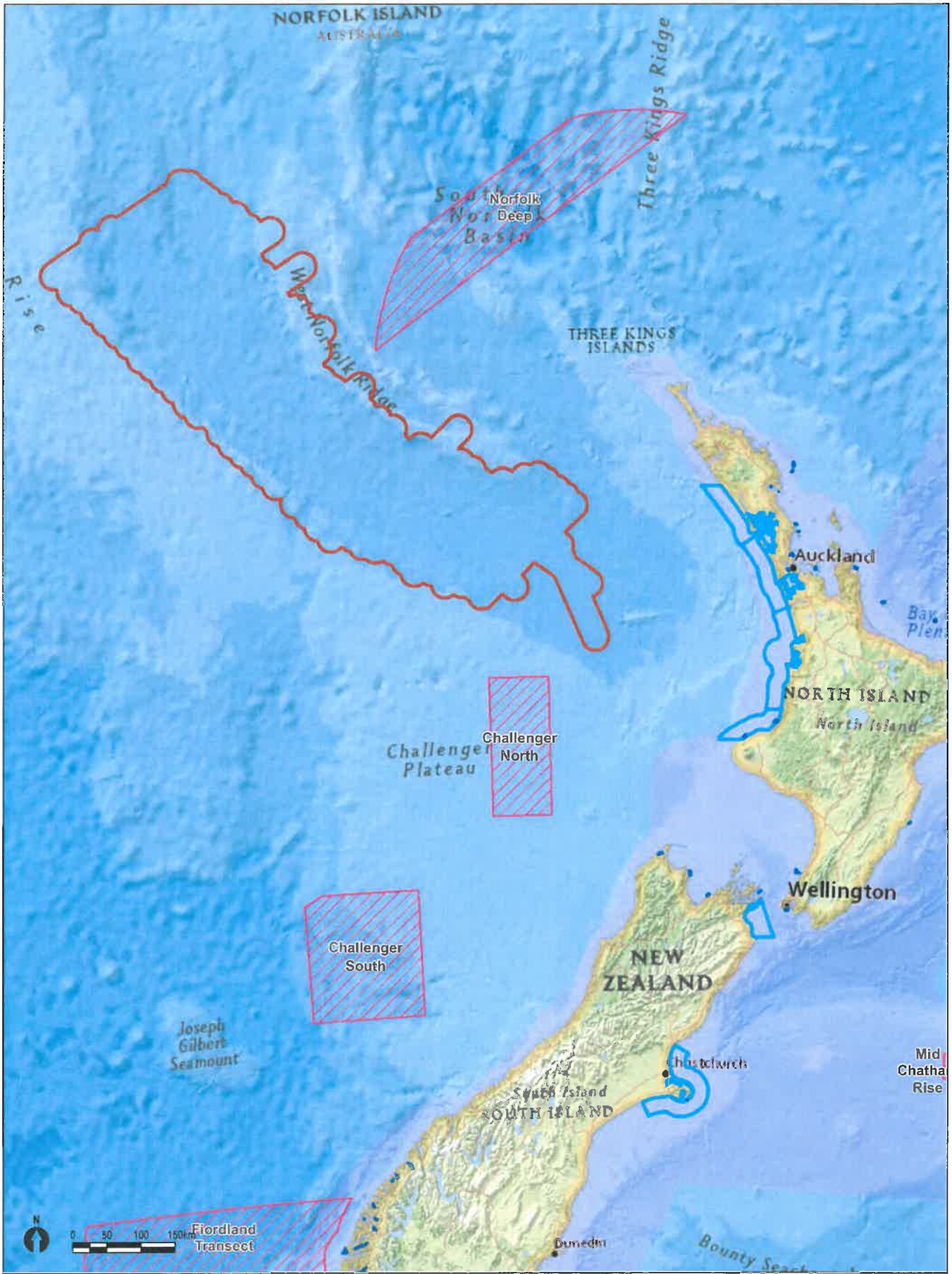
ERM

In 2000, additional protection was provided for the most significant seamounts in New Zealand waters. These were closed to trawling and dredging (see *Figure 5.20*).

The US National Oceanic and Atmospheric Administration describes seamounts as *"undersea mountains formed by volcanic activity - were once thought to be little more than hazards to submarine navigation. Today, scientists recognize these structures as biological hotspots that support a dazzling array of marine life.*

The biological richness of seamount habitats results from the shape of these undersea mountains. Thanks to the steep slopes of seamounts, nutrients are carried upwards from the depths of the oceans toward the sunlit surface, providing food for creatures ranging from corals to fish to crustaceans".

There are two significant seamounts near the permit area that have been closed to all trawling. These are Seamount 447 on the Lord Howe Rise and Telecom Seamount to the southeast of the permit area.



Legend

- Operational Area
- Benthic Protected Areas
- DOC Marine Mammal Sanctuaries
- Area of Ecological Importance
- DOC Marine Reserves

Client:	Energy Holdings Offshore Ltd		
Drawing No:	0267364m_IA_G007_R1.mxd		
Date:	30/11/2015	Drawing Size: A4	
Drawn By:	GR	Reviewed By: EW	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 5.20 - Marine Protected Areas in the Vicinity of the Operational Area.

New Caledonia Basin Marine Mammal Impact Assessment

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ERM

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 Introduction

The prospecting permit is in a remote location in deep water off the northwest coast of the North Island of New Zealand. Due to the remoteness of the location there is limited primary data available for the area. NIWA has reviewed its databases for information from historical surveys in the area. This has been augmented with information from other more generic sources.

In addition to this, EHOL placed a MMO and a Seabird Observer (SBO) on the *RV Tangaroa* during the MBESS survey of the permit area in August and September 2014. Due to permitting restrictions sampling of the benthic environment was not undertaken during this survey.

Under the New Zealand Marine Environmental Classification (MEC) the permit area is mostly within biological character Class 22. This definition of this class "*is extensive in moderately deep waters (mean = 1,879 m) over a latitudinal range from about 33-38°S. It is typified by cooler winter SST* (Sea Surface Temperatures) *than* (Class 1). *Chlorophyll a reaches only low average concentrations. Characteristic fish species (i.e. occurring at 50% or more of 20 sites) including orange roughy, Baxter's lantern dogfish, Johnson's cod, and hoki*".

The far north of the permit area is within MEC Class 1. The definition of this class "*is extensive in the far north, occurring in deep (mean = 3,001 m) subtropical waters with high solar radiation and warm winter sea surface temperatures. Average chlorophyll a concentrations are very low, but there are insufficient trawl or benthic invertebrate records to provide descriptions of these components*".

The MEC are shown in *Figure 5.21* (Snelder *et. al.* 2005).

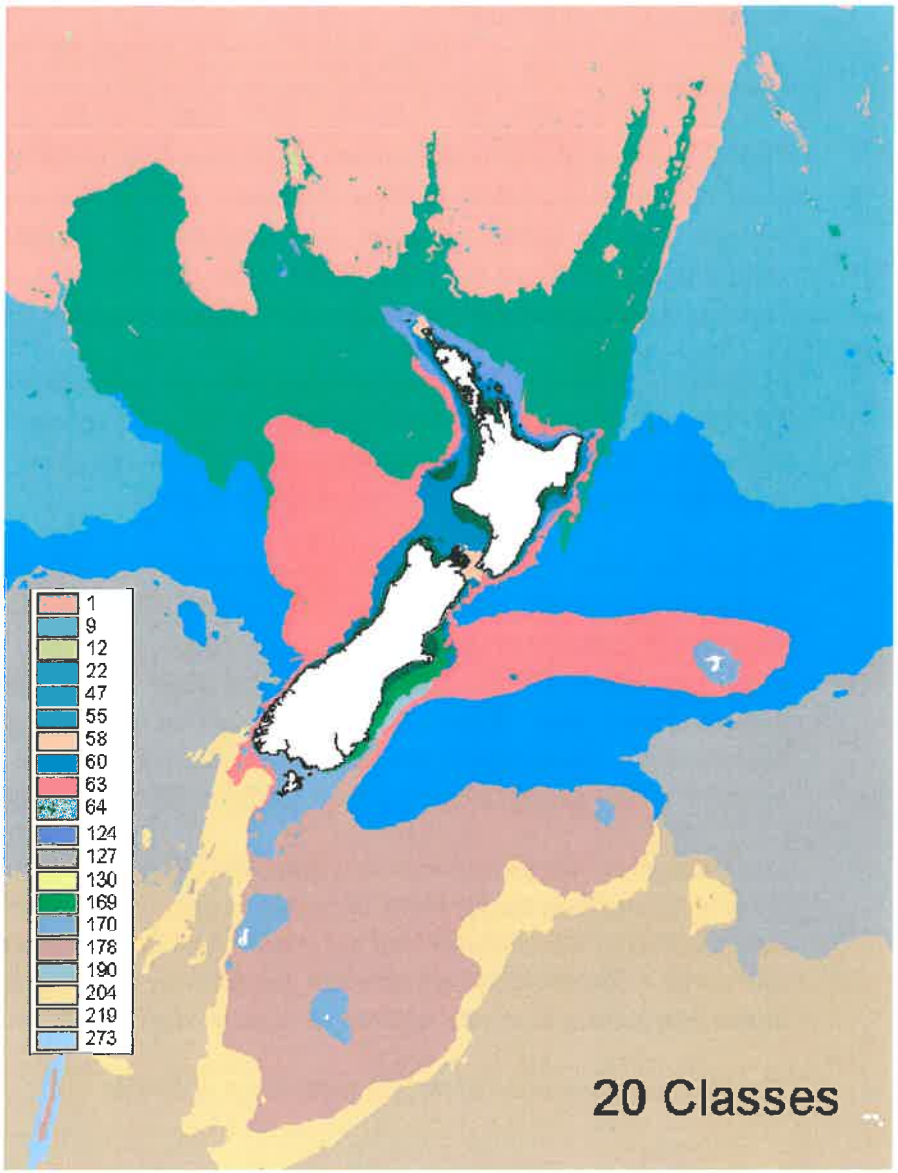


Figure 5.21 ***Marine Environmental Classification***

The following sections outline the ecosystems, communities and habitats that exist within the deep sea environment of the AOI.

5.3.2 *Benthic Environment*

NIWA identified twenty six survey stations that occurred in the prospecting permit. Of these twenty six survey stations, seventeen had invertebrate records. *Figure 5.22* (NIWA, 2014) shows the location of the benthic sampling stations.

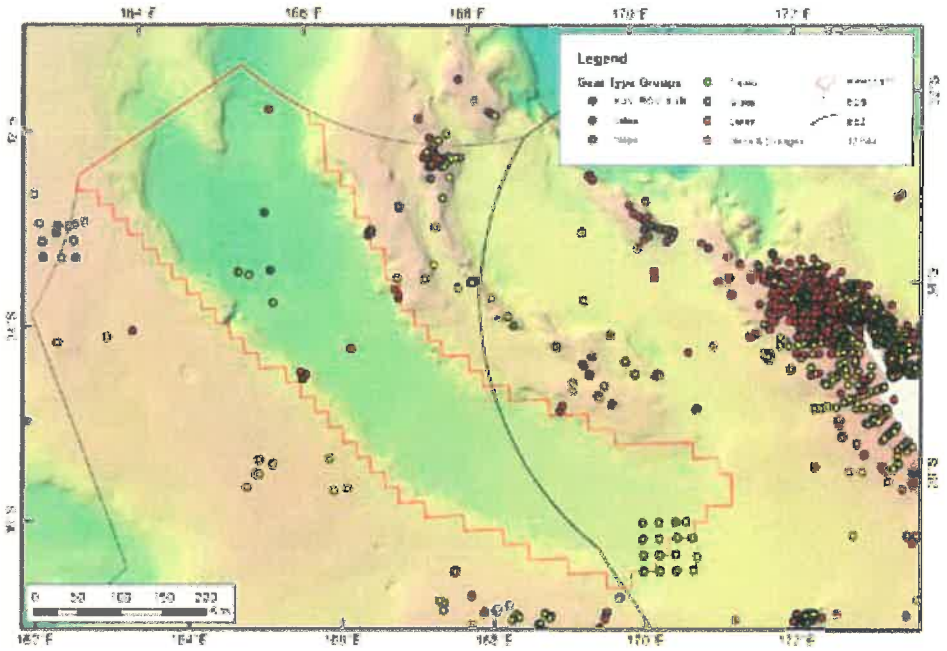


Figure 5.22 ***Benthic Sampling Stations in the AOI***

The benthic data has been collected via a number of sampling methods; grabs, trawls, corers, sleds, and cameras and over a long temporal duration (since 1954).

The benthic data were collected for different purposes and at different times. The taxonomic consistency of the data cannot therefore be combined to provide a detailed (species level) overview of the benthos of the basin. Generic invertebrate taxonomy information for the basin show the following phyla as being present; Echinodermata (49%), Anthropoda (25%), Porifera (10%), and Cnidaria (7%).

Gorgonian and black corals have also been documented in the permit area (see *Figure 5.23* (NIWA, 2014)). It should be noted that the sampling was not a comprehensive study of the basin. As the maximum depths of stony corals is nearly 5,000 m and hydro corals is over 2,000 m it is possible that they could both occur in the permit area.

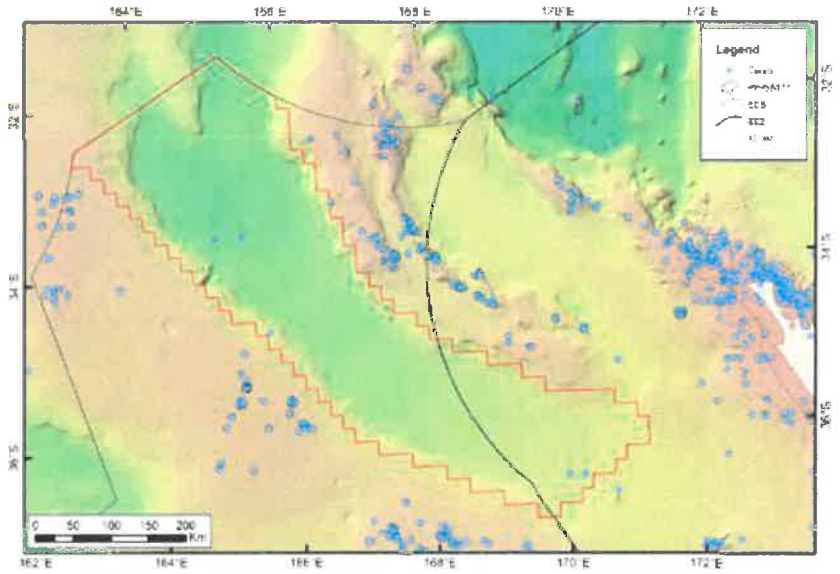


Figure 5.23 ***Deepwater Coral Records in the AOI***

5.3.3 Plankton

Studies have shown a relationship between chlorophyll *a* and phytoplankton biovolume. The relationship is not absolute however, as the ratio between chlorophyll *a* to cell carbon can depend on internal and external factors. These factors can include taxonomy, temperature, nutrient levels and light intensity. However, it is relatively easy to collect chlorophyll samples and it has therefore been used extensively to estimate phytoplankton biomass.

Figure 5.24 (NIWA, 2011a) shows that the chlorophyll levels are very low within the permit area. When this is combined with low nutrient levels and without further specific information it is therefore anticipated that phytoplankton levels will also be low.

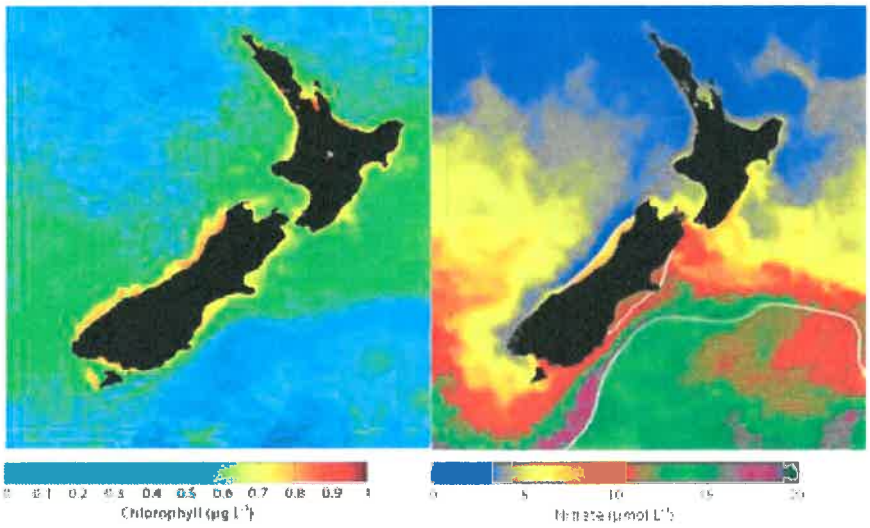


Figure 5.24 ***Chlorophyll and Nitrate Levels in New Zealand Waters***

5.3.4 *Fish*

The Ministry of Primary Industries (MPI), National Aquatic Biodiversity Information System (NABIS) was reviewed for information on fish species in the permit area.

The database indicates that there may be 21 fish species in the permit area. However, the ridges either side of this area (Lord Howe Rise and the Challenger Plateau) show a much higher number of species (30). The fish species identified in the NABIS database that are in the permit area are detailed in *Table 5.1*. The fish species found on the ridges are shown in *Table 5.2*.

Table 5.1 ***Commercial Fish Species Potentially in the Permit Area***

Common Name	*Latin Name*	*Conservation status*
Albacore Tuna	*Thunnus alalunga*	Near Threatened
Bigeye Tuna	*Thunnus obesus*	Vulnerable
Black Marlin	*Istiompax indica*	Data Deficient
Blue Marlin	*Makaira mazara*	Vulnerable
Blue Shark	*Prionace glauca*	Near Threatened
Broadbill swordfish	*Xiphias gladius*	Least Concern
Escolar	*Lepidocybium flavobrunneum*	Not evaluated
Frostfish	*Lepidopus caudatus*	Not evaluated
Kingfish	*Seriola lalandi lalandi*	Not evaluated
Mako Shark	*Isurus oxyrinchus*	Vulnerable
Moonfish	*Lampris guttatus*	Not evaluated
Pacific Bluefin Tuna	*Thunnus orientalis*	Least Concern
Porbeagle Shark	*Lamna nasus*	Vulnerable
Ray's Bream	*Brama brama*	Not evaluated
Rubyfish	*Plagiogeneion rubiginosum*	Not evaluated
School Shark	*Galeorhinus galeus*	Vulnerable
Skipjack Tuna	*Katsuwonus pelamis*	Least Concern
Striped Marlin	*Kajikia audax*	Near Threatened
Thresher Shark	*Alopias spp*	Vulnerable
Great White Shark	*Carcharodon carcharias*	Vulnerable
Yellowfin Tuna	*Thunnus albacares*	Near Threatened

Table 5.2 ***Fish Potentially Present on the Ridges on Either Side of the Permit Area but not in the Permit***

Common Name	*Latin Name*
Alfonsino	*Beryx decadactylus*
Barracouta	*Thyrsites atun*
Bass	*Perciformes*
Black Cardinal fish	*Epigonus telescopus*
Bluenose	*Hyperoglyphe antarctica*
Bronze Whaler Shark	*Carcharhinus brachyurus*
Dark Ghost Shark	*Hydrolagus novaezealandiae*
Four-rayed rattail	*Coryphaenoides subserrulatus*
Gemfish	*Rexea solandri*
Hake	*Merluccius australis*
Hapūku	*Polyprion oxygeneios*
Hoki	*Macruronus novaezelandiae*
Javelinfish	*Coelorinchus australis*
Ling	*Molva molva*
Lookdown John Dory	*Cyttus traversi*
Northern Spiny Dogfish	*Squalus griffini*
Notable Rattail	*Coelorinchus innotabilis*
Orange Roughy	*Hoplostethus atlanticus*
Red Snapper	*Centroberyx affinis*
Ribaldo	*Mora moro*
Rig	*Mustelus lenticulatus*
Rough Skate	*Dipturus nasutus*
Sea Perch	*Helicolenus percoides*
Seal Shark	*Dalatias licha*
Serrulate Rattail	*Coryphaenoides serrulatus*
Shovelnose Dogfish	*Deania calcea*
Smooth Oreo	*Pseudocyttus maculatus*
Smooth Skate	*Dipturus innominatus*
Spiky Oreo	*Neocyttus rhomboidalis*
Warty Oreo	*Allocyttus verrucosus*

The commercial significance of the fish species listed in the tables above is discussed in more detail in *Section 5.4.2*.

Research by NIWA (NIWA, 2014) shows that there were 2,169 individual records of fish or squid taxa detailing approximately 370 species. Of these the rattail group was the most noted with over 35 species. The most frequently recorded species was the Orange Roughy.

The limited information available in the area means that it is difficult to determine abundance levels of species with any certainty.

Great White Sharks have been tagged in Stewart Island and the Chatham Islands. These tags show the wide ranging nature of Great White Sharks (see *Figure 5.25*).

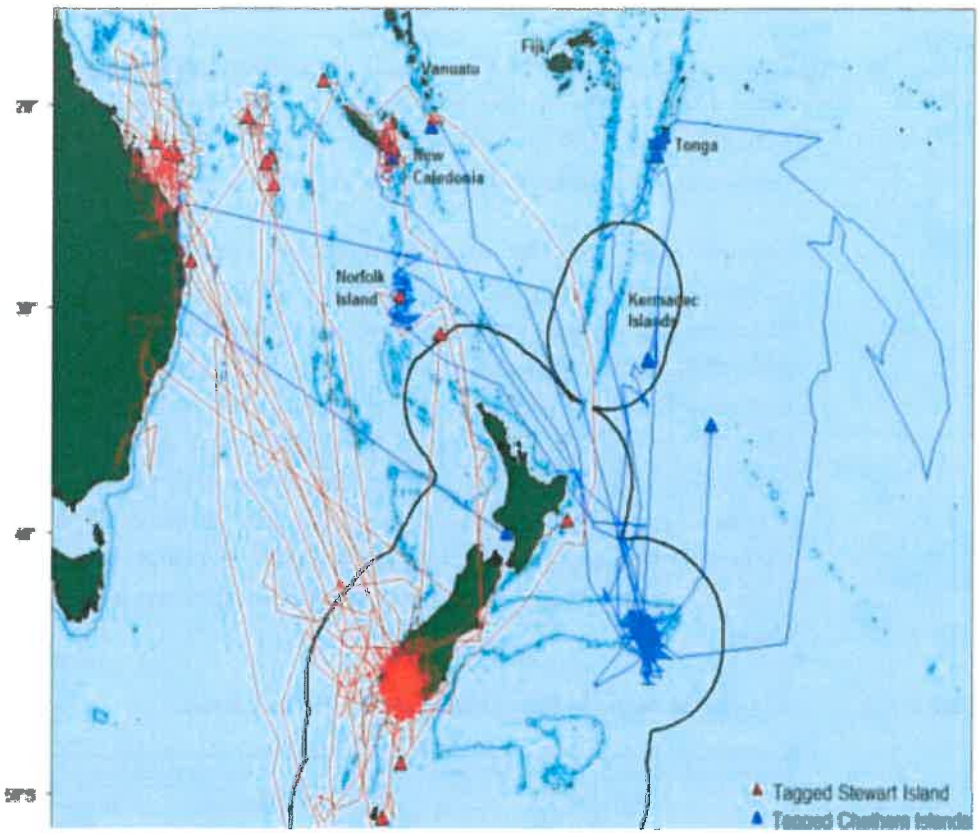


Figure 5.25 ***Great White Shark Tags (M Francis, NIWA 2011b)***

A joint NIWA / DOC tagging programme of white sharks commenced in 2005. A total of 44 sharks have been tagged mainly on Chatham Islands and Stewart Island. These islands were chosen as they are relatively easy to access and support large colonies of fur seals. Fur seals are a major food source for white sharks.

The results (M Francis (NIWA 2011b) indicate that *"most New Zealand white sharks make annual migrations to tropical waters in winter, travelling as far as 3,300 km away. Sharks have migrated to the Great Barrier Reef in Australia, the Coral Sea, New Caledonia, Vanuatu, Norfolk Island, Fiji and Tonga. They don't cross the equator.*

Most of the sharks from Stewart Island headed northwest of New Zealand, whereas most Chatham Islands sharks headed north".

Initially there do not appear to be any tracks within the permit area. However, it should be noted that these tracks are only approximate. The presence of New Zealand fur seals in the permit area means that it is likely that Great White Sharks periodically traverse the area.

5.3.5 *Marine Mammals*

The remote location of the permit area means that there is little site specific data available from marine mammal observations other than the recent surveys conducted by NIWA in 2014 described below. Most of the scientific studies in the area have focused on the benthic environment or on fisheries.

General data for the area is available on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List. This provides geospatial information on various species including marine mammals. The mapping function of the Red List was used to determine the potential for a species of marine mammal to be in the permit area. The global (IUCN) Conservation Status of the species was noted. This data was then combined with the New Zealand Department of Conservation's (DOC) NZ Threat Classification System lists 2008 - 2011 (*Table 5.3*). A total of 31 marine mammals had ranges that could potentially overlap with the permit area. Of these a total of 25 are listed as a species of concern under Schedule 2 of the Code.

Table 5.3 ***Marine Mammals Potentially in the Permit Area***

Common Name	Latin Name	Conservation Status		Listed as species of concern
		IUCN Red List	New Zealand Threat Classification	
Andrew's Beaked Whale	*Mesoplodon bowdoini*	Data Deficient	Data Deficient	✓
Antarctic Minke Whale	*Balaenoptera bonaerensis*	Data Deficient	Not Threatened	✓
Arnoux's Beaked Whale	*Berardius arnouxi*	Data Deficient	Vagrant	✓
Blainville's (Dense) Beaked Whale	*Mesoplodon densirostris*	Data Deficient	Data Deficient	✓
Blue Whale	*Balaenoptera musculus*	Endangered	Migrant	✓
Bryde's Whale	*Balaenoptera edeni*	Data Deficient	Nationally Critical	✓
Bottlenose Dolphin	*Tursiops truncatus*	Least Concern	Nationally Endangered	✓
Dwarf Sperm Whale	*Kogia sima*	Data Deficient	Vagrant	✓
False Killer Whale	*Pseudorca crassidens*	Data Deficient	Not Threatened	✓
Fin Whale	*Balaenoptera physalus*	Endangered	Migrant	✓
Ginkgo-toothed Beaked Whale	*Mesoplodon ginkgodens*	Data Deficient	Vagrant	✓
Gray's Beaked Whale	*Mesoplodon grayi*	Data Deficient	Data Deficient	✓
Hector's Beaked Whale	*Cephalorhynchus hectori*	Data Deficient	Data Deficient	✓
Humpback Whale	*Megaptera novaeangliae*	Least Concern	Migrant	✓

Common Name	Latin Name	Conservation Status		Listed as species of concern
		IUCN Red List	New Zealand Threat Classification	
Killer Whale	*Orcinus orca*	Data Deficient	Type A – Nationally Critical Others - Vagrant	✓
Long-finned Pilot Whale	*Globicephala melas*	Data Deficient	Not Threatened	✓
New Zealand Fur Seal	*Arcticephalus fosteri*	Least Concern	Not Threatened	
Pantropical Spotted Dolphin	*Stenella attenuata*	Least Concern	Vagrant	
Pygmy Right Whale	*Caperea marginata*	Data Deficient	Data Deficient	✓
Pygmy Sperm Whale	*Kogia breviceps*	Data Deficient	Data Deficient	✓
Risso's Dolphin	*Grampus griseus*	Least Concern	Vagrant	
Sei Whale	*Balaenoptera borealis*	Endangered	Migrant	✓
Short-finned Pilot Whale	*Globicephala macrorhynchus*	Data Deficient	Migrant	✓
Short-beaked Common Dolphin	*Delphinus delphis*	Least Concern	Not Threatened	
Southern Bottlenose Whale	*Hyperoodon planifrons*	Least Concern	Data Deficient	✓
Southern Right Whale	*Eubalaena australis*	Least Concern	Nationally Endangered	✓
Southern Right Whale Dolphin	*Lissodelphis peronii*	Data Deficient	Not Threatened	✓
Spade-toothed Whale	*Mesoplodon traversii*	Data Deficient	Data Deficient	
Sperm Whale	*Physeter macrocephalus*	Vulnerable	Not Threatened	✓
Strap-toothed Whale	*Mesoplodon layardii*	Data Deficient	Data Deficient	✓
Striped Dolphin	*Stenella coeruleoalba*	Least Concern	Vagrant	

It is likely that any marine mammals in the permit area are transient, following currents and food sources. The paucity of plankton in the permit area (see *Section 5.3.3*) would reduce the likelihood of species maintaining a permanent presence in the area. It should be noted that the abundance of species is likely to be dependent on migration and sea temperatures.

In the broader area surrounding the AOI, marine mammal sightings recorded during seismic surveys have been reported to DOC. Data reported from 2014 to 2015 was requested from DOC on 29th April 2015 (DOC, 2015). The information showed a total of 192 marine mammal sightings, this comprised a minimum of 1,689 individuals and at least 8 different species (see *Table 5.4* below). Of the animals able to be identified to species level, the Blue Whale was the most frequently observed in the broader area with 39 sightings and a minimum of 60 individual animals. The second most frequently observed

species was the Sperm Whale, with at least 129 individual animals recorded from 30 sightings. The Common Dolphin was the third most frequently observed species, with 20 sightings and a minimum of 476 individual animals. Unspecified species of large whales, toothed whales and dolphins also contributed to the overall number of sightings within this broader area. Of the 8 species identified, 7 are listed as a species of concern under Schedule 2 of the Code.

It is important to note that the permit area of interest comprises only a small proportion of the broad area to which this data relates and therefore it can be assumed that the number of marine mammals transiting through this area is proportionately less.

Table 5.4 ***Marine Mammal Observations on the DOC Database during Seismic Surveys 2014 – 2015 (DOC, 2015)***

Species	Sightings	Minimum Number	Number of Adults	Number of Calves
Blue Whale	39	60	58	3
Bryde's Whale	2	2	2	0
Fin Whale	1	1	1	0
Long-Finned Pilot Whale	13	149	143	6
Sperm Whale	30	129	123	6
False Killer Whale	2	18	18	0
Bottlenose Dolphin	1	12	12	0
Common Dolphin	20	476	445	31
Baleen Whales (Unspecified)	12	18	18	0
Whale (Unspecified)	40	69	67	2
Dolphins and Toothed Whales (Unspecified)	24	692	679	23
Dolphin (Unspecified)	8	63	63	0
Total	192	1689	1629	71

During August and September 2014, EHOL undertook an MBESS in the NCB. EHOL placed an experienced MMO on board the vessel to gather information on marine mammals during daylight hours for the duration of this survey.

Observations were typically commenced 15 minutes before sunrise and until after sunset. Operational hours increased throughout the voyage as the daylight hours increased. MMO operations occurred from the bridge of the *RV Tangaroa* at an eye-height of 12.5 m.

Routine effort, weather and marine mammal sighting data was recorded into DOC's "Off-survey Seismic MMO reporting forms" in Microsoft Excel. Throughout the voyage, spanning 38 days, a total of just over 350 observer hours were completed by the MMO.

Only 11% of this time was considered to be "good" for sighting marine mammals based on the Department of Conservation guidelines from the 2012 Seismic Code of Conduct. The remaining 89% of time would be classified as "poor".

A total of 39 discrete sightings of species of concern were made during the voyage, consisting of a total of 50 whales. Whales sighted for which the species could not be identified were noted as "large un-identified cetaceans" and were typically distant from the ship. Only one dolphin sighting occurred during the voyage.

A total of 35 discrete New Zealand Fur Seal sightings were made throughout the voyage, consisting of 41 individuals. The observations from the survey are shown in *Table 5.5*.

Table 5.5 ***Summary of Marine Observations during TAN1410, Separated by Scope (2014)***

Dates	MMO Hours	Whale sightings	Dolphin sightings	Seal sightings	% Good sighting conditions	% Poor Sighting conditions
17-19 August	23:57	1	0	11	30	70
20 August - 7 September	179:15	4	1	12	2	98
8 September	10:22	3	0	0	-	100
9 September	11:48	18	0	12	72	28
10-11 September	20:01	2	0	0	15	85
12 September	9:28	0	0	0	-	100
13-21 September	86:58	10	0	0	20	80
VOYAGE TOTALS	350:20	38	1	35	11	89

The geographical location of these species is shown in *Figure 5.24*.

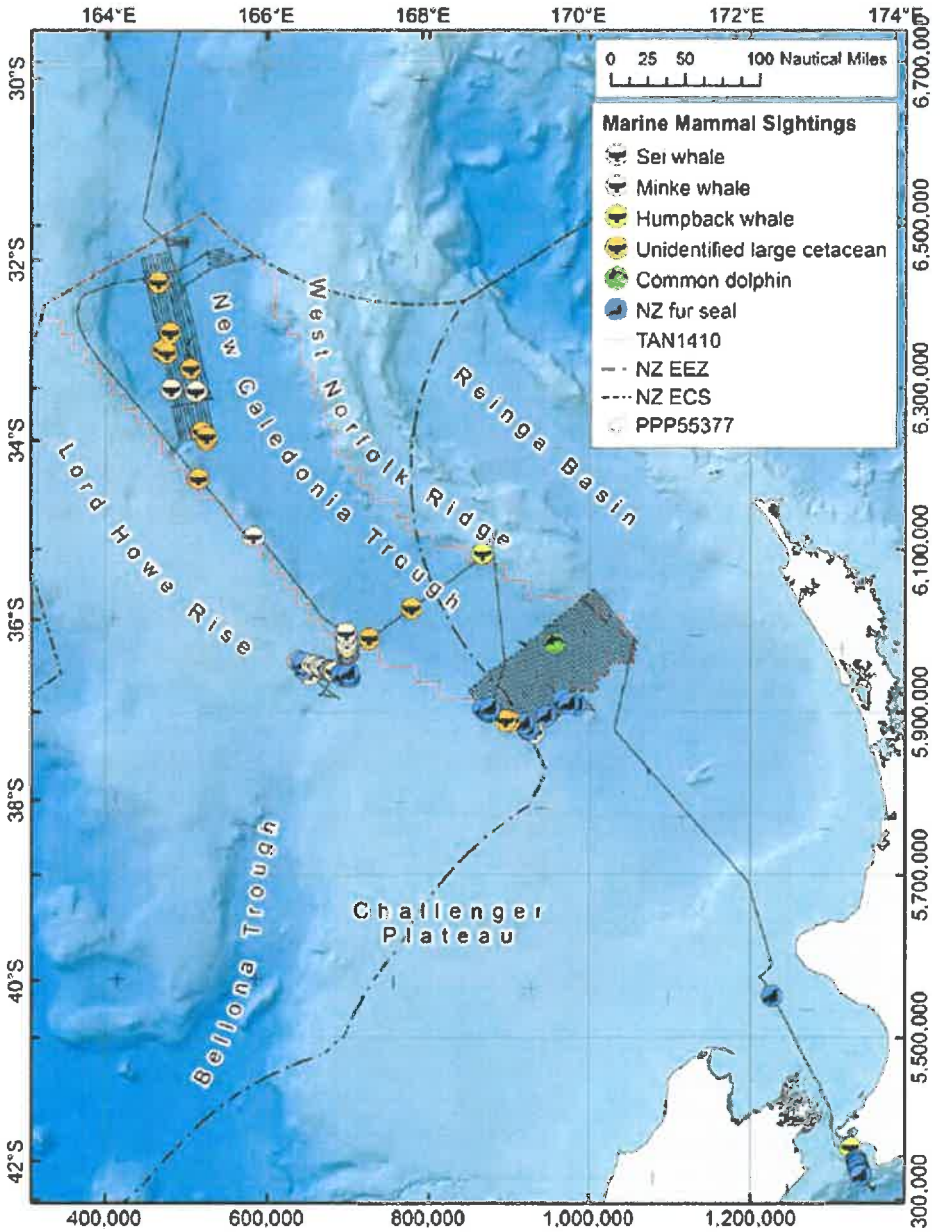
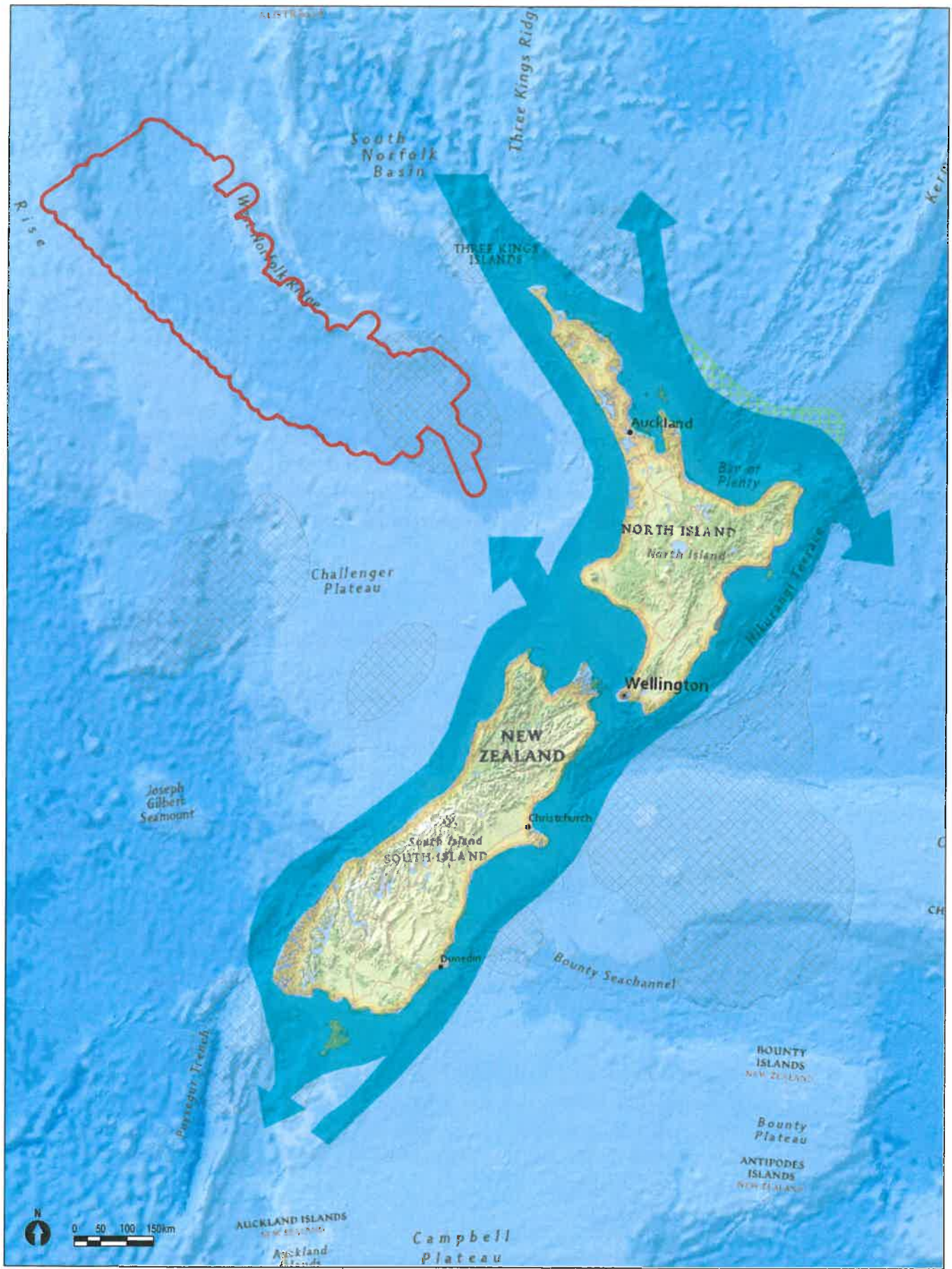


Figure 5.26 ***Marine Mammal Observations in the Area during the 2014 MBESS***

A concentration of marine mammals was observed in the Bellona Trough that runs from the Bellona Basin into the NCB between Lord Howe Rise and the Challenger Plateau (outside the boundaries of the proposed MSS). The reason for this concentration is unknown however it is speculated that the currents flowing north and east through the Trough cause an upwelling in the area.

The seasonal migrations of species like Humpback Whales are well recorded. They migrate north from Antarctica and pass along the west coast of New Zealand into the waters of Vanuatu and New Caledonia. In November and December, the whales return south to Antarctica.

The migration routes for key species are shown below in *Figure 5.27*.



Legend

- Operational Area
- Humpback
- Bryde's
- Southern Right
- Sperm

Client:	Energy Holdings Offshore Ltd	
Drawing No:	0267364s_IA_G005_R0.mxd	
Date:	30/11/2015	Drawing Size: A4
Drawn By:	GC	Reviewed By: AL

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 5.27 - Humpback Whale Migration through New Zealand Waters and Approximate Locations of Sperm, Bryde's and Southern Right Whales

New Caledonia Basin Marine Mammal Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM

The International Whaling Commission (IWC 2014) identifies 13 great whales, 8 of which could occur in the permit. These species are described in more detail below.

Antarctic Minke Whale

The Antarctic Minke Whale is considered to be a species of least concern. It is also a baleen whale that feeds on krill and fish. They are approximately 11 m long and 9 tonnes in weight (IWC 2014).

The distribution of the whale is poorly known; however, it appears to summer in the Antarctic (at around 7°S) and winter at around 35°S. Antarctic Mike Whales are listed as *Not Threatened* under the NZ Threat Classification System.

An Antarctic Minke Whale was observed just outside the permit area. There have been no marine mammal observations recorded during the winter period, when they would be expected in the area. Based on this single observation and the fact that Antarctic Minke Whale would be anticipated during the winter period it is considered likely that they visit the permit area during the southern winter.

Blue Whale

The Blue Whale is a very large baleen whale (~26 m long) that has an average weight of 100 - 120 tonnes (IWC 2014). The Blue Whale was a primary target for the whale industry with numbers crashing until they became protected in the 1960's. The species has been slow to recover with IUCN estimating that there are between 10,000 to 25,000 globally. Blue Whales are listed as *Migrant* under the NZ Threat Classification System.

Blue Whales are widely distributed and migrate from polar waters for feeding in the summer and back to equatorial regions for breeding in the winter. They are baleen whales whose primary target is krill.

Although no Blue Whales have been seen in the permit area, it is possible that they may migrate through the permit and were reported from near to the southeast boundary of the permit during a survey conducted in 2015.

Bryde's Whale

Bryde's Whale is smaller than the Blue Whale at approximately 14 m long and 17 tonnes (IWC 2014). It is also a baleen whale that feeds on krill and fish. IUCN note the conservation status of Bryde's Whale as being data deficient. This is based on the fact that the number of species and subspecies has not been clearly identified.

There is evidence of migration patterns (IUCN) in the southeast Atlantic population; however, there is not enough data in other regions to clearly establish migration patterns. Bryde's Whales are listed as *Nationally Critical* under the NZ Threat Classification System.

No Bryde's Whales have been observed in the permit area; however, they were reported from near to the southeast boundary of the permit area during a survey conducted in 2015 and their range is considered to be to approximately 35°S, so they may potentially occur in the NCB.

Fin Whale

The Fin Whale is regarded as endangered. It was a primary target for whaling with numbers heavily reduced (IWC 2014). There is evidence of some recovery; however, numbers are still thought to be low at approximately 53,000 in 2000 (IUCN 2014). Fin Whales are listed as *Migrant* under the NZ Threat Classification System.

Fin Whales are approximately 22 m long and 70 tonnes (IWC 2014). They are baleen whales that prey on krill and small fish.

The Fin Whale's summer distribution is mainly 50°- 65°S in the South Pacific similar to the Blue, Minke and Humpback Whales (IWC 2014). The winter distribution is poorly understood; however, they are thought to migrate and therefore may be present in the permit area.

Humpback Whale

Humpback Whales have been recorded in the area. The recent MBESS recorded a humpback whale to the north of the permit on the West Norfolk Ridge *(Photograph 5.1)*.

Humpback Whales are approximately 13 m long and weigh approximately 27 tonnes (IWC 2014). They are wide ranging and follow known seasonal migration routes that cover long distances. They spend the summer months in Antarctic waters before migrating to winter calving and breeding grounds in subtropical and tropical waters. DOC (2014c) states that "*they travel mainly along the east-coast and Cook Strait during winter and return along the west-coast during spring*".

Humpback Whales were heavily exploited (IWC 2014); however, they appear to be recovering in most areas. Population estimates by DOC have indicated that they only recovering slowly in New Zealand waters. The Oceania subpopulation is considered to be endangered (IUCN 2014). Humpback Whales are listed as *Migrant* under the NZ Threat Classification System.

It is considered likely that Humpback Whales will be in the permit area.

Photograph 5.1 Humpback Whale (S. Wood - NIWA)

Sei Whale

Sei Whales (*Photograph 5.2*) are the only confirmed species of whale within the permit area. Sei Whales were observed in the permit area in August and September 2014.

Sei Whales are approximately 16 m long and weigh around 23 tonnes (IWC 2014). They are a baleen whale and target krill, small fish, squid and copepods.

They were heavily targeted between 1905 and 1979, when over 200,000 were thought to have been taken (IUCN 2014). There was a severe decline in numbers with an estimated 10,000 left in the southern hemisphere in 1996 (IUCN 2014). The IUCN consider the species to be endangered. Sei Whales are listed as *Migrant* under the NZ Threat Classification System.

Photograph 5.2 Sei Whale (S. Wood - NIWA)

Southern Right Whale

Southern Right Whales are approximately 15 m long and weigh approximately 60 tonnes (IWC 2014). They are circumpolar and occur between 20°S and 55°S. They feed mainly on copepods and occasionally krill. Southern Right Whales migrate between the Antarctic seas in summer to their breeding grounds at higher latitudes. They have major breeding areas off southern Australia and New Zealand (Auckland Islands and Campbell Islands).

Southern Right Whales were heavily targeted by whalers. The total numbers taken are not known; however, a conservative estimate is around 150,000 (IUCN 2014). By the beginning of the last century the species was rare and was protected in 1935 when it was considered that there were only about 1,600 remaining (IUCN 2014).

The population of the Southern Right Whales has increased and they are now considered to be of *Least Concern* globally by the IUCN, with the population estimated to be around 7,500 in 1997 (IUCN 2014). However, in New Zealand the species is listed as *Nationally Endangered* under the NZ Threat Classification System.

Although the permit is not known to be a major breeding area for Southern Right Whales (these are further south), it is still within their migration range. It is, therefore, possible that they may be within the permit area.

Sperm Whale

Sperm Whales are a large toothed whale. The males are approximately 15 m long and 45 tonnes (IWC 2014). Females are smaller at approximately 11 m long and 20 tonnes.

The Sperm Whale has a large geographical range and can be found from the equator to the Antarctic (IWC 2014). They prefer deep water and can be found in most seas with depths of over 1,000 m (IUCN 2014). There appears to be some variation between the movements of adult Sperm Whales and juveniles (IWC 2014). Males tend to range further with females usually in deeper waters (> 1000 m) and at latitudes less than 40-50° (DOC 2014).

IUCN suggests that the pre-whaling population of Sperm Whales may have been over a million. However, whaling reduced the population by over 60%. It is thought that the global population is in the 100,000's (2002). Sperm Whales are classified as *vulnerable* by the IUCN but are listed as *Not Threatened* under the NZ Threat Classification System.

Based on the preferred depth of the Sperm Whale and their geographical range it is likely that they will be present in the permit area.

Other Cetaceans Observed in the Area

The DOC observations in the region noted another four species that had been recorded.

Bottlenose Dolphin

The Bottlenose Dolphins (also known as the Common Bottlenose Dolphin) has a global distribution and are generally found in tropical and temperate waters. They tend to be primarily coastal; however, they do range into deeper water. In coastal areas they can maintain definable home ranges (IUCN 2014). Bottlenose Dolphins generally do not venture beyond approximately 45°S (IUCN 2014). Bottlenose Dolphins prey mostly on fish and squid. The Bottlenose Dolphin is listed as *Nationally Endangered* under the NZ Threat Classification System.

Bottlenose Dolphins range in size from approximately 150 - 650 kilograms (kg) in weight and 200 - 400 cm long.

Short-beaked Common Dolphin

The Short-beaked Common Dolphin, is found in warm temperate waters with extant range in Australasia covering all of New Zealand and the southern waters of Australia. According to DOC (2014c) the species "*tends to remain a few kilometres from the coast and is particularly common in the Hauraki Gulf and off Northland*". However, DOC has records of the Common Dolphin in the region of the permit area, which indicates that they do range a considerable distance offshore.

They range in size from approximately 150 - 240 cm long and weigh approximately 100 -140 kg. They can dive to depths of around 300 m and feed upon a variety of prey. According to IUCN they "*have a preference for upwelling-modified waters, areas with steep sea floor relief, and extensive shelf areas, but they are widespread in warm temperate and tropical waters*".

DOC observations show that the numbers range from individuals to pods of around 20. The main impact on the Common Dolphin is mortalities associated with by-catch (IUCN 2014).

The Short-beaked Common Dolphin is listed as *Not Threatened* under the NZ Threat Classification System.

It is possible that the Common Dolphin may transit the area. However, based on their preference for upwelling areas, they are more likely to found on the ridges either side of the permit.

Pilot Whale

A Pilot Whale was noted in the DOC records, however the record does not identify whether it is a Long-finned or Short-finned Pilot Whale.

Pilot Whales are Odontocetes (toothed) whales. Long-finned Pilot Whales generally live in cooler waters near the poles, while Short-finned Pilot Whales live in tropical and subtropical waters. There are regions of overlap, with the permit area being one of these regions.

Pilot Whales primary prey is squid; however, they will also target fish. Long-finned Pilot Whales are on average approximately 6.5 m long and around 2 tonnes. Short-finned Pilot Whales are on average approximately 6 m long and around 3 tonnes. IUCN class both species of Pilot Whale as Data Deficient. The Long-finned Pilot Whale is listed as *Not Threatened* under the NZ Threat Classification System. The Short-finned Pilot Whale is listed as *Migrant* under the NZ Threat Classification System.

Killer Whale

Killer Whales, also known as Orca, have a wide geographical range from the poles to the equator (IUCN 2014); however, they are more common in areas of high marine productivity.

Killer Whales are toothed whales and prey on a wide variety of species, including marine mammals, seabirds, sea turtles, fish and cephalopods (IUCN 2014). Killer Whales are around 7 m long and between 4 and 6 tonnes.

DOC records show that individuals and pods of Killer Whales have been seen in the area. Although there are no records of Killer Whales in the permit, their wide ranging nature means that they are likely to transit the area. The type A Killer Whale is listed as *Nationally Critical* and all other types as listed as *Vagrant* under the NZ Threat Classification System.

Beaked Whales

There are 11 species of beaked whales known to inhabit New Zealand's waters, however the chance of seeing these enigmatic species is rare and in most cases limited to strandings. Beaked whales occupy open oceans, diving to depths of 300 m to feed on squid.

Beaked whales have a small head, a beak and bulging forehead, and small depressions on each side of their body, knows as flipper pockets, that are thought to assist the whale with streamlining during diving. They range in size from approximately 3 - 13 m long.

Beaked whales are rarely observed in New Zealand waters with only 5 sightings recorded since the introduction of the Code of Conduct in 2013 (DOC, 2015). These sightings did not include any observations in the far north of New Zealand and there were no observations during the August/September 2014 MBESS over the NCB. Given the low abundance of observations it is unlikely that the presence or absence of beaked whales will be ascertained during in this seismic survey.

Pinnipeds

There are four main species of pinniped (DOC 2014) that occur in New Zealand waters. Three of these species are restricted in range to the Antarctic and Sub-Antarctic regions and are not likely to occur in the permit area. The other species (the New Zealand Fur Seal) has been recorded in the southern part of the permit (*Photograph 5.3*).

Male New Zealand Fur Seals can weight around 150 kg with females weighing around 40 kg. Males can are approximately 2 m long, while females are around 1.5 m (IUCN 2014).

IUCN considers that New Zealand Fur Seals are non-migratory; however, they can spend significant time at sea a long way from shore.

There are thought to be approximately 200,000 New Zealand Fur Seals (IUCN 2014) and considered to be a species of least concern.

Photograph 5.3 NZ Fur Seal (S. Wood - NIWA)

New Zealand Fur Seals prey on a large variety of cephalopods, fish, and birds. The most frequently taken birds are little penguins and short-tailed shearwaters (IUCN 2014). The New Zealand Fur Seal can dive to considerable depths (male up to 380 m (IUCN 2014)). However, they generally dive to shallower depths (100 - 200 m (DOC 2014)). The depth of the dives depends on the vertical migration of their prey.

5.3.6 *Marine Reptiles*

The metocean information detailed in *Section 4.1.3* shows that the summer sea surface temperatures in the NCB are relatively warm. This combined with the Tasman Front means that there is a potential for marine reptiles to occur in the NCB, including sea snakes and turtles.

There are two types of sea snake that may be present in the permit area; the Yellow-bellied Sea Snake (*Pelamis platura*) and the Sea Krait (*Laticauda colubrine*). Both of the snakes have a conservation status of Least Concern.

With regards to turtles in the permit, it is possible that the following may be present: Green Turtle (*Chelonia mydas*) (Endangered); Leatherback Turtle (*Dermochelys coriacea*) (Vulnerable); Loggerhead Turtle (*Caretta caretta*) (Endangered); Hawksbill Turtle (*Eretmochelys imbricate*) (Critically Endangered).

These reptiles will follow the warm currents and will transit through the permit. It is not considered that they will be abundant in the permit area.

5.3.7 *Seabirds*

Bird observations were undertaken by during the MBESS in August and September 2014, from vantage points all around the *RV Tangaroa*, and were limited to the confines of the bridge only during periods of very rough weather. Throughout the voyage a total of 4,458 bird observations were logged and 37 species catalogued, including some terrestrial species.

Notable sightings of specific birds included:

- 1 Indian Yellow Nosed Albatross (21 August);
- 3 New Zealand Storm Petrels (9 September and 11 September;
- 1 Grey Headed Albatross (9 September); and
- 1 Great Shearwater (18 September).

A list of birds for which the species was positively identified during the survey is included in *Table* 5.6. The most common sightings included the Grey faced Petrel (1837), New Zealand wandering albatross (200) and white capped albatross (188).

Table 5.6 ***Table 5.6 Seabirds for which Species was Identified Surveyed between Cook Straight on 17th August to New Caledonia on 21st September 2014***

Species	Total Seabirds Surveyed - Cook Strait, South Taranaki, Nth Taranaki, South NCB, West Norfolk Ridge, Lord Howe Rise, Lord Howe Rise and Norfolk Trough, West Norfolk Ridge, Northern NCB and Noumea transit.
Black-Browed Albatross	28
Buller's Albatross	15
Campbell Albatross	98
Grey Headed Albatross	1
Indian Yellow-nosed Albatross	2

Light Mantled Sooty Albatross	2
Northern Royal Albatross	17
NZ Wandering Albatross	200
Salvin's Albatross	18
Snowy Albatross	30
Southern Royal Albatross	5
White Capped Albatross	188
Black Bellied Storm Petrel	12
Black winged Petrel	1
Cape Petrel	178
Common Diving Petrel	8
Cook's Petrel	38
Grey Faced Petrel	1837
Grey Petrel	1
Kermadec Petrel	1
Northern Giant Petrel	89
NZ Storm Petrel	3
Soft Plummed Petrel	3
White Chinned Petrel	13
White Faced Storm Petrel	33
Total	**2821**

The NABIS database has details of bird species that are anticipated in the area and these are listed in *Table 5.6*, which also includes the results of the surveys undertaken during the MBESS. It should be noted that due to the short duration of the MBESS, the absence of a particular species from the observations does not mean that the species is absent from the area.

Table 5.6 ***Seabirds Potentially or Known to be Present in the AOI***

Common Name	Latin Name	Conservation Status		Observed in the Permit Area (number)
		IUCN Red List	NZ Conservation Status	
Antipodean Albatross	*Diomedea antipodensis antipodensis*	Vulnerable	Nationally Critical	
Gibson's Albatross	*Diomedea antipodensis gibsoni*	Vulnerable	Nationally Critical	
Indian Yellow-Nose Albatross	*Thalassarche [chlororhynchos] carteri*		Non Resident Native	(Photo 4.4)

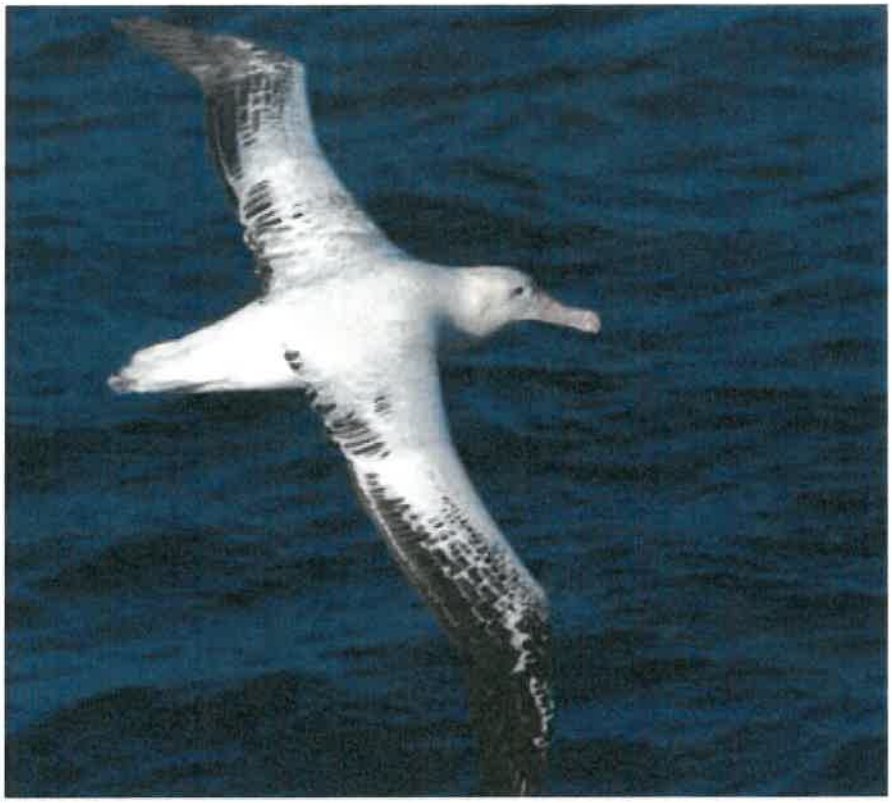
Common Name	Latin Name	Conservation Status		Observed in the Permit Area (number)
		IUCN Red List	NZ Conservation Status	
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable	Naturally Uncommon	
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	Naturally Uncommon	2
Northern Buller's Albatross	*Thalassarche bulleri platei*	Near Threatened	Naturally Uncommon	5
Salvin's Albatross	*Thalassarche salvini*	Vulnerable	Nationally Critical	
Campbell Albatross	*Thalassarche impavida*	Vulnerable	Naturally Uncommon	(Photo 4.5)
Black-Browed Albatross	*Thalassarche melanophrys*	Near Threatened	Non Resident Native	
New Zealand Wandering Albatross	*Diomedea exulans*	Vulnerable	Migrant	20
White-Capped Albatross	*Thalassarche steadi*	Near Threatened	Declining	23
Fairy Prion	*Pachyptila turtur*	Least Concern	Relict	164 (Photo 4.8)
Broad-Billed Prion	*Pachyptila vittata*	Least Concern	Relict	
White-Chinned Petrel	*Procellaria aequinoctialis*	Vulnerable	Declining	
Cape Petrel	*Daption capense australe*	Least Concern	Naturally Uncommon	14
Northern Giant Petrel	*Macronectus halli*	Least Concern	Naturally Uncommon	8
Grey Petrel	*Procellaria cinerea*	Near Threatened	Naturally Uncommon	1
Black Petrel	*Procellaria parkinsoni*	Vulnerable	Nationally Vulnerable	
Cook's Petrel	*Pterodroma cookii*	Vulnerable	Gradual Decline	10
Pycroft's Petrel	*Pterodroma pycrofti*	Vulnerable	Recovering	
Mottled Petrel	*Pterodroma inexpectata*	Near Threatened	Relict	
Grey-Faced Petrel	*Pterodroma macroptera gouldi*	Least Concern	Not Threatened	358 (Photo 4.7)
Black-Winged Petrel	*Pterodroma nigripennis*	Least Concern	Not Threatened	

Common Name	Latin Name	Conservation Status		Observed in the Permit Area (number)
		IUCN Red List	NZ Conservation Status	
White-Naped Petrel	*Pterodroma cervicalis*	Vulnerable	Relict	
Kermadec Petrel	*Pterodroma neglecta*	Least Concern	Relict	
Little Shearwater	*Puffinus assimilis*	Least Concern	Not Resident Native	23
Buller's Shearwater	*Puffinus bulleri*	Vulnerable	Naturally Uncommon	
Flesh-Footed Shearwater	*Puffinus carneipes*	Least Concern	Nationally Vulnerable	
Fluttering Shearwater	*Puffinus gavia*	Least Concern	Relict	
Hutton's Shearwater	*Puffinus huttoni*	Least Concern	Declining	63
Sooty Shearwater	*Puffinus griseus*	Near Threatened	Declining	
White-Bellied Storm Petrel	*Fregetta grallaria*	Least Concern	Nationally Endangered	
White-Faced Storm Petrel	*Pelagodroma marina*	Least Concern	Relict	8
Australasian Gannet	*Morus serrator*	Least Concern	Not Threatened	60
Masked Booby	*Sula dactylatra*	Least Concern	Nationally Endangered	
White Tern	*Gygis alba*	Least Concern	Not listed	

Photographs of some of the birds observed during the MBESS are shown below.

Photograph 5.4 Indian Yellow Nosed Albatross (S. Wood - NIWA)

Photograph 5.5 Campbell Island Albatross (S. Wood - NIWA)



Photograph 5.6 Snowy Albatross (S. Wood - NIWA)

Photograph 5.7 Grey Faced Petrel (S. Wood - NIWA)

Photograph 5.8 Fairy Prion (S. Wood - NIWA)

The species observed are primarily wide ranging seabirds that will transit the basin opportunistically looking for food. It is unlikely that any of the species will spend large amounts of time in the permit area as they will follow the winds and the currents.

5.4 CULTURAL, SOCIAL AND ECONOMIC ENVIRONMENT

This section provides an overview of the socio-economic and cultural environment relevant to the Project. Whilst the AOI is located a significant distance from the shoreline, it is recognised that the nature of the proposed activity and the potential extent of unplanned events in particular require discussion with key socio-economic and cultural aspects within the broader regional AOI. This includes onshore communities, regional industries and cultural contexts. Data for this section have been compiled from a broad range of sources, including Census data from Statistics New Zealand, outputs from iwi consultation and engagement activities, and reviews of local media, regional council information and other community forums.

As with many indigenous cultures, Māori have a close affinity with the natural environment in which they live, and have developed a complex spiritual, psychological and physical world view that focuses strongly on the management and custodianship of this environment. These interactions and concepts of guardianship and authority such as *kaitiaki* and *mana whenua* extend strongly into the coastal and marine environment as a result of the traditional history of Māori as seafaring island peoples.

Oral traditions tell of how Paikeha came to Aotearoa (New Zealand) from Hawaiki on the back of a whale after his waka (canoe) sinks. This tradition corresponds with the annual migration of whales from the Pacific Ocean to Aotearoa.

It is considered likely that Māori ancestors followed the whale migrations in their wakas south in the months of November and December to the feeding and calving grounds offshore Aotearoa. The whales move at a speed of 3 to 5 knots that could have been followed by waka.

When this is combined with knowledge of migratory birds like kuaka (godwit) and the movement of the stars, the Māori ancestors would have confidently followed whales over considerable distances.

The time when the Humpback Whales migrate south aligns with the stars and constellations most useful for navigation including Kōpū (Venus), Te Waka o Tamarereti (Scorpio) and Māhutonga (the Southern Cross). It is known that there was Māori knowledge of the stars by tukutuku weaving which adorns the walls of whare (houses).

In Māori tradition whales are the descendants of Tangaroa, the god of the oceans. They are often deemed tapu or sacred.

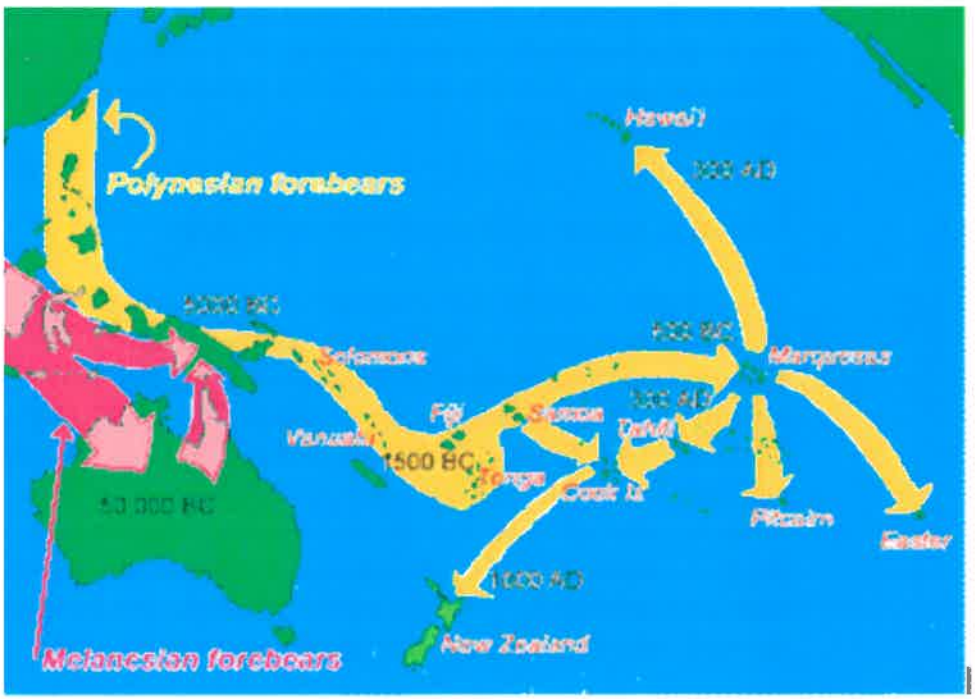


Figure 5.28 ***Historical Movements of Peoples in the Pacific***
Source: www.maaori.com

The iwi and hapū in the Northland area have been identified through consultation with DOC and by viewing http://www.tkm.govt.nz/region/te-tai-tokerau/. It is acknowledged that treaty settlements have not been made

with all iwi and hapū in the region, therefore, all maps and figures are for general reference only and should not be consider absolute boundaries.

Figure 5.29 shows the iwi groups in the Te Tai Tokerau (Northland Region) as detailed by Te Puni Kōkiri (http://www.tpk.govt.nz/en/). Te Puni Kōkiri state that the groups listed here are based on:

- Iwi recognised by the Crown in the Māori Fisheries Act 2004;
- Any other iwi/hapū groups that have been formally recognised by the Crown for historic Treaty settlement purposes; and
- Most of these recognised iwi/hapū are represented by an Iwi authority for the purposes of the Resource Management Act 1991 (RMA).

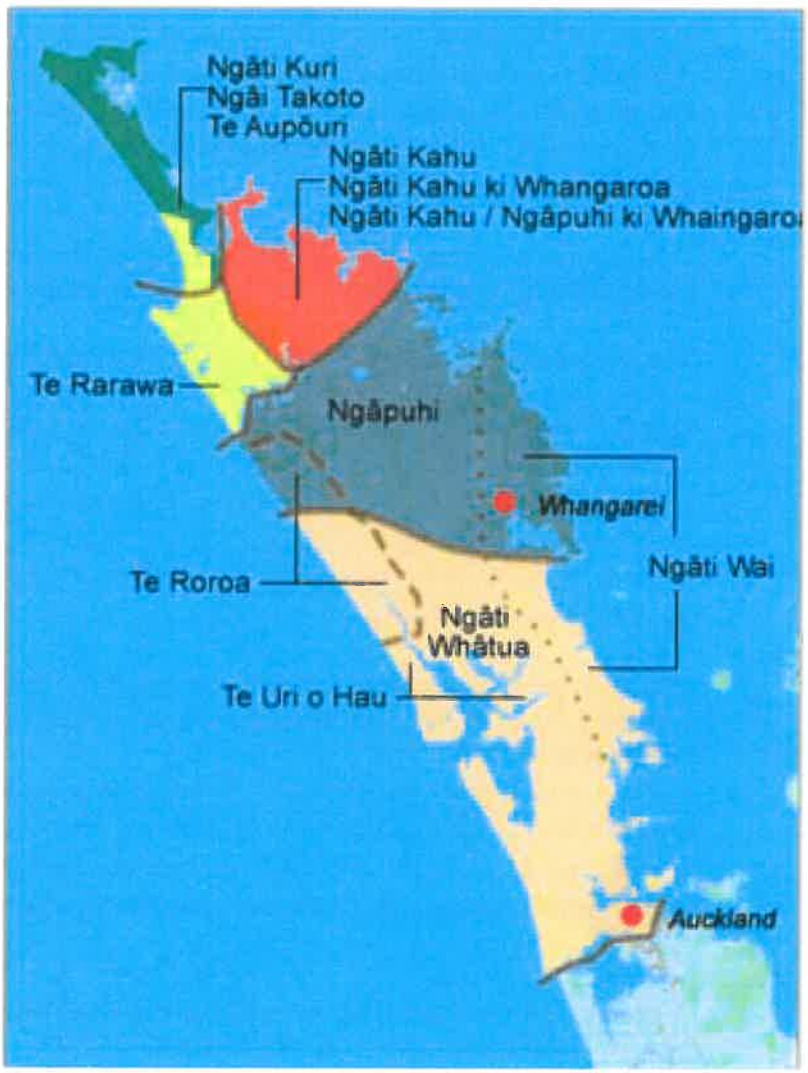


Figure 5.29 ***Iwi Groups in Te Tai Tokerau***
Source: *http://www.tkm.govt.nz/region/te-tai-tokerau/*

The Waitangi Tribunal in Ko Aotearoa Tēnei – Factsheet 3 on Taonga Species acknowledges that *"Protecting taonga species and mātauranga Māori [Māori*

traditional knowledge] aids the survival of Māori culture itself". It also identifies that iwi and hapū are obliged to act as kaitiaki (cultural guardians) of taonga species within their tribal areas.

The Tribunal identifies taonga species as being "*species of flora and fauna that are significant to the culture or identity of Māori iwi or hapū – for example, because there is a body of inherited knowledge relating to them, they are related to iwi or hapū by whakapapa, and iwi or hapū is obliged to act as their kaitiaki*". This definition is quite broad; however, in relation to the permit area it could be considered that taonga species are cetaceans and migratory birds. Due to the significant distance offshore of the permit it would be hard to determine which individual iwi or hapū would have kaitiaiki over the area. To this end EHOL has undertaken a detailed consultation process with iwi and hapū in their role as kaitiaki. Please see the consultation section (*Section 4.3.3*).

In this MMIA the effects on the taonga species is considered in the Impact Assessment section (*Section 6*). It should be noted that the Impact Assessment only reviews the potential physical and behavioural effects of the survey on taonga species. It does not consider the relationship between iwi or hapū by whakapapa to taonga species.

The following claims have been made by those iwi identified as having interests in the area for which this MMIA has been developed:

The settlement of a historical claim under the Treaty of Waitangi Act 1975

Historic claims made by Te Rarawa, Te Aupōuri, Ngāi Takoto, Te Roroa, Te Uri o Hau, Ngāti Kuri and Ngāti Whātua under the *Treaty of Waitangi Act 1975* have been agreed and supporting legislation passed. Other iwi within the Northland region, including Ngāti Kahu, Ngāpuhi and Ngāti Wai, are yet to settle on their claims under this Act. These settlements are not relevant to the activities of this MMIA.

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

- It is understood that there are no customary areas as established under the *Fisheries Act 1996* and *Kaimoana Customary Fishing Regulations 1998* within the permit area. There are also no special management areas (mātaitai reserves and taiapure) along the west coast of the upper North Island of New Zealand.

A protected customary right or customary marine title recognized under the Marine and Coastal Area (Takutai Moana) Act 2011.

As at October 2015, there are no active applications to have customary rights or customary marine titles within the permit area. However, it is important to note that applications can be submitted until April 2017. Outside of the permit area and lying adjacent, Hapū of Te Uri o Hau have a customary

marine title and protected customary rights extending from Kaipara Harbour, north to Mahuta Gap and out to 12 nm.

5.4.1 *Regional Context*

The closest point to the NCB permit area is the west coast of the North Island, and the two closest regions are Northland and Auckland.

The Northland Region is a narrow peninsula, stretching 330 km from Auckland to Cape Rēinga (*Figure 5.30*). Northland's regional and administrative boundaries account for 265 km of this area. Northland has a population of over 448,000 people.

The region is 85 km across at its widest point, and 7.5 km at its narrowest. The typical inland landscape is rolling hill country. Flat land is rare, found mainly in narrow river valleys and coastal areas.

There are three districts that make up Northland Region including Far North, Whangarei and Kaipara. The largest city is Whangarei located on the eastern side of the region. The two larger towns are Kaitaia and Dargaville.

Figure 5.30 ***Map of Northland and Districts***

The Auckland region is the largest and most populous urban area in New Zealand. It has a population of 1,318,000, which is 32 percent of the country's population.

The Auckland urban area ranges from Waiwera in the north, Kumeu in the northwest, and Runciman in the south (*Figure 5.31*). Auckland lies between the Hauraki Gulf of the Pacific Ocean to the east, the low Hunua Ranges to the south-east, the Manukau Harbour to the south-west, and the Waitakere Ranges and smaller ranges to the west and north-west.

The wider Auckland Region includes the rural areas and towns north and south of the urban area, plus the islands of the Haruaki Gulf. The whole region is governed by the Auckland Council.

Figure 5.31 *Map of Auckland Region*

5.4.2 *Fishing*

The permit area is a considerable distance from shore (~200 km). The distance removes the likelihood of recreational fishing occurring in the area. Recreational fishing is not therefore considered further in this MMIA.

New Zealand's deepwater fisheries are considered to be those that occur beyond the 12 nautical miles. Deepwater fisheries produced over NZ$648 million in export earnings during the 2012 calendar year (the most recent year for which statistics are reported on the Ministry for Fisheries website) (http://www.fish.govt.nz/en-nz/Deepwater). Deepwater fisheries have been ranked into three tiers based on their commercial importance:

- Tier 1 - high volume and/or high value fisheries. Important export revenue earners, with high quota value. Species include; Hoki, Hake, Ling, Southern Blue Whiting, Jack Mackerel, Orange Roughy, Oreo, Scampi, and Squid;

- Tier 2 - less sizable fisheries or only target fisheries at certain times of the year. Species include; Alfonsino, Silver Warehou, Barracouta, Cardinal Fish, Frostfish, Ribaldo, Ruby Fish, Spiny Dogfish, Lookdown Dory, Pale Ghost Shark, Blue (English) Mackerel, Prawn Killer, Redbait, Gemfish, Deepwater Crabs, Dark Ghost Shark, Sea Perch; and

- Tier 3 - species caught as bycatch that are not managed through the quota management system.

The southern part of the permit area is in the northwest region Fisheries Management Area 9.

The MPI provided information on all the commercial fishing activity within the NCB and surrounding areas. There are six types of commercial fishing activity in the region targeting three species. These include:

- Bottom trawl for Orange Roughy on the West Norfolk Ridge;

- Bottom trawl for Orange Roughy on the Challenger Plateau;

- Bottom trawl for Orange Roughy on the Lord Howe Rise;

- Midwater and bottom trawl for Alfonsino on the Lord Howe Rise;

- Bottom longline fishery for Bluenose on the West Norfolk Ridge; and

- Bottom longline fishery for Bluenose on the Lord Howe Rise.

Discussions with Sealord and the Deep Water Fisheries Group (see *Section 6.3.3*) identified Orange Roughy as the most important fishery species in the area. *Figure 5.32* shows the location of fishing activity in the area.

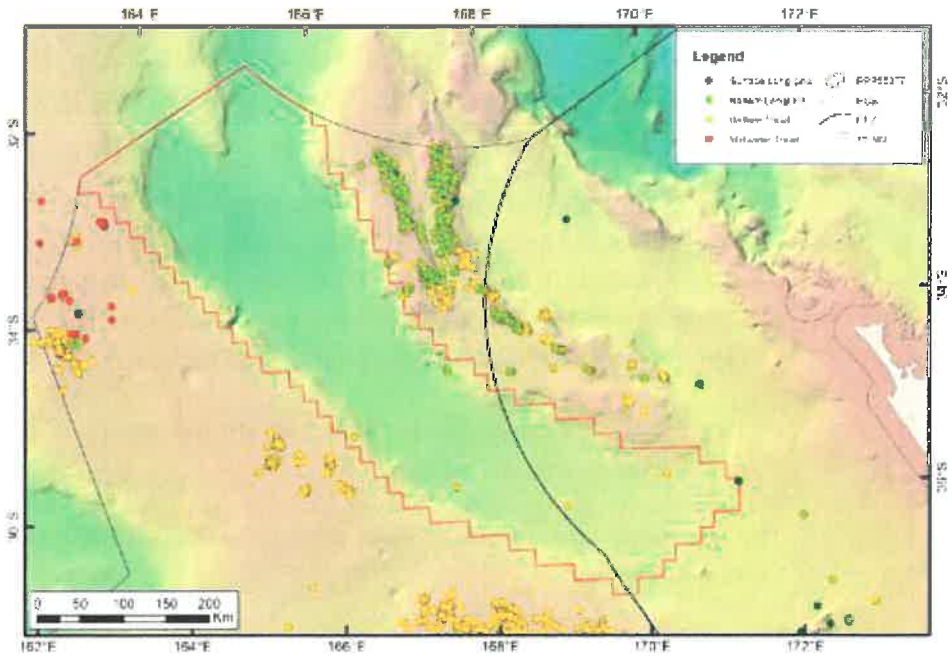


Figure 5.32 ***Fishing Activity in the Area 2008 – 2012***

Even though Orange Roughy are a Tier 1 species, they are only seasonal in the NCB area. Sealord and the Deep Water Fisheries Group confirmed that they target the species in June to August. According to MPI *"There is no customary non-commercial or recreational fishing for orange roughy"*.

Orange Roughy

Orange Roughy (*Figure 5.33*) are a deepwater fish. They are slow-growing and are believed to be long-lived (120-130 years). They are estimated to reach sexual maturity between 23 and 31 years of age.

Orange Roughy spawn each year, between June and early August. Spawning fish form dense aggregations at depths of 700 m - 1,000 m during this period and hence are targeted by fisheries at this time. The spawning areas are usually associated with bottom features such as pinnacles and canyons that are found on the West Norfolk Ridge, Lord Howe Rise and the Challenger Plateau.

The Orange Roughy quota, across all fisheries, was 5,859 tonnes (processed weight) in 2008, with an export value of $60.8 million. The majority of Orange Roughy is exported as frozen fillets with 69% exported to the USA and 18% to Australia.

Figure 5.33 ***Orange Roughy***
Source: SeaLord©

Bluenose

Bluenose (
Figure 5.34) is considered to be common in New Zealand waters. The depth distribution of Bluenose tends to be dependent on age, with younger fish being found near the surface and more mature fish being found at deeper waters (below 600 m).

Bluenose live up to 60 years and reach maturity at about ten years. They spawn between January and April.

There was no specific catch information from West Norfolk Ridge and Lord Howe Rise; however, the Bluenose Auckland East (BNS1) that covers the southern part of the permit caught 2,927,301 kg in 2013.

Figure 5.34 Bluenose
Source: SeaLord©

Alfonsino

Alfonsino (*Figure 5.35*) are part of the Berycidae family (Alfonsinos). They inhabit deep offshore reefs. Http://www.amalmark.co.nz/alfonsino.html describes the alfonsino as being found around the North Island and the northern part of the South Island at depths between 200 m and 800 m. This species is not abundant. During the day they appear to school near the seabed, dispersing upwards to feed on plankton at dusk.

Alfonsino have a maximum recorded age of 17 years. Females grow faster than males. Spawning grounds are not known but may be in tropical waters to the north. They are caught year-round by mid-water trawling off the east coast of New Zealand and the Chatham Islands. The main target fishery is off the lower east coast of the North Island.

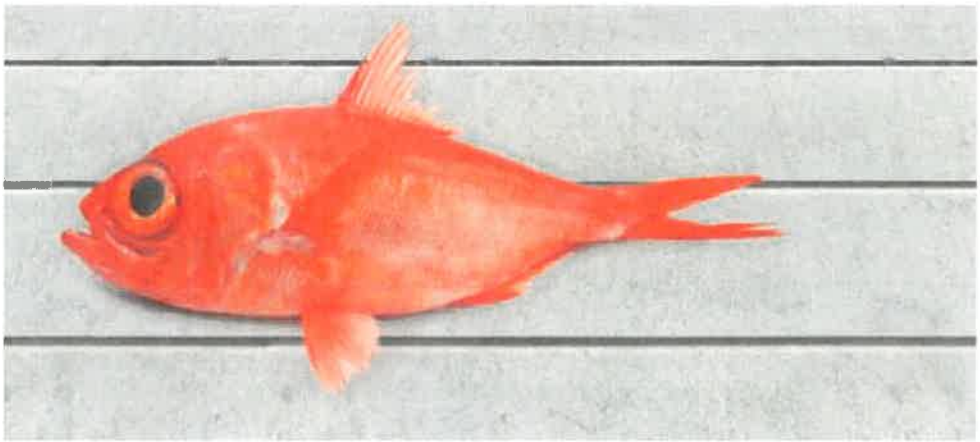


Figure 5.35 ***Alfonsino***
Source: Seafoods.com©

Both Alfonsino and Bluenose can be caught all year round.

5.4.3 Shipping

The AOI is within an area that may be traversed by commercial shipping transiting around the top of the North Island, fishing vessels accessing offshore fishing grounds, private yachts or other offshore mineral interests transiting to permit areas to the north of the AOI. The open water nature of the AOI means that navigation in the area is not restricted, other than by safety restrictions that may be in place around the operating seismic survey vessel. To provide an indication of the density of vessel movements in the area, historical vessel positions around New Zealand (over a 6-month period in 2013) for commercial vessels using Automatic Identification Systems are shown in *Figure 5.36*.

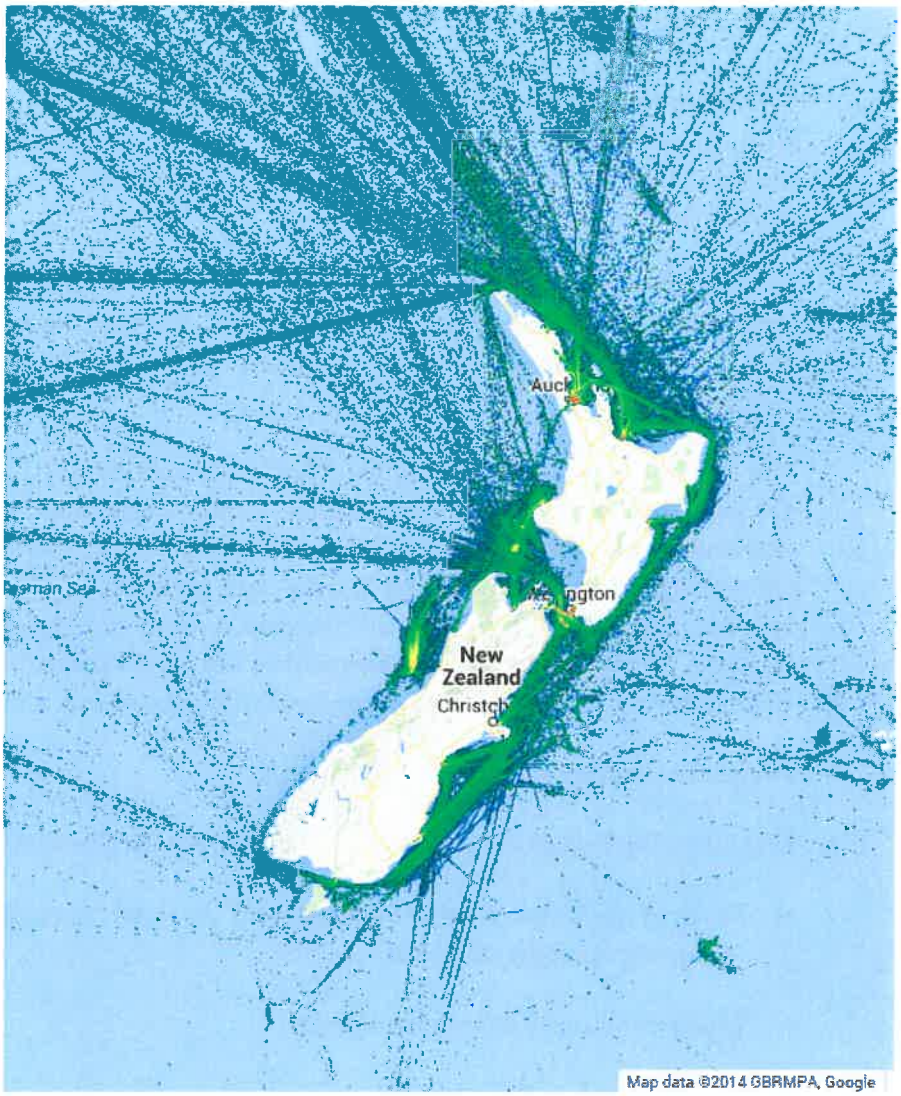


Figure 5.36 ***Vessel Positions Recorded during July - December 2013***
Source: ***Marine Traffic.com***

6 SCREENING AND SCOPING RESULTS

Screening was conducted by EHOL to identify any impact assessment requirements for the Project. The process assessed all legislative and internal corporate regulations and standards to determine if the proposed development requires an MMIA.

As a result of this process it was determined that, under the EEZ Act the Project would need to comply with the Code. Further, under the Code the Project was considered a Level 1 Survey and therefore an MMIA was required.

The Project was assessed against Shell's internal Health Safety Security Environment and Social Performance Control Framework and it was determined that the Project falls under Category B as it was considered that the impacts of a 2D MSS under normal and abnormal operations were site specific, and few if any were irreversible. It was not considered to be a Category C project, as the environment is not well known in the NCB and there is no conclusive data to determine whether the area is sensitive or not.

6.1.1 *Project Interactions*

The following Project aspects have been considered in this MMIA:

- Physical presence of the vessel/s and in-water equipment including "occupation", light and noise;
- Underwater noise from seismic array;
- Vessel operational discharges;
- Unplanned events –
  - Spills of fuels, oil and chemicals;
  - Collision;
  - Loss of in-water equipment; and
  - Introduction of invasive marine species.

The following physical, biological and cultural, social and economic values and receptors have been considered:

Physical

- Water column; and
- Atmosphere.

Biological

- Marine mammals;
- Seabirds;
- Fish;
- Benthic communities;
- Plankton; and
- Atmosphere.

Cultural, Social and Economic

- Cultural values;
- Recreation;
- Commercial fishing;
- Shipping; and
- Tourism.

Potential impacts from the Project have been identified through a systematic process whereby the features and activities (both planned and unplanned) associated with each stage of the Project have been considered with respect to their potential to interact with resources/receptors. Potential impacts have each been classified in one of three categories:

- **No interaction**: where the Project is unlikely to interact with the resource/receptor (e.g. offshore projects are unlikely to interact with onshore receptors);

- **Interaction possible, but not likely to be significant**: where there is likely to be an interaction, but the resultant impact is unlikely to change baseline conditions in an appreciable or detectable way; and

- **Significant interaction**: where there is likely to be an interaction, and the resultant impact has a reasonable potential to cause a significant effect on the resource/receptor.

Each cell on the Potential Interactions Matrix presented in *Table 6.1 Potential Interactions Matrix completed as part of the Scoping Stage of the Project* represents a potential interaction between a Project aspect and an environmental or socio-economic receptor or value. Those cells that are coloured white were scoped out of further consideration in the MMIA. The MMIA includes a discussion of all interactions coded grey or black, with the greatest attention paid to those interactions that have potential to cause a significant effect.

Those resources/receptors with interactions that have been identified as possible, but which are not likely to lead to impacts of significance are presented in *Table 6.2*.

Table 6.1 ***Potential Interactions Matrix completed as part of the Scoping Stage of the Project***

Project Phases and Activities	Resources and Receptors									
	Biological and Physical						Social and Economic			
	Marine Mammals	Seabirds	Fish	Benthic Communities	Water Column	Atmosphere	Commercial Fishing	Shipping	Cultural Values	Tourism
Planned Activities										
Physical presence of the seismic and support vessel in-water equipment	■	■				▒	■	■		
Underwater noise from seismic survey	■		■	■			■		■	
Operational discharges from the survey and support vessel	▒	▒	▒		■				▒	
Unplanned Activities										
Minor spills of fuels, oils and chemicals	■	■	■	■	■		■		■	
Collisions	■	■	■	■	■		■	■	■	
Accidental loss of in-water equipment		■					■	▒	■	
Introduction of invasive marine species			■	■			■		■	

□ No interaction

▒ Interaction possible but not likely to be significant

■ Interaction – potentially significant

Table 6.2 ***Interactions from Planned Activities Identified as Possible, but that are not Likely to Lead to Significant Impacts***

(Note: All unplanned activities have been assessed within Section 7.7*)*

Interaction (between Project activity and resource/receptor)	Justification for expectation of non-significant impacts
Physical presence of the seismic and support vessel and towing of equipment	
Atmosphere	As the Project site is located offshore and a significant distance from any potentially sensitive receptors, the air quality in the area is expected to be of very high quality, with the only likely current impacts coming from occasional passing shipping. Emissions from the operation of the Project vessels, will impact air quality with such impacts relating to reduced air quality in the immediate area. Within the offshore environment where high winds are frequent, rapid dispersion of any emissions will minimise any impacts. This, coupled with the lack of receptors due to the remote nature of the Project and the temporary nature of the Project, supports the conclusion that any impacts will not lead to significant impacts.
Operational discharges from the survey and support vessel	
Marine mammals, seabirds and fish	Discharges of grey water and treated sewage or food waste from the seismic vessel may interact with marine mammals, seabirds and fish if they are present within the mixing zone at the time of discharge. However, given the unlikely nature of such an occurrence eventuating, coupled with the short duration of exposure should it occur, it is unlikely that any impacts will be significant.
Cultural values	Due to the distance of the vessel offshore, any impacts on cultural receptors will be indirect and the nature of treated operational waste means there is negligible chances of significant interactions with ecological or other economic values such as commercial fishing.

7 IMPACT ASSESSMENT RESULTS

7.1 INTRODUCTION

This chapter describes the assessment of the potential environmental impacts from planned and unplanned activities relating to the Project. The assessment considers how the various aspects of the Project activities (*Section 2*) could affect aspects of the physical, biological, and human environment within the AOI (described in *Section 5*).

7.2 IMPACT ASSESSMENT SCOPE

This MMIA considers impacts of the Project on relevant environmental and social resources and receptors. It addresses all impacts that will occur and may occur during the seismic survey programme, both within the AOI and in the broader region where secondary impacts may occur.

As discussed in *Section 6*, this MMIA has been scoped to include those project aspects that are considered to be of likely significance, which are addressed in this section. The remainder of impacts, which are not considered to be of significance, are outlined in *Table 6.2*.

The Project has been broken down to the following components that may result in significant impacts:

- Physical presence of the vessel/s and in-water equipment including "occupation", light and noise;
- Underwater noise from seismic array;
- Vessel operational discharges;
- Unplanned events –
  - Spills of fuel, oil or chemicals;
  - Collision;
  - Loss of in-water equipment; and
  - Introduction of invasive marine species.

The majority of the impacts resulting from project activities are anticipated to occur in the marine environment near the proposed survey location. The main impact sources and receptors relating to the proposed MSS programme are presented in *Table 7.1*.

Table 7.1 ***Potential Significant Impacts and Relevant Receptors***

Impact Source	Resource/ Receptor	Section
Impacts from Planned Project Components		
Physical presence of the seismic and support vessel and in-water equipment	• Marine Mammals • Seabirds • Commercial Fishing • Shipping	*7.4*
Underwater noise from the firing of the airgun arrays	• Marine Mammals • Fish • Benthic Communities • Commercial Fishing • Cultural Values	*7.5*
Waste discharges from the survey and support vessel	• Water Column	*7.6*
Impacts from Unplanned Events		
Minor spills of fuels, oils and chemicals	• Marine Mammals • Seabirds • Fish • Benthic Communities • Water Column • Commercial Fishing • Cultural Values	*7.7.2*
Collisions	• Marine Mammals • Seabirds • Fish • Benthic Communities • Water Column • Commercial Fishing • Shipping • Cultural Values	*7.7.3*
Accidental loss of in-water equipment	• Seabirds • Commercial Fishing	*7.7.4*
Introduction of invasive marine species	• Fish • Benthic Communities • Commercial Fishing • Cultural Values	*7.7.5*

7.3 *ASSESSMENT METHODOLOGY*

As discussed in *Section 4* planned impacts have been quantified by assessing the sensitivity of the resources and receptors being impacted, coupled with the magnitude of the impacts, to determine the overall impact significance. Unplanned impacts have been assessed by considering the severity of potential impacts against the likelihood of the impacts occurring to assess the overall impact significance (criteria for the rankings can be found in *Section 4.4*). In all instances, mitigation and control measures are considered after the initial MMIA, and residual impact significance is then provided.

A Marine Mammal Management Plan (MMMP) will be produced for the Project, prior to any seismic activities commencing. The MMMP will incorporate all of the mitigation measures outlined in this MMIA, as well as any additional measures identified as necessary, through consultation with DOC and the contracted MMOs, after completion of this MMIA. The MMMP will be an operational document for use during the survey and a copy will be provided to DOC for their review and approval.

7.4 *Physical Presence Of The Seismic And Support vessel and In-Water Equipment*

7.4.1 *Impact Sources*

The key impact sources from the operation of the seismic and support vessel and the towing of the equipment include:

- The presence of the seismic survey and support vessel;
- Vessel lighting; and
- The spatial extent of the towed airgun and streamer array.

7.4.2 *Sensitivity of Receptors*

The key receptors potentially subject to interactions relating to the physical presence of the vessels, including vessel lighting, and in-water equipment include:

- Marine Mammals;
- Seabirds;
- Commercial fishing; and
- Shipping.

Marine Mammal Sensitivity

Although the records of actual sightings of marine mammals in the AOI area indicate that numbers are likely to be very low, a total of 31 marine mammal species have been identified as being present or potentially present within the AOI. It is possible that these will include marine mammal species that are under pressure both within New Zealand and globally, thus they are afforded regulatory protection. Accordingly, marine mammal sensitivity to physical disturbance resulting from the operation of the vessels and towing of the equipment is considered ***medium.***

Marine Mammal Sensitivity	Low	Medium	High
Applicable Criteria	Some whale and dolphin species have low abundance, restricted ranges, are currently under pressure or are slow to adapt to changing environments. Species are valued locally / regionally and may be endemic, endangered or protected.		

Seabird Sensitivity

The interaction of seabirds with vessels has been studied among commercial fishery operations (DOC, 2008; Thompson, 2009). Such studies have shown that vessels alone don't attract seabirds and that other attractors are required, such as food availability (Pierre *et al.*, 2010). During the Project, the only artificial light sources that may attract seabirds are deck lighting on the seismic survey vessel and the support vessel. If seabirds are within the visual range of the vessels at night they may be attracted to lighting (Black, 2005). It was noted by observers on the 2014 MBESS in the AOI that seabirds did not appear to be attracted to the survey vessel, and no incidents of bird strike occurred. There will be no discharge of food wastes during the survey that may attract seabirds to the MSS vessel. Although unlikely to be affected, some of the seabirds in the area have low population numbers or are under threat. Accordingly, the sensitivity of seabirds to the physical presence of the Project infrastructure is considered to be ***medium***.

Seabird Sensitivity	Low	Medium	High
Applicable Criteria	Seabirds in the area are rare or endemic, under pressure and / or slow to adapt to changing environments. Species are valued nationally / globally and are listed as endangered or protected.		

Commercial Fisheries Sensitivity

There is potential that the physical presence of the seismic vessel and support vessel may exclude fisheries from the area for the duration of the Project, or cause temporary displacement of fish stocks. However, the Project will be completed within approximately 4 months and covers only a small proportion of the total FMA available for fishing operations. Therefore the physical presence of the vessels is not expected to cause any significant disruption to fishing or displacement of fish stocks. Any impact is therefore expected to be temporary and localised. Further, direct discussions with representatives of the fishing industry did not identify any specific concerns. Accordingly, the sensitivity of commercial fisheries to physical disturbance is considered ***low***.

Commercial Fisheries Sensitivity	Low	Medium	High
Applicable Criteria	Minimal areas of vulnerabilities; consequently with a high ability to adapt to changes brought by the Project.		

Shipping Sensitivity

During the Project, marine traffic will be able to move through the region despite the navigation safety area around the survey vessel. Marine traffic in the area will therefore be required to navigate around the survey vessel and in-water equipment. The COLREGS and the *Maritime Rules Part 22: Collision Prevention* outline the compulsory use of warning signs including those announcing restricted manoeuvrability or the presence of underwater structures including fishing equipment or streamers. Following these guidelines reduces the risk of any collisions between vessels and therefore the sensitivity of shipping to physical disturbance is considered ***low***.

Shipping Sensitivity	**Low**	Medium	High
Applicable Criteria	Minimal areas of vulnerabilities; consequently with a high ability to adapt to changes brought by the Project.		

7.4.3 *Evaluation of Impacts – Physical Presence of Seismic Survey Vessel and the Support Vessel*

Impact Description

The only receptors considered likely to be affected by the movement of the seismic and support vessel are marine mammals. Vessel collision with other vessels or marine mammals has been assessed as an unplanned event and is covered in *Section 7.7.3, Evaluation of Potential Impacts – Collisions.*

The potential for behavioural changes of marine mammals as a result of vessel presence vary between species, locations and vessel activity, and a variety of behavioural changes of cetaceans has been recorded in studies relating to tourism operations New Zealand. Behavioural changes such as the formation of tighter dolphin pods as well as shorter respiratory intervals and decreased surface intervals for Sperm Whales are all thought to indicate an element of stress from vessel interaction (MacGibbon, 1991; Ritcher *et al.* 2003). However, this stress is thought to be associated specifically with rapid approaches, sudden changes in speed and close approaches as part of tourism-related activities that typically use small fast-moving vessels (Gordon *et al.*, 1992). Further, these vessels intentionally locate themselves in the vicinity of the cetaceans and, due to the nature of the industry, there are likely to be multiple vessels and interactions within a limited area or time period. When vessels slowed their approaches and limited sudden changes in speed and direction around the mammals, less behavioural impacts on sperm whales were observed (Gordon *et al.*, 1992).

Given the localised nature of this impact, slow operating speeds of the seismic vessel, large area of open water in which the vessels are operating and the temporary nature of the Project it is expected this impact will be limited to a specific group of localised individuals, travelling through the area at the time

of the Project, and any impacts will be limited to the duration of the activity. Thus, the overall magnitude of this impact is considered to be ***small***.

Magnitude of Impacts – Vessel Movements	Negligible	**Small**	Medium	Large
Applicable Criteria	Affects a specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.			

Mitigation Measures

Vessels working on the Project will abide by the guidelines outlined in the *Marine Mammals Protection Regulations 1992* and will not intentionally approach marine mammals and, where safely possible, vessel operators will take evasive action such as reducing speed or changing course to avoid close interactions with whales. MMOs and/or PAM operators will be on watch at all times during the survey and MMOs will generally be on watch during vessel transits to and from port. The seismic vessel is also likely to relocate to another part of the survey area if frequent marine mammal mitigations are encountered in order to minimise disruption/downtime under the Code.

Residual Impact

While the sensitivity of marine mammals to physical disturbance was found to be ***medium***, the impact magnitude from vessel movement was found to be ***negligible*** with the implementation of the above mitigation measures. Accordingly, the impact significance from physical disturbance relating to the presence of the seismic and support vessel on marine mammals is considered to be ***negligible***.

Category	**Impact before Mitigation**	**Residual Impact**
Magnitude of Impact	Small	Negligible
Sensitivity of Marine Mammals	Medium	Medium
Significance of Vessel Movement on Marine Mammals	**Minor**	**Negligible**

7.4.4 *Evaluation of Impacts – Vessel Lighting*

Impact Description

Lighting of the seismic survey and support vessel decks can attract bird species (Wiese *et al.*, 2001). It is not considered that there is any potential for other receptors to be impacted by vessel lighting relating to the operations. The duration of the risk is limited to the project duration. Further, the physical distance across which this lighting would be visible and could have an impact will be limited. Due to the time frame and the localised nature of

the impact, coupled with the limited number of vessels (a single seismic and single support vessel), the magnitude from lighting is considered to be ***small***.

Magnitude of Impacts – Vessel Lighting	Negligible	**Small**	Medium	Large
Applicable Criteria	Affects a specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.			

Mitigation Measures

The key mitigation of impacts from lighting on board the seismic survey vessel and the support vessel decks involves using only lighting required for safe navigation and operations and limiting the degree of light spill on the water surface as far as is safe and practicable. The effects of the survey vessel lighting are expected to be less than those typically associated with offshore fishing vessels.

Residual Impact

While the sensitivity of seabirds to lighting impacts was found to be ***medium***, the impact magnitude from lighting on the seismic survey vessel and the support vessel decks was found to be ***negligible*** with the implementation of the mitigation measures detailed above. Accordingly, the impact significance from deck lighting is considered to be ***negligible***.

Category	**Impact before Mitigation**	**Residual Impact**
Magnitude of Lighting Impacts	Small	Negligible
Sensitivity of Seabirds to Lighting Impacts	Medium	Medium
Significance of Lighting Impacts on Seabirds	**Minor**	**Negligible**

7.4.5 *Evaluation of Impacts – Presence of In-Water Equipment*

Impact Description

The only receptors considered likely to be affected by equipment towed by the seismic survey vessel are commercial fishing and other shipping traffic. The towing of the streamer array poses a risk to other vessel operations, including shipping and commercial fishers, operating or transiting through the area. Not only could the array limit the area within which commercial fishing and shipping traffic can navigate, should the vessels not be aware of the towed array they may cross the streamers and cause damage to the vessel or fishing equipment. Further, streamers can become tangled in set nets should they be present in the area, causing damage to the nets. However, there is currently no identified commercial fishing effort within the survey area and the density of the shipping traffic in the area is not high or constrained by other

navigational restrictions in the area. Accordingly, the magnitude of this impact is ***small***.

Magnitude of Impacts – Towed equipment	Negligible	**Small**	Medium	Large
Applicable Criteria	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a temporary nature.			

Mitigation Measures

The mitigation of impacts from towed equipment involves communications between EHOL and their seismic contractors, commercial fisheries and marine traffic, both prior to and during the Project. This communication will be conducted through a Notice to Mariners following the guidelines outlined in the *Maritime Rules Part 22: Collision Prevention.* Further, the streamer will have a tail buoy attached with radar reflectors to ensure that all vessels can visualise the tail of the streamer. On board AIS will ensure the vessel is tagged as a seismic vessel while at sea, alerting all surrounding vessels to the potential for in-water equipment and the limited navigation capacity of the vessel during operations. The support vessel will be available at all times to facilitate communications with other vessels and remove fishing gear from the water that may entangle the streamer.

Residual Impact

The sensitivity of commercial fishing and shipping was found to be ***low*** and the impact magnitude from towed equipment was found to be ***small***. With the introduction of the above mitigation measures, the magnitude of impact is reduced to ***negligible***. The resulting impact significance from towed equipment is ***negligible***.

Category	**Impact before Mitigation**	**Residual Impact**
Magnitude of In-Water Equipment Impacts	Small	Negligible
Sensitivity of Shipping to In-Water Equipment	Low	Low
Sensitivity of Commercial Fishing to In-Water Equipment	Low	Low
Significance of In-Water Equipment Impacts on Shipping	**Negligible**	**Negligible**
Significance of In-Water Equipment Impacts on Commercial fishing	**Negligible**	**Negligible**

7.5 UNDERWATER NOISE FROM THE SEISMIC SURVEY

7.5.1 *Sources of Impact*

The firing of airgun arrays during the seismic survey is considered to be the only significant underwater noise source for the Project. Marine seismic surveys use sound energy sources to create seismic waves in the Earth's crust beneath the sea. Moderate to high energy, low frequency sounds, usually in the form of short-duration pulses, are created along the transect grids (refer to *Section 2.4.5 – Sound Source*).

7.5.2 *Sensitivity of Receptors*

The key receptors potentially subject to impacts from underwater noise generated by the airgun arrays are:

- Marine mammals;
- Fish and invertebrates; and
- Commercial fishing.

Marine Mammal Sensitivity

Marine mammals, in particular cetaceans, are the receptor most prone to impacts from seismic activity. Whales and dolphins utilise their highly sensitive acoustic sense to monitor their environment, communication, socialising, breeding and (for Odontocetes) foraging and feeding. Accordingly, there is potential that they will be sensitive to loud underwater sound within their hearing frequency range.

Baleen whales have a low frequency hearing range of approximately 7 Hz to 22 kiloHertz (**kHz**) with greatest sensitivity around 10 Hz to 10 kHz (Southall *et al.*, 2007; DCENR, 2008). The baleen species identified as potentially occurring within the AOI include the following:

- Humpback Whale;
- Blue Whale;
- Bryde's Whale;
- Fin Whale;
- Sei Whale;
- Pygmy Right Whale;
- Southern Right Whale; and
- Antarctic Minke Whale.

Most toothed whales have auditory sensitivity ranges of 150 Hz to 160 kHz with greatest sensitivity around 20 kHz, and are classified as mid-frequency cetaceans (Southall *et al.*, 2007). Toothed whales and dolphins identified as potentially occurring within the AOI include:

- Bottlenose Dolphin;
- Long-finned Pilot Whales;
- Short-finned Pilot Whales;
- Orca;
- False Killer Whale;
- Sperm whale;
- Dwarf Sperm Whale;
- Gray's Beaked Whale;
- Arnoux's Beaked Whale;
- Strap-Toothed Whale;
- Andrew's Beaked Whale;
- Blainville's Beaked Whale;
- Ginkgo-Toothed Beaked Whale;
- Southern Bottlenose Whale;
- Spade-toothed Whale;
- Hector's Beaked Whale;
- Pygmy Sperm Whale;
- Southern Right Whale Dolphin;
- Short-beaked Common Dolphin;
- Risso's Dolphin;
- Pantropical Spotted Dolphin; and
- Striped Dolphin.

The work of Southall *et al.*, (2007) sets out criteria for permanent and temporary impacts on marine mammals as a result of noise. In order to cause instantaneous injury to cetaceans resulting in a permanent loss in hearing ability the sound level needs to exceed 230 dB referenced to 1 micropascal (re 1 µPa) (peak).

Behavioural changes as a result of disturbance can include cessation of normal activities such as regular diving patterns and commencement of avoidance or 'startle' behaviour, particularly when the noise source is intermittent. Such behavioural effects can result in long-term impacts on individuals, particularly

if a startle response causes a deep-diving animal to rush to the surface, or if avoidance of the source causes the animal to be exposed to predators.

For continuous and repetitive sounds, avoidance behaviour is considered a possibility, although results of field studies are mixed with some not detecting obvious avoidance by whales in the vicinity of operational airguns (e.g. Miller *et al.* 2009, Croll *et al.* 2006) and others finding evidence of avoidance behaviours at sound levels >160dB re 1 µPa (Richardson *et al.* 1986). Some studies have also found some changes to diving and surfacing patterns (Richardson *et al.* 1986, Miller *et al.* 2009) in the presence of airguns and active sonar, although these findings seem to vary between species and season, with another study showing no evidence of changed foraging behaviour by Blue or Fin Whales in the presence of military sonar where the received sound levels exceeded 140 dB re 1 µPa (Croll *et al.* 2006).

A review of the environmental implications of marine seismic surveys on marine species was undertaken by a team of scientists in 2000 (McCauley *et al.*, 2000a). The report outlined that the observed localised avoidance behavioural responses of migrating Humpback Whales to a 3D seismic vessel was to take avoidance manoeuvres of greater than 4 km and allowing the vessel to pass no closer than 3 km. Resting pods with females showed an even greater avoidance response of between 7 km and 12 km. However, some males were seen to be attracted to a single operating air gun thought to be due to it potentially sounding similar to a whale breaching (McCauley *et al.*, 2000a).

For Humpback Whales, studies have shown behavioural response to the upper levels of noise from the seismic survey array of around 175-180 dB re 1µPa (McCauley *et al.*, 1998; McCauley *et al.*, 2000a), which is still below levels of the highest component of Humpback Whale song (192 dB re 1µPa) (McCauley *et al.*, 2000a). Humpback Whale migrations along New Zealand's west coast occur between September and December (Gibbs & Childerhouse, 2000).

Some toothed whales have highly advanced echolocation systems that use intermediate to very high frequencies (tens of kHz to 100+ kHz) (Southall *et al.* 2007). Nachtigall *et al.* (2008) (*cited in* Southall 2007), showed that false killer whales have very acute hearing capabilities including an active 'automatic gain control' mechanism entailing a high susceptibility to marine noise pollution. Social sounds appear to be emitted at a lower frequency band (1 kHz to tens of kHz) (Southall *et al.*, 2007). It is then expected that their functional hearing would cover a wide range of frequencies, but most sensitive at the frequency of their echolocation signals. Based on the combined available data, mid-frequency species are estimated to have lower and upper frequency "limits" of nominal hearing at approximately 150 Hz and 160 kHz, respectively (Southall *et al.*, 2007). Orca have been recorded as displaying strong reactions to noise levels of 140-150 dB re 1 µPa (rms) (Morton and Symonds, 2002 in Table 16 of Southall *et al.*, 2007).

With respect to reported studies of changes in vocalisation patterns in response to underwater noise there are also mixed results. One study reporting increased volume and length of Humpback Whale vocalisation in the presence of active sonar (Fristrup *et al.*, 2003), while others found some evidence of reduced vocalisation of Bowhead and Blue Whales at higher sound levels (Melcón *et al.*, 2012; Blackwell *et al.*, 2015). Many of the studies noted substantial variability in the behaviour of the whales at different times throughout the study periods, but these could not be conclusively linked to the presence of anthropogenic underwater noise and indicate the need for further quantitative research.

Adopting a conservative approach, Southall *et al.* (2007) have applied 120 dB re 1 µPa (rms) as the sensitivity threshold above which behavioural changes by baleen whales may occur and 140 dB re 1 µPa (rms) as the threshold for potential temporary impacts on hearing *(Table 7.2)*.

Table 7.2 ***Noise Assessment Criteria for Baleen Whales, Toothed Whales and Dolphins***

Faunal Group	Long-term Impact Threshold	Temporary Impact Threshold
Baleen whales (low-frequency hearing)	230 dB re 1 µPa	120 dB re 1 µPa (rms)
Toothed whales (mid-frequency hearing)	230 dB re 1 µPa	140 dB re 1 µPa (rms)

The presence of various marine mammals has been recorded within the AOI and the potential for different species to be in the area can be inferred from their distribution ranges. As described above, while some studies suggest there may be changes to diving and vocalisation behaviour of whales in response to underwater noise, many of these studies are inconclusive. There is, as yet, no substantive evidence that underwater noise from seismic activities is directly harmful to marine mammals.

Should any cetaceans be in the region at the time of the Project, they are likely to be in low numbers relative to their overall population (see *Section 5.3.5, Marine Mammals*) and the disturbances associated with most seismic programs are likely to be temporary, infrequent and very localised, so the effects on marine mammals are therefore expected to be minimal (McCauley, 1994). The sightings data that have been obtained, coupled with the informed assumptions made about the presence of species in the area, indicate the presence of marine mammal species that are under pressure both within New Zealand and globally, thus they are afforded regulatory protection. Accordingly, marine mammal sensitivity is considered ***medium.***

Marine Mammal Sensitivity	Low	**Medium**	High
Applicable Criteria	Some whale and dolphin species have low abundance, restricted ranges, are currently under pressure or are slow to adapt to changing environments. Species are valued locally / regionally and may be endemic, endangered or protected.		

Marine Mammal Strandings and Necropsy Results

In the lead up to this survey, that was first scheduled to occur over the 2014/15 summer, there were several whale strandings reported in Northland and some community groups raised concerns that these events were potentially related to seismic activities. There were at least two confirmed whale strandings on Northland beaches during August 2014; a Sperm Whale washed up on Ninety Mile Beach, 4 km South of Hukatere, on August 13th; and a Brydes Whale washed up at Tauroa point, Ahipara, on August 20th . On September 18th, the New Zealand Herald reported that there had been four such strandings in the past 6 weeks on Far North beaches (M. Dinsdale 2014, *Answers Being Sought for Whale Strandings).* The article notes that this has raised concerns amongst some hapū and environmentalists that *"seismic surveying for oil and gas off Northland's west coast could have contributed to the deaths."* The ear bones from the above aforementioned two whales were removed by local hapū and sent to Professor Ewan Fordyce of Otago University for examination. The findings of this examination, provided to DOC, did not show any evidence of damage to the ear bones that might explain the strandings or the cause of death. The conclusion of the examination was that human activity could not be implicated or ruled out absolutely.

In relation to these concerns, it should be noted that the last seismic activity in New Zealand prior to these strandings (starting August 13th) was concluded on July 8th in South Taranaki, more than 400 km to the South. In addition, a multibeam echo-sounding (bathymetry) survey was performed by the NIWA Research Vessel *Tangaroa* on behalf of another Operator in the Reinga Basin, inshore of the New Caledonia Bain, between June 1st and 15th. The same vessel also commenced survey operations in the New Caledonia Basin on August 19th, which is relatively remote and located more than 200 km offshore from Northland.

Based on both peer-reviewed scientific literature and four decades of operational experience there is no evidence to suggest that sound produced during oil and gas industry seismic air-gun survey's has resulted in any physical or auditory injury to a marine mammal. The U.S. National Oceanic and Atmospheric Administration (NOAA) concluded that: *"To date, there is no evidence that serious injury, death, or stranding by marine mammals can occur from exposure to air gun pulses, even in the case of large air gun arrays"* (March 4th, 2014, Federal Register Notice, Vol. 79, No. 42, Pg. 12166).

The non-profit PEW Charitable Trust recently (2015) conducted a review of seismic operations, marine mammal observations and whale strandings occurring in two summer periods in New Zealand in order to help inform public policy. *Figure 7.1* and *Figure 7.2* depict a selected comparison of whale strandings most applicable to the Northland and West Coast that occurred in the presence and absence of seismic surveys. During the 2010/11 summer

period the study identified there were no marine seismic surveys in northern New Zealand, with the nearest activity being a limited survey effort taking place in the South Taranaki region. During this period there was a relative large number of marine mammal strandings in Northland, which occurred in the absence of seismic surveys. In contrast, the recent 2014/15 summer season saw a large number of extensive seismic surveys being conducted from Northland to South Taranaki, yet there were relatively very low numbers of marine mammal strandings in Northland (*Figure 7.2*). These data show no obvious direct relationship between historical marine mammal strandings and marine seismic surveys in New Zealand.

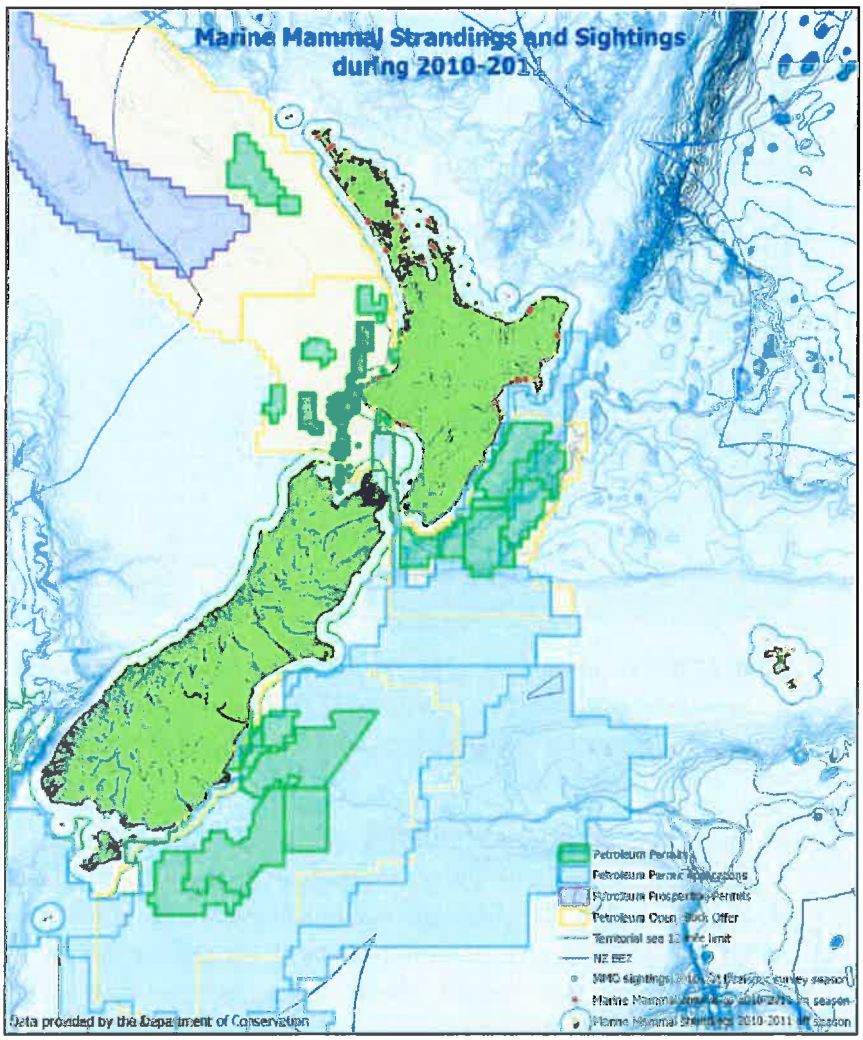


Figure 7.1 ***A 2010/2011Comparison of Marine Mammal Observations (blue dots) During a Summer Seismic Survey period in New Zealand, showing Whale Strandings During the Same Period (red dots) and Outside of this Period (yellow dots)***
Source: PEW Charitable Trusts

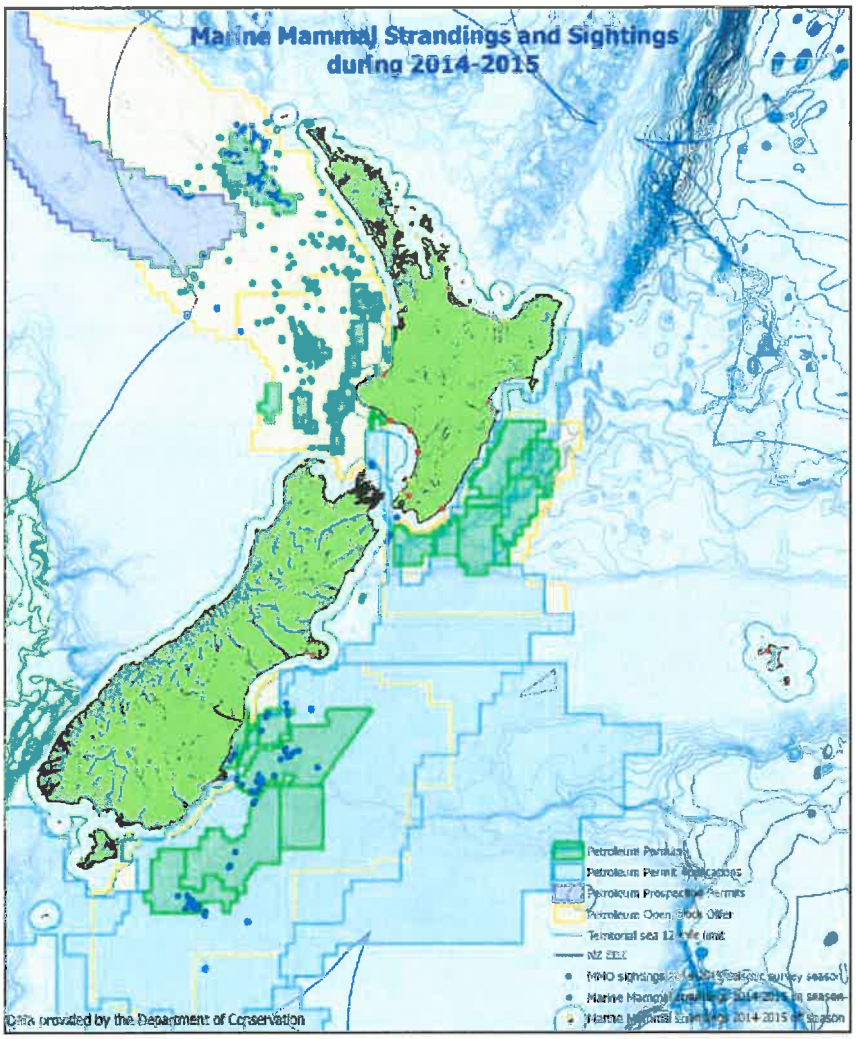


Figure 7.2 ***A 2014/2015 Comparison of Marine Mammal Observations (blue dots) During a Summer Seismic Survey Period in New Zealand, showing Whale Strandings During the Same Period (red dots) and Outside of this Period (yellow dots)***
Source: ***PEW Charitable Trusts***

Whilst this and other studies indicate no systemic impacts, EHOL acknowledges that sub-lethal injuries to marine mammals, or behavioural changes, are very difficult to ascertain. There is a need for ongoing research to better understand any potential impacts on marine mammals from seismic activities. In this regard, Shell supports the Joint Industry Program: http://www.soundandmarinelife.org/.

Based on our stakeholder engagements, EHOL also acknowledges that scientific conclusions around seismic surveys and the mitigation measures that industry employs have been poorly communicated and are little understood at the community level, particularly in areas where such surveys are new. As such, there is a healthy concern over the potential effects of seismic activities being expressed by some Northland hapū members specifically in relation to some 2014 whale strandings. This concern has been conveyed to EHOL staff during the 2014 stakeholder engagements associated with this MMIA, including that with Northland DOC officers. As part of our

mitigation plan and to ease community concern, DOC in Northland recommended to EHOL that they consider supporting necropsy of any stranded whales during our seismic survey.

Shell NZ has previously voluntarily given an undertaking for necropsy on the basis that the phenomena of whale stranding has been documented for centuries and to this day, the contributing factors are still being researched and understood. Scientists have identified a number of these factors, which include: illness, injuries, predators, storms and toxins from algae. EHOL would therefore like to contribute to such scientific research into understanding the cause of any such coincidental marine mammal stranding of relevance to our survey area and activity. EHOL will therefore voluntarily agree to sponsor the independent scientific necropsy of representative marine mammals that strand between Kaipara Harbour to Cape Reinga in Northland during the survey and within two (2) weeks following survey completion.

The necropsy's will be at the discretion and under the management of DOC, with the actual necropsy conducted by Massey University, who will examine and report on all potential causes of mortality, including an auditory examination. It should be noted that DOC's ability to organise such necropsies may be limited by access restrictions and timing (decomposition) constraints given some remote Northland coastline localities.

Fish and Invertebrate Sensitivity

If present, fish may be exposed to underwater noise during the firing of the airgun arrays. Some fish use sound to communicate, locate prey, detect predators and as a cue for orientation (McCauley *et. al.,* 2000a). The susceptibility of fish to seismic sound differs between species, with those with a swim bladder more susceptible. Fish have been shown to display a startle response to short range start up or high level air gun air gun level above 156–161 dB re 1 µPa (rms) (McCauley *et al.*, 2000a) or may swim faster and form tighter groups or swim deeper and the accumulations of fish adjacent to operating facilities indicates that in the absence of any associated threats, they can be expected to habituate to this noise (Lindquist *et al.* 2005). Normal fish behaviours are expected to return some 14-30 minutes after the cessation of the sound emission (McCauley *et al.*, 2000a).

Within close range however, seismic surveys have been found cause a variety of sublethal impacts on fish such as damaging orientation systems and reducing their ability to find food and even lead to mortality in both adult and larval fish (Alaska Marine Conservation Council, no date.). Other studies have identified developmental impacts on invertebrate larvae as a result of sound impacts (Aguilar de Soto *et al.*, 2013). Impacts on squid species (*Sepioteuthis australis*) have been investigated and the results indicated that noise levels greater than 147 dB referenced to 1 micropascal squared second (re 1 $\mu Pa^2.s$) induce avoidance behaviour but that a gradual increase in acoustic intensity and prior exposure to air gun noise, decreases the severity of the alarm responses (Fewtrell and McCauley, 2012). Damage can also be done

to fish's inner ear system, where sensory hair cells are damaged and regeneration is generally either very slow or non-existent (McCauley, Fewtrell & Popper, 2002). These results however were recorded with caged fish, unable to flee after the immediate startle from the source sound, and potentially not relating to actual oceanic conditions.

Invertebrate species are often sessile thus unable to avoid impacts from sound. Some species of invertebrates possess mechanosensors that show some resemblance to vertebrate ears (Popper, 2003). Research on a species of crayfish (*Cherax destructor*) indicated sensitivities to water vibration frequencies between 150-300 Hz (Tautz & Sandeman, 1980 *cited in* Miriyasu *et al.* 2004) and North Sea shrimp (*Crangon crangon*) indicating maximal sensitivities to water vibration at 170 Hz (Heinisch & Wiese, 1987 *cited in* Miriyasu *et al.* 2004). Kosheleva (1992) (*cited in* Miriyasu *et al.* 2004) found no discernible effects on amphipods (*Gammarus locusta*) or molluscs (*Mytilus edulis*) exposed to source levels of 220-240 dB re 1 µPa. McCauley *et al.*, (2000b) found behavioural changes in squid (*Sepioteuthis australis*) with alarm responses at 156-161 dB re 1 µPa (rms) and startle responses with ink ejection and rapid avoidance at 174 dB re 1 µPa (rms). No impacts have been detected in available research on soft or hard corals (Woodside, 2008). Research indicates that the majority of marine benthic invertebrates will only respond the seismic sources at extremely close ranges, where deep ocean seismic surveys generally have no effect on benthic invertebrates (McCauley, 1994).

Given the above information, the sensitivity of fish and invertebrates to underwater noise impacts is considered ***low.***

Fish and invertebrate sensitivity	**Low**	Medium	High
Applicable criteria	Fish species are abundant, common or widely distributed and are generally adaptable to changing environments. Species within the AOI are not endangered or protected.		

Commercial Fisheries Sensitivity

As sound source transmissions can cause disturbance to fish species, this can impact on the catch of any commercial fisheries within the area. As stated previously, the AOI is contained almost entirely within an area of low commercial fishing activity (see *Section 5.4.2*) and no commercial fishing occurs within the proposed operational survey area. Nonetheless there is potential that the sound produced from the seismic survey may cause a temporary localised reduction in fish abundance in the area during the Project and concern by commercial fishing operators with respect to Orange Roughy and other species present on the banks and ridges near the survey area. Sensitivity of commercial fisheries to physical disturbance is considered ***low***.

Commercial Fisheries	**Low**	Medium	High
Applicable criteria	Minimal areas of vulnerabilities; consequently with a high ability to adapt to changes brought about by the Project.		

7.5.3 *Evaluation of Impacts – Underwater Noise from Firing of Airgun Arrays*

Impact Description

A seismic airgun is an impulsive underwater transducer which produces moderate to high energy level sound at low frequencies. Airguns function by venting high-pressure air into the water. This produces an air-filled cavity that expands rapidly, then contracts, and re-expands. A seismic wave is created with each oscillation. During operation, air at high pressure (nominally 2,000 psi) is supplied continuously to the airgun. The pulses from the guns are broad band, with most energy concentrated in the 10-200 Hz frequency range, with lower levels in the 200-1000 Hz range. Sound levels at the source can range from 237-262 dB re 1uPa/m, but will vary based on the makeup of the arrays i.e., the number of guns fired concurrently. Generally this sound, in particular at higher frequencies, attenuates rapidly across the initial few hundred metres, with the lower frequency sounds dropping off more slowly (Wyatt, 2008). For seismic airgun sound, usually a reduction in sound intensity of around 6 dB per doubling of distance from the source can be expected, however attenuation is dependent on the conditions and in can range dramatically (McCauley, 1994). Typically, most underwater sound from the airguns will be low frequency (0.01 to 0.3 kHz) with some weaker pulses of higher frequencies (up to 0.5-1 kHz) interspersed, depending on the Project requirements (Richardson *et al.*, 1995).

The duration of the impact on any single receptor will vary depending on the firing sequence required at the time, coupled with the speed of the airgun through the water and the frequency of the sound thereby determining the attenuation. The impacts from the firing of the airgun arrays will be limited to a specific group of localised individuals present at the time of the Project.

As discussed in *Section 6*, marine mammal abundance in the survey area is expected to be very low and limited to transiting individuals. Fish species in the area are generally expected to have wide distributions with the exception of some commercial fisheries species targeted on banks and ridges just outside the permit area. These impacts will not flow through into future generations, nor will it significantly impact the overall population of any marine organisms. Accordingly, the magnitude of the impacts on any receptor from the firing of the airgun arrays is considered to be ***small***.

Magnitude of impacts – Seismic Source Sound	Negligible	**Small**	Medium	Large
Applicable criteria	Affects a specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.			

Mitigation Measures

Section 4.1 of the Code outlines the requirements in which the Project will comply during this activity including pre-survey planning, observers, soft starts and delayed starts and shutdowns. Section 4.1 is applicable as this will be a Level 1 survey due to the size of the acoustic source, and requires, but is not limited to the following measures:

- The completion of a MMIA to be completed and provided to the Director-General of DOC (this MMIA fulfils this requirement);
- At least two (2) qualified Marine Mammal Observers (MMO) and passive acoustic monitoring (PAM) operators on board the source vessel;
- Continuous pre-start PAM for 30 minutes at night or during poor sighting conditions;
- No sightings of marine mammals other than fur seals within the respective mitigation zones for at least 30 minutes before start up during good sighting conditions;
- If starting up in a new location in poor sighting conditions, there will be at least 2 hours of observations during the last good sighting conditions in daylight less than 20 nautical miles from the start up position.
- If, during pre-start observations or while the acoustic source is activated (which includes soft starts), a qualified observer detects at least one cetacean with a calf within 1.5 km of the source, start up will be delayed or the source will be shut down and not be reactivated until:
    - A qualified observer confirms the group has moved to a point that is more than 1.5 km from the source, or
    - Despite continuous observation, 30 minutes has elapsed since the last detection of the group within 1.5 km of the source, and the mitigation zone remains clear;
- If, during pre-start observations or while the acoustic source is activated (which includes soft starts), a qualified observer detects a Species of Concern within 1 km of the source, start up will be delayed or the source will be shut down and not reactivated until:
    - A qualified observer confirms the Species of Concern has moved to a point that is more than 1 km from the source, or
    - Despite continuous observation, 30 minutes has elapsed since the last detection of the Species of Concern within 1 km of the source, and the mitigation zone remains clear.

- If, during pre-start observations a qualified observer detects a marine mammal within 200 m of the source, start up will be delayed until:
    - A qualified observer confirms the marine mammal has moved to a point that is more than 200 m from the source, or
    - Despite continuous observation, 10 minutes has passed since the last detection of a New Zealand fur seal within 200 m of the source and 30 minutes has elapsed since the last detection of any other marine mammal within 200 m of the source, and the mitigation zone remains clear.
- If the PAM system has malfunctioned or become damaged, operations may continue for 20 minutes without PAM while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM gear must be retrieved to solve the problem, operations may continue for an additional 2 hours without PAM monitoring as long as all of the following conditions are met:
    - It is daylight hours and the sea state is less than or equal to Beaufort 4;
    - No marine mammals were detected solely by PAM in the relevant mitigation zones in the previous 2 hours;
    - Two MMOs maintain watch at all times during operations when PAM is not operational;
    - DOC is notified via email as soon as practicable with the time and location in which operations began without an active PAM system; and
    - Operations with an active source, but without an active PAM system, do not exceed a cumulative total of 4 hours in any 24 hour period.
- Where there have been less than 2 hours of good sighting conditions preceding proposed operations (within 20 nm of the planned start up position), the source may be activated if:
    - PAM monitoring has been conducted for 2 hours immediately preceding proposed operations, and
    - Two MMOs have conducted visual monitoring in the 2 hours immediately preceding proposed operations, and
    - No Species of Concern have been sighted during visual monitoring or detected during acoustic monitoring in the relevant mitigation zones in the 2 hours immediately preceding proposed operations, and
    - No fur seals have been sighted during visual monitoring in the relevant mitigation zone in the 10 minutes immediately preceding proposed operations, and

- No other marine mammals have been sighted during visual monitoring or detected during acoustic monitoring in the relevant mitigation zones in the 30 minutes immediately preceding proposed operations.

- In relation to other marine mammals within a mitigation zone of 200 m, if, during pre-start observations prior to initiation of a Level 1 acoustic source soft start, a qualified observer detects a marine mammal within 200 m of the source, start up will be delayed until:

  - A qualified observer confirms the marine mammal has moved to a point that is more than 200 m from the source; or

  - Despite continuous observation, 10 minutes has passed since the last detection of a New Zealand fur seal within 200 m of the source and 30 minutes has elapsed since the last detection of any other marine mammal within 200 m of the source, and the mitigation zone remains clear.

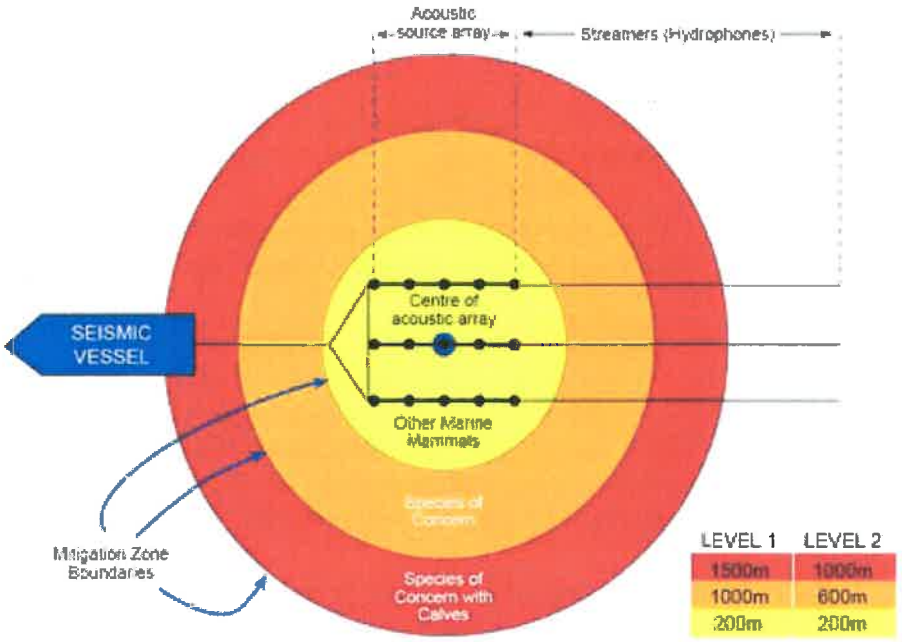


Figure 7.3 ***Seismic Mitigation Zones for Delaying Start or Triggering Shutdown***

Additional mitigation measures to be implemented by EHOL include the following:

- The shot point distance has been increased from the standard shot interval, decreasing the overall number of shots required for the survey by approximately 30%;

- A specific review of the need to collect seismic information from the Bellona Trough given the abundance of Sei Whales (EHOL 2014 MBES Survey), and subsequent decision that it can be avoided (mitigation) during this survey;

- Avoidance of undersea banks and ridges known to be of importance to commercial fisheries;

- Programming the survey to take place outside the peak fishing period for those species targeted on nearby banks and ridges where practicable; and

- Notification of fishing operators in advance the survey commencing.

- With respect to specific mitigations to minimise potential impacts to beaked whales, the only practical mitigation to allow these deeper diving marine mammal species greater opportunity to move away from noise disturbance is to increase the soft start period. This must be balanced by operational constraints and the desire to minimise overall noise disturbance, including duration. The survey design generally consists of Northeast-Southwest perpendicular transects across the NCB between the Lord Howe rise and the West Norfolk Ridge and as such, transects begin and end in shallower water either side of the basin. EHOL does not propose to alter the normal soft start period for such transects. However, where there is an interruption or need to commence or re-commence acquisition within the deep water intra-basin, then EHOL will increase the soft-start to a minimum period of 30 minutes. In the very unlikely event that Shell is experiencing exceptional unforeseen circumstances and/or beaked whales are observed within the basin, then EHOL will revise the soft start mitigation measures in consultation with DOC.

- Additionally, when entering the survey area the support vessel will opportunistically (as available) precede the seismic vessel and maintain an active lookout for marine mammals and notify the MMOs on board the survey vessel. This will allow additional time for avoidance of deep diving marine mammals and opportunity to increase the soft-start time if it is deemed necessary.

Residual Impact

The sensitivity of marine mammals to noise impacts without mitigation was found to be ***medium*** and for fish and invertebrates was found to be ***low.*** The sensitivity of commercial fisheries to noise impacts without mitigation was found to be ***low.*** The significance of noise impacts from the firing of airgun arrays on marine mammals and fish (and therefore commercial fisheries) without mitigation is considered to be ***minor*** and ***negligible*** respectively.

The significance of impacts on fish will remain unchanged after the implementation of the above mitigation measures. The application of mitigation measures will substantially reduce the likelihood of marine

mammals being exposed to noise, however there is some potential that underwater noise may affects a specific group of localised individuals within a population over a short time period, and so the potential magnitude of the impact is unchanged. As a result the overall significance for this impact on marine mammals is expected to be ***minor***.

Category	Impact before Mitigation	Residual Impact
Magnitude of impact	Small	Small
Sensitivity of marine mammals	Medium	Medium
Sensitivity of fish and invertebrates	Low	Low
Significance of impacts from the firing of the airgun arrays on marine mammals	**Minor**	**Minor**
Significance of impacts from the firing of the airgun arrays on fish and invertebrates	**Negligible**	**Negligible**

Category	Impact before Mitigation	Residual Impact
Magnitude of impact	Small	Negligible
Sensitivity of commercial fisheries	Low	Negligible
Significance of impacts from the firing of the airgun arrays on commercial fisheries	**Negligible**	**Negligible**

7.6 OPERATIONAL DISCHARGES FROM THE SEISMIC AND SUPPORT VESSEL

7.6.1 *Sources of Impact*

This section addresses the potential impacts from routine operational discharges to the sea from the vessels.

Wastewater and discharges to the marine environment may occur from the following operational vessel discharges, which will be treated in accordance with relevant MARPOL provisions where these apply to the vessel:

- Deck drainage and treated oily water;
- Treated sewage;
- Grey water (e.g. showers, sinks); and
- Food wastes.

7.6.2 *Sensitivity of Receptors*

Water Quality Sensitivity

The AOI has been subject to limited anthropogenic disturbance and there are few vessel operations within the area other than transits by commercial shipping, the majority of which also do not pass through the NCB. Accordingly, the water quality of the AOI is expected to be very high. Given the strong currents and wave action of the open ocean environment where the Project activities are taking place (see *Section 5.2.2*) any discharges into the marine environment will be subject to very high levels of dispersion and the water quality is expected to rapidly return to its pre-impact state. Accordingly, the sensitivity of the water quality within the AOI is considered to be ***low***.

Water quality sensitivity	**Low**	Medium	High
Applicable criteria	Existing water quality is good and the ecological resources that it supports are not sensitive to a change in water quality.		

7.6.3 *Evaluation of Impacts – Deck Drainage and Bilge Water Discharge*

Impact Description

Any potentially contaminated seawater will be directed to a holding tank then routed through an oil/water separator and monitored for oil concentration before discharge. The content of oil contaminated water that may be discharged to the marine environment is controlled under MARPOL Annex I, with oil-in-water concentrations not to exceed 15 parts per million (ppm). Where practicable, all oily water will be returned to shore for disposal. Based on a maximum concentration of 15 ppm oil-in-water and the nature of the vessel having limited machinery on the deck, any impact will be highly localised to the immediate area of the discharge point, and there would be no visible sheen. Accordingly, the magnitude of this impact is considered to be ***small***.

Magnitude of impacts – deck drainage and oily water discharges	Negligible	**Small**	Medium	Large
Applicable criteria	Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres; and / or discharges are well within benchmark effluent discharge limits.			

Mitigation Measures

Mitigation measures to reduce the impacts of deck drainage and oily water discharges are inherent in the project design or required by regulation including:

- Only uncontaminated deck drainage water can be discharged overboard, all deck drainage from areas that may be contaminated will be directed to bilges for treatment prior to discharge.
- Oily water discharges will be fitted with continuous monitoring equipment and automatic valves to ensure that oil content in effluent being discharged does not exceed 15 ppm.
- Any waste oil transfers will be logged and recorded in the vessels' Oil Record Book and all transfer records held for the required period.
- Vessels will maintain a valid International Oil Pollution Prevention Certificate (IOPPC) and Oil Record Book and will have onboard International Maritime Organization (IMO)-type approved oily water separators and piping arrangements.

Residual Impact

The impact magnitude of these discharges was found to be ***small*** due to the localised nature of the impact and rapid dispersion at the offshore location. The sensitivity of water quality and fish to these discharges was found to be ***low***. Accordingly, the overall impact significance of vessel emissions is considered to be ***negligible***.

Category	Impact before Mitigation	Residual Impact
Magnitude of deck drainage and oily water impacts	Small	Small
Sensitivity of water quality	Low	Low
Sensitivity of fish	Low	Low
Significance of deck drainage and bilge water discharge impacts on water quality	Negligible	Negligible
Significance of deck drainage and bilge water discharge impacts on fish	Negligible	Negligible

7.6.4 *Evaluation of Impacts – Sewage, Grey Water and Food Discharges*

Impact Description

Sewage can contain harmful microorganisms, nutrients, suspended solids, organic material with an associated chemical and biological oxygen demand (**BOD**), and residual chlorine from sewage treatment. On-board systems will treat sewage to IMO standards as set out in Annex IV of MARPOL.

Increased BOD directly impacts water quality as it is a measure of the increased uptake of dissolved oxygen by microorganisms that decompose organic material in the sewage, which in turn temporarily reduces the dissolved oxygen content of the water in the localised area of the discharge. Treated sewage will be discharged offshore in relatively small volumes, which is expected to disperse and dilute quickly due to the ocean currents and wave action in the open ocean environment of the Project area (*Section 5.2.2*). Accordingly, the magnitude of impact from sewage discharge is considered ***small***.

Grey water discharge includes drainage from baths, showers, laundry, wash basins and dishwater. Grey water is not required under MARPOL to be treated before discharge (provided it does not contain a prescribed pollutant). Grey water will be discharged within the AOI throughout the Project duration. This discharge is not predicted to cause any deterioration to water quality outside the immediate point of discharge with high levels of dilution. The magnitude of this discharge is considered to be ***small***.

In accordance with MARPOL Annex V food waste will be discharged without treatment where the vessel is at least 12 nm from nearest land and, when the vessel is less than 12 nm from nearest land, food waste will only be discharged after being comminuted so that the waste is not more than 2.5 mm in diameter. Accordingly, the magnitude of this discharge is considered to be ***small***.

Magnitude of impacts – sewage and grey water discharges	Negligible	**Small**	Medium	Large
Applicable criteria	Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres; and / or discharges are well within benchmark effluent discharge limits.			

Mitigation Measures

- All waste will be handled and disposed of in accordance with the Waste Management Plan (to be developed prior to project initiation) and in full compliance with relevant MARPOL Annexes. All sewage and organic kitchen waste generated on-board Project vessels will either be treated in an approved on-board wastewater treatment facility and discharged more than 12 nm from shore (in compliance with MARPOL Annex IV and V), or contained and discharged at appropriate onshore facilities when the vessels call into port. No marine pollutants will be discharged in operational waste streams.

- The treatment standard for any sewage discharge at sea will be not more than 250 faecal coliforms per 100 ml, total suspended solids of less than 50 mg l^{-1} and the 5-day BOD of less than 50 mg l^{-1}.

- Clinical waste will be stored separately and will not be placed into the sewage or grey water waste stream.

- Any discharges of controlled (non-hazardous) wastes and effluent from the washing or rinsing of containers or equipment will meet acceptable standards for marine discharge in accordance with the relevant regulations.

Residual Impact

The impact magnitude of sewage, grey water and food discharges was found to be ***small*** due to the treatment of waste pre-discharge and the rapid dispersion in the offshore environment. The sensitivity of water quality to these discharges was found to be ***low***. Accordingly, the overall impact significance of sewage, grey water and food discharges is considered to be ***negligible*** both before and after the application of mitigation measures.

Category	Impact before Mitigation	Residual Impact
Magnitude of sewage and grey water discharge impacts	Small	Small
Sensitivity of water quality	Low	Low
Sensitivity of fish	Low	Low
Significance of sewage and grey water discharge impacts on water quality	Negligible	Negligible
Significance of sewage and grey water discharge impacts on fish	Negligible	Negligible

7.7 POTENTIAL IMPACTS FROM UNPLANNED EVENTS

7.7.1 *Potential Sources of Impact*

There is a potential for adverse consequences on both environmental and human receptors in the event of non-routine or accidental events (e.g. spills, leaks or collisions). The primary upset conditions, hazardous events and major accident hazards that could potentially occur include the following:

- Oil, fuel and chemical spills - spills of chemicals or fuel during transfer, handling, storage and use, topside process leaks, or bunker fuel spills in the event of a vessel incident;
- Introduction of invasive species – the introduction of invasive species by the seismic survey vessel or support vessel;
- Collisions – vessel collisions, given that the area is within the vicinity of where fishing activities occur; and
- Streamer cable break and cable content release.

Should these events happen, the following impacts could occur:

- Risks to human life;
- Reduction in water quality and consequent impacts on ecology;
- Direct impacts on marine fauna from oil or chemicals;
- Impacts on fisheries resulting from actual or perceived contamination of fish stocks; and
- Damage to property.

7.7.2 *Evaluation of Potential Impacts -Spills of Fuels, Oils and Chemicals*

Potential Impact Description

The most likely unplanned spill or release during survey operations is the accidental spillage of fuel products during transfer operations (e.g. while refuelling generators or topping up hydraulic fluids). Spill volumes for this kind of unforeseen event, are typically small (ranging from around a few litres) however bunkering spills may be more substantial.

The seismic survey vessel will use marine gas oil and the support vessel will use marine gas oil or marine diesel. Both these fuel types are a middle petroleum distillates that typically undergo rapid dispersion and evaporation in the marine environment when subjected to weathering. Consequently, any small releases are likely to break up and disperse in a short space of time especially in the high energy offshore environment of the Project Area. However, a larger spill has the potential to affect local fish populations, seabirds, and marine mammals including the potential for direct toxicity where oil is ingested, fouling of birds and seals leading to loss of waterproofing and the potential for hypothermia and drowning, and inhalation of vapours by surface breathing mammals. If a spill were to occur close to shore, coastal habitats and communities could also be affected, although this is unlikely given the remote location of the Project.

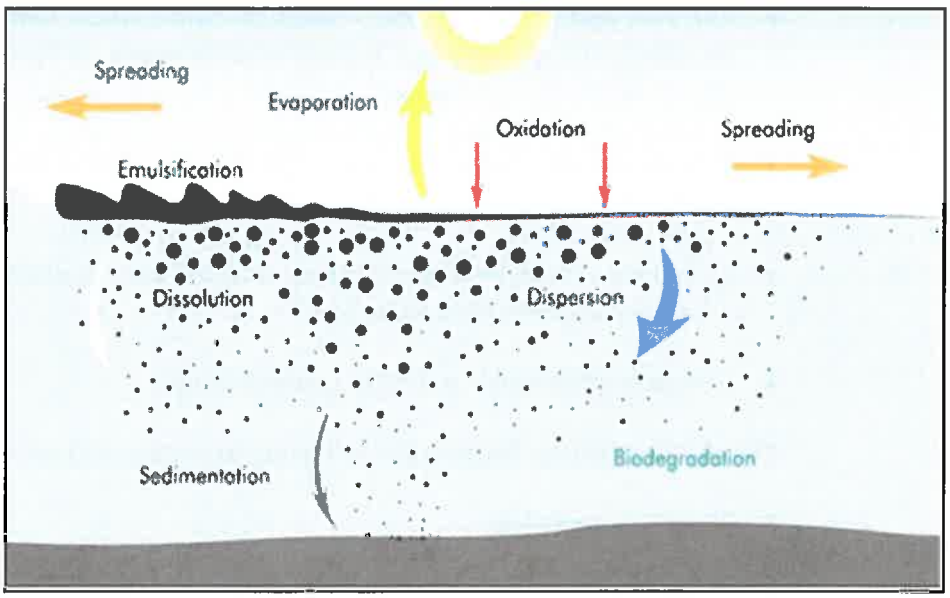


Figure 7.4 ***Fate of Oil Spilled at Sea Showing the Main Weathering Processes***
Source: ITOPF, 2013

Table 7.3 ***Hydrocarbon Fate Processes***
Source: ITOPF, 2013

Process	Description
Drifting	Physical movement of surface hydrocarbon from one location to another due to the combined effects of water current, tides, waves and wind. Hydrocarbons on the water surface typically moves at 100% of the current speed and direction and 3% of wind speed and direction.
Spreading	Increase in the length and breadth of the hydrocarbon slick as it spreads and thins on the sea surface.
Evaporation	Evaporation of lighter hydrocarbons to the atmosphere.
Emulsification/ mousse formation	Formation of water in hydrocarbon emulsions, resulting in an increase in hydrocarbon viscosity. Hydrocarbons with a high asphaltene content are more likely to form stable emulsions.
Entrainment/ dispersion	The formation of hydrocarbon droplets due to breaking waves, resulting in transport of hydrocarbon from the sea surface into the water column.
Dissolution	Physical chemical process resulting in hydrocarbon from the hydrocarbon slick or from suspended oil droplets dissolving into the water column.
Shoreline interaction/ stranding	Increase in density of hydrocarbon due to weathering and interaction with suspended sediments or material of biological origin. Deposition of material to the sea floor. Tar balls may be formed, which could roll along the seabed.
Submergence/ sinking/ sedimentation	Impact of hydrocarbon on the shoreline where it may strand on the surface, or become buried in layers, or may refloat and move elsewhere. The rate of weathering of stranded hydrocarbon depends on several factors, in particular the amount of exposure to waves.
Photo oxidation/ photolysis	Chemical transformation of petroleum hydrocarbons caused by sunlight.
Biodegradation	Biological chemical process altering or transforming hydrocarbons through the action of microbes and/or the ingestion by plankton and other organisms.

Failure of equipment such as hydraulic hoses or storage drums can cause the accidental spillage of hydrocarbons and chemicals. Such spills are generally contained on the vessel due to their small size.

Due to the range of operations that could result in an accidental spill, it is considered possible that a small accidental spill may occur at some stage during the Project.

Likelihood of Occurrence	Extremely Unlikely	**Unlikely**	Possible	Likely
Applicable Criteria	The event is unlikely but may occur at some time during normal operating conditions.			

Given the localised nature of the accidental spills outlined above, due to the small quantities considered, the severity of impacts from the accidental spill of hydrocarbons or chemicals is considered to be ***medium***.

Severity of Impact	Low	**Medium**	High
Applicable Criteria	• Localised environmental damage. • No sensitive resources impacted. • Degradation of spilled materials and full recovery of affected resources.		

Mitigation and Control Measures

EHOL and their contractors will implement the following measures aimed at reducing the potential risk of accidental fuel, oil or chemical spills:

- The following systemic measures will be in place:
  - No refuelling of vessels will be undertaken at sea except in an emergency;
  - Refuelling at port will use established port bunkering facilities for which a current Tier 1 oil spill contingency plan (OSCP) and equipment are in place;
  - Refuelling during the hours of darkness will be avoided where possible;
  - Vessels will use only marine gas oil or marine diesel oil;
  - Review of job hazard analysis for bulk transfer of fuel before transfer commences;
  - Use of a detailed checklist to confirm correct valve line up, quality of equipment and communications arrangements;
  - Pressure testing of hoses before use;
  - Continuous visual monitoring of hoses, couplings and the sea surface during refuelling or transfer;
  - Continuous monitoring of flow gauges on both the seismic vessel and supply vessel; and
  - Continuous contact between the seismic vessel and the supply vessel.

- The following equipment design measures will be in place:
  - Quick disconnect couplings for all transfer hoses used for refuelling in port;
  - Use of dry break couplings and drip trays;
  - Double valves on all systems prone to leakage; and
  - All fuel, oil and chemicals will be stored in special bunded and lined areas designed to hold the full volume of the product being stored.
- The following management measures will be in place:
  - Project vessels will have a valid SOPEP in accordance with MARPOL Annex I requirements, with all crew trained in their roles and responsibilities under the plans and regular exercises of the plans in accordance with the IOPPC requirements;
  - Project vessels will be equipped with appropriate Tier 1 oil spill containment and clean-up equipment;
  - Any spills will be immediately reported to Maritime New Zealand, together with the response actions taken; and
  - There will be very limited chemicals held on board vessels, consisting principally of small quantities of substances required for cleaning and maintenance. Potentially hazardous chemicals (e.g. paint and solvents) will be stored in secure areas on the vessel. Therefore there will be limited eco-toxicological impacts to the environment in the event of a spill.

With the implementation of the above mitigation measures the likelihood of an accidental spill of fuel, oil or chemicals in the AOI is considered to be ***Extremely Unlikely***.

Likelihood of Occurrence	**Extremely Unlikely**	Unlikely	Possible	Likely
Applicable Criteria	The event is extremely unlikely to occur under normal operating conditions but may occur in exceptional circumstances.			

With the implementation of the above mitigation measures the severity of impacts from the accidental spill of fuel, oil or chemicals is considered to be ***Low***.

Severity of Impact	**Low**	Medium	High
Applicable Criteria	• Some damage to the environment/very localised. • No sensitive resources impacted. • Rapid degradation of spilled materials and rapid recovery of affected resources.		

Residual Potential Impact

In the absence of mitigation and control measures the impact significance of impacts from the accidental spill of fuel, oil or chemicals is considered to be ***medium***. With the implementation of the above mitigation and control measures the likelihood of an accidental spill of fuel oil and chemicals occurring in the AOI is ***extremely unlikely***. The severity of the impact is reduced to ***low***. As a result, the overall impact significance from the accidental spill of fuel, oil or chemicals is considered to be ***ALARP***.

Category	Ranking	Residual Impact
Severity of Impact	Medium	Low
Likelihood of Occurrence	Unlikely	Extremely Unlikely
Significance	Minor	ALARP

7.7.3 *Evaluation of Potential Impacts – Collisions*

Potential Impact Description

Impacts that may result from a vessel collision with another vessel are death and injury of vessel crew involved in the incident, damage to the vessels involved, and the potential for this damage to lead to the sinking or either vessel. Damage to the vessel may also result in a loss of containment of bunker fuels, leading to a marine oil spill. The loss of part or a vessel's entire fuel inventory resulting from rupture of the vessel's fuel tanks in a collision would be categorised as a Tier 2 or Tier 3 spill and responded to by the relevant Regional Council or Maritime New Zealand depending on the location and extent of the spill. The maximum spill size would depends on the maximum fuel capacity of the vessel involved, and it is possible that the leak could arise from breaching of fuel tanks of a larger vessel (not forming part of the Project contingent) following collision with a Project vessel.

Incidents resulting from vessel collisions with Project vessels are highly unlikely due to the low density of marine traffic expected at the AOI and the navigational systems and procedures in use on the vessels. In practice, unless there is a catastrophic failure of the vessel's hull usually only part of a vessel's fuel inventory is lost in the case of a bunker tank rupture. Fuel loss is reduced with ingress of water into the tank displacing oil away from the hole and the ability of most vessels to transfer fuel internally or adjust ballast to minimise leakage.

In the unlikely event that the seismic vessel sinks or is involved in a collision, environmental impacts may also arise from the vessel contact with the sea floor and the release of any on-board hazardous materials or solid wastes that may cause a hazard to other vessels in the area or could be ingested by marine fauna (e.g. plastics). In terms of the environmental impacts associated with

support vessel collision or sinking, the quantities of the hazardous materials carried on the vessels are relatively small and are likely to be rapidly dispersed should accidental spillage occur. Nonetheless there will be short-term impacts to water quality. The extent of these impacts will depend on the quantity of the materials lost overboard, but it is most likely impacts will remain local.

Collisions from Project vessels with marine mammals, during transit to and from the Project Area, are also possible. Physical impacts from boat-strikes include the potential for injury, and possibly mortality in severe instances. A global study collated all known ship strikes up until 2002, listing a total of 292 records of confirmed or possible strikes of which 48 were fatal (Jensen & Silber, 2003). Most fatal or serious whale injuries involve strikes from larger vessels (Laist *et al.*, 2001).

Speed is considered a key factor in ship strikes of cetaceans and one study recording the mean speed of the vessels at the point of strike at greater than 18 knots (Jensen & Silber, 2003). It is not expected that any vessels associated with the Project will travel at speeds much greater than approximately 12 knots. Additionally, there will not be small, fast moving vessels that are more commonly associated with marine mammal disturbance, and intentional approaches of marine mammals by Project vessels will not occur.

Given consideration to the above, overall impacts severity of potential impacts from collisions is considered to be ***high*** and the likelihood of a collision occurring is considered to be ***unlikely***.

Severity of Impact-Collisions	Low	Medium	**High**
Applicable criteria	• Severe environmental damage. • Sensitive resources impacted. • Recovery of affected resources is very slow.		

Likelihood of Occurrence	Extremely Unlikely	**Unlikely**	Possible	Likely
Applicable Criteria	The event is unlikely but may occur at some time during normal operating conditions.			

Mitigation and Control Measures

To minimise the likelihood of a collision the following measures will be adopted during the project:

- MMOs and PAM operators will provide notification to the vessel master of any marine mammals in the area of the vessel, including continuing the watch during transits wherever practicable;

- Compliance with *Maritime Rules Part 22: Collision Prevention* (MNZ, 2009), in terms of obligatory appropriate radio, navigational aids e.g. lights, flags and other visible signals, and good navigational practices and seamanship;

- Vessel speeds during the survey will be very slow, generally in the order of 4 to 5 knots;

- Warnings of the proposed survey activities will be issued (Coastal Navigation Warning) and a vigilant watch will be maintained throughout survey activities (radio, Automatic Identification System (**AIS**), radar and visual). Both English and signal code protocols will be employed to allow multi-lingual communication streams;

- Limiting offshore vessel movements to levels that are required for safe and efficient operations;

- No direct approach to marine mammals by vessels and avoidance action taken where possible when a marine mammal is observed in the area of vessel operations;

- Establishing and enforcing a safety buffer zone with a 500 m radius around the Project; and

- Support vessel to act as liaison with any vessels approaching the seismic vessel.

With these mitigation and control measures in place, the likelihood of a collision is considered to be ***extremely unlikely.***

Likelihood of Occurrence	**Extremely Unlikely**	Unlikely	Possible	Likely
Applicable Criteria	The event is extremely unlikely to occur under normal operating conditions but may occur in exceptional circumstances.			

In the unlikely event a collision does occur, EHOL and its contractors will employ the following measures aimed at reducing any subsequent impacts on the marine and coastal environment:

- The seismic and support vessel will use marine gas oil or marine diesel oil in place of heavier fuel products;

- A fully trained and exercised vessel SOPEP in place prior to the Project commencing;

- All chemical and fuel containers including the vessels fuel tanks will be inspected and maintained for the duration of the Project; and

- Any incidents will be immediately reported to Maritime New Zealand, together with the response action taken and EHOL will work with Maritime New Zealand to facilitate any required response activities.

With the implementation of the above mitigation measures, the severity of impacts from a vessel collision is reduced to ***medium*** principally due to the use of light fuel products that will rapidly disperse and weather in typical offshore conditions.

Severity of Impact	Low	**Medium**	High
Applicable Criteria	• Localised environmental damage • No sensitive resources impacted • Degradation of spilled materials and full recovery of affected resources		

Residual Potential Impact

In the absence of mitigation and control measures the impact severity of potential impacts from a collision are considered to be ***high***. However, the implementation of mitigation and control measures reduces the likelihood of a collision to ***extremely unlikely***, and the severity of the impact to ***medium***. This results in the overall impact significance from collisions, to be ***ALARP***.

Category	**Ranking**	**Residual Impact**
Severity of Impact	High	Medium
Likelihood of Occurrence	Unlikely	Extremely Unlikely
Significance	Moderate	ALARP

7.7.4 *Evaluation of Potential Impacts – Loss of Steamers or Other Equipment*

Potential Impact Description

Impacts on ecological communities from the physical presence of project vessels may include the risk of the loss of streamers or other equipment. Streamers may become tangled or break during rough weather, snagging on floating debris or rupturing from interaction with marine species such as sharks or seals. The streamer that will be utilised is mainly gel-filled (solid). These streamers have a very small amount of fluid (typically a low odour, low solubility, low aromatic hydrocarbon solvent such as Isopar M) where the hydrophones are located in the streamer, which amounts to approximately 6 litres in each 150 m section to provide electrical insulation and neutral buoyancy.

The Project vessels also operate under a SOPEP which details actions to be taken in the event of a shipboard oil spill emergency.

Streamers are solid and are expected to be fitted with Streamer Recovery Devices. These devices trigger at certain depths to release gas-filled floats that are attached to the streamers, bringing the streamer to the surface and allowing recovery of the streamer by a support vessel. Lost streamers can also be located through tracking of the signal from the tail buoy, which continues

for up to around 48 hours. Therefore, if a break should occur they would not pose a risk to benthic habitats. However, a broken streamer could foul fishing equipment.

Should any other equipment be lost overboard, the resultant impact would be dependent on the specific item. Foreign items could result in impacts on water quality, harm to marine life by ingestion or impacts on benthic organisms and benthic structure.

Should a streamer break or equipment loss occur, the resultant impact is expected to be minimal and of a temporary duration. As such, the severity of such potential impacts is considered to be *low*.

Severity of Impact	**Low**	Medium	High
Applicable Criteria	• Some damage to the environment/ very localised. • No sensitive resources impacted. • Rapid degradation of spilled materials and rapid recovery of affected resources.		

Despite the use of quality and durable streamers, rough seas and interactions with marine species increases the risk of streamer breaks. Rough seas, other vessel movements through the survey area and wildlife interactions (e.g. sharks biting equipment) also increase the risk of equipment loss. Therefore the likelihood of occurrence is ***unlikely***.

Likelihood of Occurrence	Extremely Unlikely	**Unlikely**	Possible	Likely
Applicable Criteria	The unplanned event is **unlikely but** may occur at some time during normal operating conditions..			

Mitigation and Control Measures

- All streamers and towed and towing equipment will be kept in good condition and stored appropriately. Regular checks will be carried out for leaks or cracks in streamers and towed and towing equipment;
- When deploying or recovering the streamers, any leaks or cracks will be immediately resealed;
- Only qualified technicians will deploy or retrieve streamers and other towed equipment and will adhere to strict handling guidelines;
- A reasonable effort will be made to retrieve any lost floating equipment, and any other equipment lost overboard will be recorded.
- All equipment on board will be stored and secured to minimise the risk of overboard loss;
- Streamer design facilitates identification and recovery if lost;
- A workboat to assist with streamer or equipment recovery is available at all times; and

- A record will be kept of all equipment on board and any loss of equipment will be reported immediately and, if possible, retrieved as soon as safely possible.

With these mitigation and control measures in place the likelihood of loss of streamers or other equipment is considered to be ***unlikely.***

Likelihood of Occurrence	Extremely Unlikely	**Unlikely**	Possible	Likely
Applicable Criteria	The event is unlikely but may occur at some time during normal operating conditions.			

Residual Potential Impact

In the absence of mitigation and control measures the impact severity of potential impacts from lost streamers or equipment was considered to be ***minor***. While the severity remains unchanged, the implementation of the above mitigation and control measures reduced the likelihood of any break of loss to ***unlikely***. This results in the overall impact significance to *ALARP*.

Category	**Ranking**	**Residual Impact**
Severity of Impact	Low	Low
Likelihood of Occurrence	Unlikely	Unlikely
Significance	**ALARP**	**ALARP**

7.7.5 *Evaluation of Potential Impacts – Introduction of Invasive Species*

Potential Impact Description

Impacts on ecological communities from physical presence of project vessels may include the risk of introduced marine species, some of which may have the potential to become established in a new location. All marine vessels pose some risk of transporting marine species through hull fouling and ballast water.

Invasive species, such as non-native mussels, crabs, seaweeds, worms and sea squirts, could become a nuisance or threaten local industries such as aquaculture by settling on submerged structures such as marine farms and out-competing native species. Should invasions succeed, the resultant impact could be widespread and long-term or permanent. As such, the severity of such potential impacts is considered to be ***high***.

Severity of Impact	Low	Medium	**High**
Applicable Criteria	• Severe environmental damage. • Sensitive resources impacted. • Recovery of affected resources is very slow.		

The seismic survey vessel will be sourced from overseas, thus poses a risk of transporting invasive species into New Zealand waters. Even for vessels sourced from within New Zealand there is potential for the translocation of marine species. Given the remote location and water depth of the AOI, the potential for invasion within this offshore environment is very limited. The greatest risk of marine invasive species becoming established is in shallow waters where conditions are similar to those that the species has originated from. The likelihood of an invasive marine species becoming established in the area as a result of hull fouling or ballast water discharge is considered ***unlikely***.

Likelihood of Occurrence	Extremely Unlikely	**Unlikely**	Possible	Likely
Applicable Criteria	The event is unlikely but may occur at some time during normal operating conditions.			

Mitigation and Control Measures

- A Senior Marine Advisor within the Border Standards team of the MPI will be consulted with and, if applicable, a Craft Risk Management Plan will be produced to effectively manage the risk of invasive species.
- Any vessels that are sourced from outside New Zealand waters will have recent evidence of antifouling, and the hull of the survey vessel has been completely cleaned and new antifouling paint applied just prior to mobilisation to New Zealand.
- Any vessels that are sourced from outside New Zealand waters will be meet the 'Clean Hull' requirements for Long-Stay Vessels established in the voluntary *Craft Risk Management Standard: Biofouling on Vessels Arriving to New Zealand*. This will be implemented through:
  - cleaning and inspection prior to the vessel mobilisation; or
  - continual maintenance using best practices such as the use of antifoul coatings and operation of marine growth prevention systems and backed up with inspections; or
  - application of approved treatments; or
  - development of a Craft Risk Management Plan.

  With the selection of option being dependent on the type and condition of the vessel.
- The seismic vessel will be coming from Tianjin, China and consistent with advice from the Ministry of Primary Industries it will be inspected whilst in dry-dock to confirm compliance with the "Clean Hull" requirements prior to coming to New Zealand.

- Advance notice of arrival and supporting documents for vessels entering New Zealand for the project will be provided to the Ministry for Primary Industries.

- Project vessels will not anchor within the AOI.

With these mitigation and control measures in place the likelihood of a successful invasion from pest species is considered to be ***extremely unlikely.***

Likelihood of Occurrence	**Extremely Unlikely**	Unlikely	Possible	Likely
Applicable Criteria	The event is extremely unlikely to occur under normal operating conditions but may occur in exceptional circumstances.			

Residual Potential Impact

In the absence of mitigation and control measures the impact severity of potential impacts from invasive species was considered to be ***high***. While the severity remains unchanged, the implementation of the above mitigation and control measures reduced the likelihood of the successful invasion from pest species to ***extremely unlikely***. This results in the overall impact significance from collisions, to be *ALARP*.

Category	**Ranking**	**Residual Impact**
Severity of Impact	High	High
Likelihood of Occurrence	Unlikely	Extremely Unlikely
Significance	**Moderate**	**ALARP**

7.8 CUMULATIVE IMPACTS

From available information we are not aware of any seismic surveys being planned for the NCB or adjacent areas during the 2015/2016 summer season. However, if additional seismic surveys are carried out in the vicinity of the permit area it is considered that any cumulative impacts experienced are likely to be indirect given the spatial attenuation of the sound and the fact that there will not be concurrent surveys in close proximity due to operational and navigation restrictions. For example, the length of seismic streamers and limited manoeuvrability of seismic vessels while equipment is in the water means the vessels will generally maintain as much distances as is practicable from other vessels.

As discussed in *Section 7.5*, as the magnitude of underwater noise decreases across space, so does the significance of any of the impacts. It is considered that the spatial extent of direct impacts on whales is unlikely to overlap based on the following:

- The implementation of mitigation measures to reduce impacts on marine mammals that will be implemented by all survey operators under the Code; and

- It is unlikely that active operational surveys will be occurring in near proximity to each other due to:

  - the variable timing of the surveys;

  - the large extent of each of the survey areas (noting the present proposal is for an operational area of 205,000 km2) that means survey vessels will be removed from the boundaries of adjacent permit areas for the majority of the survey duration; and

  - navigational and operational constraints that make it desirable for surveys to not operate near to other vessels.

Given the above, any cumulative impacts are likely to be limited to migratory species transiting through the multiple survey areas or commercial fishers that have interests in more than one of the survey areas. In such instances they could experience the impacts described in this MMIA on more than one occasion.

Cumulative Impact Ranking

As discussed above, the most severe potential cumulative impact is from the overlap of the sound from the surveys operating at the same time. The most sensitive receptor to such an overlap would be marine mammals and their sensitivity to underwater sound is considered to be ***high***. However, given the distance between the surveys and mitigation measures employed, the likelihood of such an overlap is considered to be ***extremely unlikely***. This results in the overall cumulative impact significance to be ***negligible***.

Category	Impact
Severity of Impact	High
Likelihood of Occurrence	Extremely Unlikely
Significance	**Negligible**

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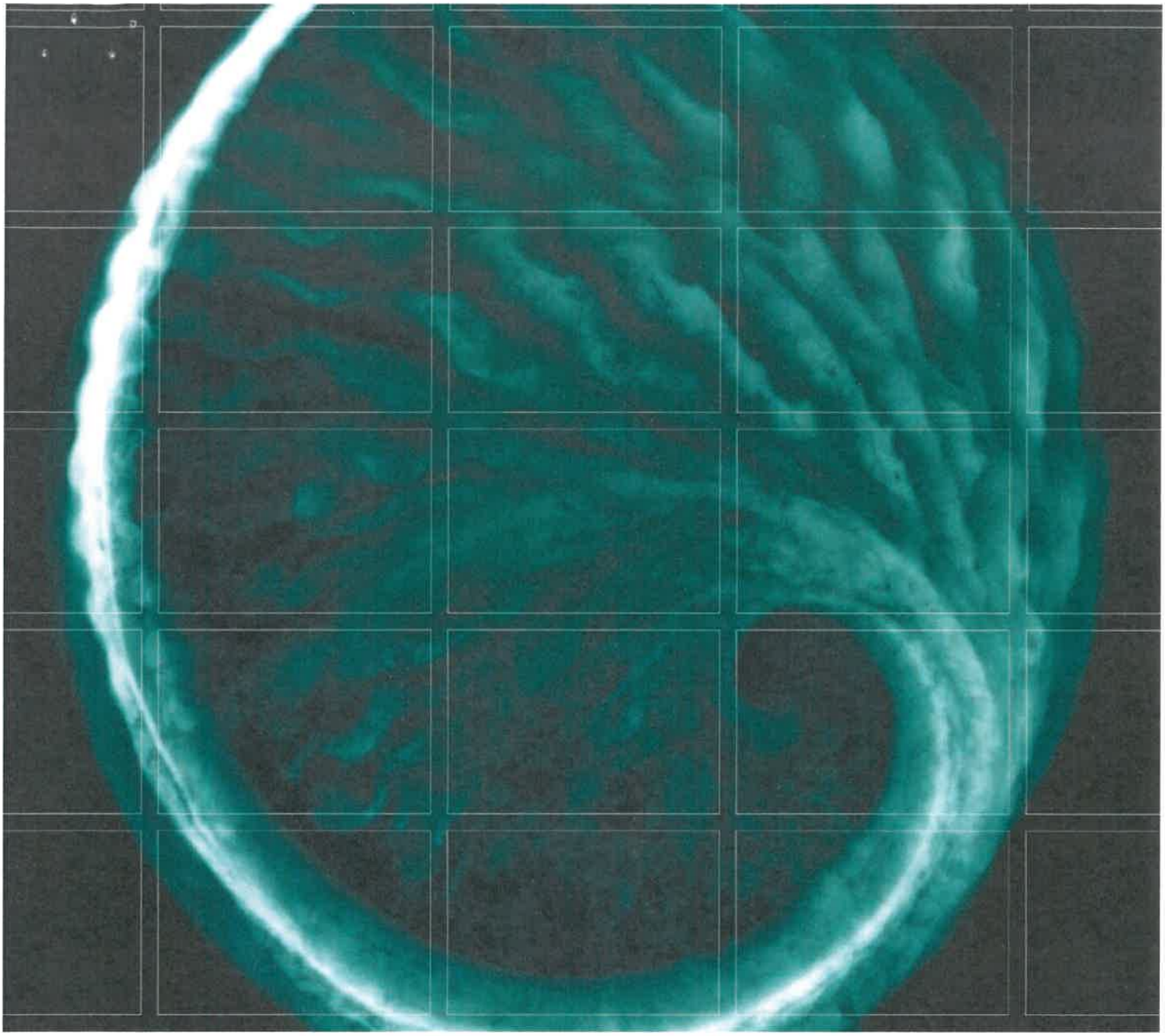

Marine Mammal Management Plan

New Caledonia Basin 2D Marine Seismic Survey

Energy Holdings Offshore Limited

Final
December 2015

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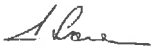
Signed:	
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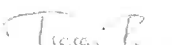
Signed:	
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ANNEXURES

ABBREVIATIONS AND GLOSSARY OF TERMS

Term	*Definition*
Code	2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals for Seismic Survey Operations
DOC	New Zealand Department of Conservation
ECS	Extended Continental Shelf
EEZ	Exclusive Economic Zone
EHOL	Energy Holdings Offshore Limited
Hz	Hertz
MMIA	Marine Mammal Impact Assessment
MMMP	Marine Mammal Management Plan
MMO	Marine Mammal Observer
NCB	New Caledonia Basin – in this report the basin is limited to the area within New Zealand waters
PAM	Passive Acoustic Monitoring
PPP	Petroleum Prospecting Permit
2D	Two dimensional

1 INTRODUCTION

This Marine Mammal Management Plan (MMMP) has been prepared for Energy Holdings Offshore Ltd (EHOL) for the proposed 2-dimensional (2D) Marine Seismic Survey (MSS) within the New Caledonia Basin (NCB), north-west of New Zealand's North Island.

This MMMP describes procedures and mitigation measures to be implemented during operations in order to minimise the disturbance to marine mammals from seismic activity.

This document should be read in conjunction with EHOLs Marine Mammal Impact Assessment (MMIA) and the Department of Conservation's (DOC) *2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Activities 2013* (the Code).

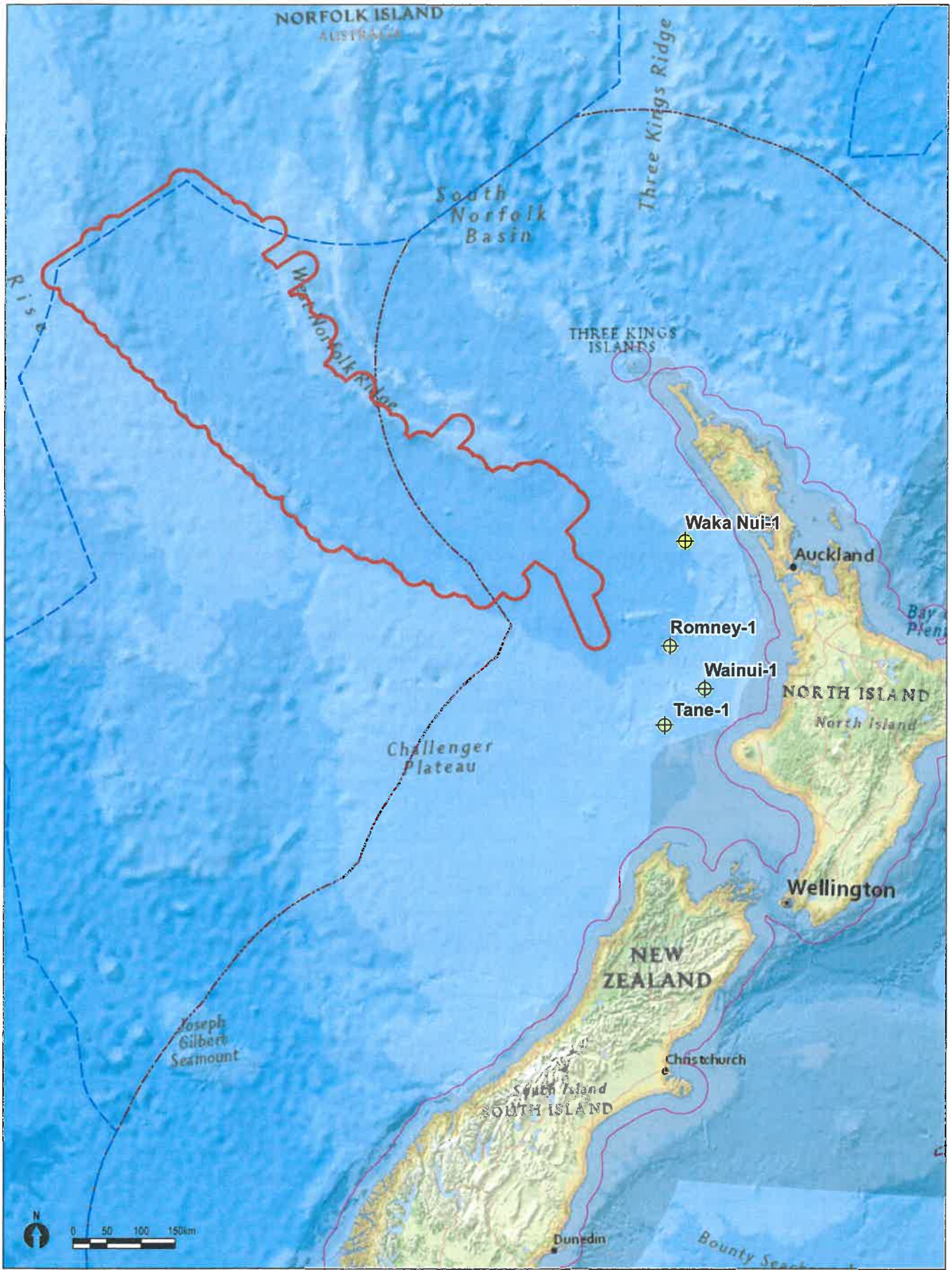
The Code is the primary reference document for Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) Operators during the survey, while this MMMP provides additional project specific information that will aid in the MMOs and PAM Operators duties.

This MMMP is an operational document and will be circulated amongst crew and personnel engaged in observational duties prior to the commencement of the survey.

1.1 ENERGY HOLDINGS OFFSHORE LTD NEW CALEDONIA 2D MARINE SEISMIC SURVEY

1.1.1 *Survey Location*

EHOL propose to undertake a 2D MSS within New Zealand Petroleum Prospecting Permit (PPP) 55377 in the NCB, which is located approximately 200 kilometres (km) from the west coast of New Zealand and extends out to the edge of the New Zealand Extended Continental Shelf (ECS) (see *Figure 1.1 - Location of PPP 55377 in the NCB*).



Legend

- Operational Area
- NZ Territorial Limit
- NZ Exclusive Economic Zone
- NZ Extended Continental Shelf
- Area of Ecological Importance
- Historic Well Site

Client:	Energy Holdings Offshore Ltd		
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Figure 1.1 - Location of Operational Area

New Caledonia Basin Marine Mammal Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

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1.1.2 *Survey Operational Area*

The survey will take place over an Operational Area of approximately 205,000 km^2 situated mostly within PPP 55377 in the NCB. The Operational Area is outside New Zealand's 12 nautical mile (nm) Territorial Sea limit and straddles the Exclusive Economic Zone (EEZ) boundary and therefore in addition to the Code, the survey is required to adhere to provisions of the *Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013.* The Operational Area does not include any Areas of Ecological Importance or Marine Mammal Sanctuaries.

Survey lines are generally programmed to the edge of the PPP boundary and some data will be acquired into adjacent areas to provide tie-lines. Tie-lines are required to establish a reference point for the seismic data collected. The ties are usually to areas covered by previous seismic surveys or marine drilling programmes. The Operational Area is therefore comprised of the following:

- A survey acquisition area of 2D seismic lines within which seismic acoustic emissions will occur for the purposes of acquiring data within the PPP;
- A surrounding buffer area (of approximately 20 km width) in which the seismic source may be discharged at or below full capacity for the purpose of seismic line turns (run-ins and run-outs), source testing and soft starts; and
- Extension areas encompassing tie-lines to legacy seismic grids or wells.

1.1.3 *Survey Timing*

The seismic survey is planned to be undertaken in the summer window of 2015/2016. The survey is proposed to commence in December 2015 and will take place over a period of approximately four months. The exact duration is dependent on the operating conditions encountered during the survey.

1.1.4 *Survey Vessel*

The *Hai Yang Shi You 718* seismic vessel has been selected for this Project. This vessel is 79.8 m long and will accommodate between 50 and 60 personnel (including the ship's crew and survey team). *Table 1.1* shows the specifications of the seismic vessel and acoustic equipment that will be used during the survey. The seismic vessel will be accompanied by a support vessel, the *PT Fortitude*, which has a length of 34 m and will be manned by a crew of approximately eight (8) personnel.

Table 1.1 *Summary Table of Seismic Survey Vessel and Equipment Specifications*

Vessel Size	79.8 m
Duration of Survey	Approximately four months
Survey Area	Approximately 205,000 km^2
Total Seismic Source Size	4,750 cubic inches
Peak to peak in bar-m	150 - 165
Zero to peak in bar-m	74 - 80
RMS pressure in bar-m	254 -256
Number of Streamers	One
Length of Streamers	Approximately 10,000 m
Towing Depths of the Source and Streamer	Source ~ 8 m (± 1 m); Streamer ~ 50 m (maximum)
Towing Speed	Approximately 4 - 5 knots

1.1.5 *Acoustic Equipment and Source*

During the seismic acquisition the *Hai Yang Shi You 718* will typically travel at a speed of 4-5 knots along predetermined survey lines. The vessel will tow a single airgun array formed of 20 – 30 individual airguns at a depth of 8 m. These airguns will emit an acoustic source at an interval of 37.5 m along each survey line.

The returning sound waves will be recorded by a series of receivers (hydrophones) attached to a streamer towed by the vessel. A single Sentinel RD solid streamer will be used during this survey. The streamer is approximately 10,000 m long and is expected to be used in a flat profile to a maximum depth of 50 m.

The acoustic source will be a single source 4,750 In3 array. This source strength has been selected based on the water depth within the Operational Area (over 3,000 m), sediment thickness (over 5,000 m) and the depth of the Moho target formation (approximately 16,000 m). Given the strength of the acoustic source being applied, the survey has been classified as a Level 1 Survey under the Code. The requirements of a Level 1 Survey and the mitigation measures are described in Section 3 of this MMMP.

2 *RECORDING KEEPING AND REPORTING REQUIREMENTS*

MMO and PAM Operators are responsible for:

- Maintaining records of all marine mammal sightings during the survey period, including any beyond the maximum mitigation zone boundaries or during transit to and from the permit area;
- MMO's are required to determine the distance and bearing of marine mammals and plot their position in relation to the acoustic source throughout the detection; and
- All observers are required to record the acoustic source activity and power at the time of the sighting.

All reporting requirements are detailed in full in Appendix 2 of the Code and should be read carefully.

EHOL will ensure that information relating to the activation of an acoustic source and the power output levels employed throughout survey operations is readily available to support the activities of the qualified observers in real time by providing a display screen for acoustic source operations. The acoustic operator will immediately notify the qualified observers if operational capacity is exceeded at any stage.

All sightings must be recorded on DOCs standardised Reporting Forms, which can be downloaded from the DOC website at http://www.doc.govt.nz/notifications.

Reporting Forms are to be tested prior to mobilisation.

EHOL will submit a written summary report to the Director-General of Conservation at the earliest opportunity but no longer than 60 days after completion of the survey. In addition to the above summary report, qualified observers will submit all raw datasheets directly to the Director-General of Conservation, at the earliest opportunity but no longer than 14 days after completion of each deployment.

2.1 *NOTIFICATIONS TO DOC*

Immediate notification to the Director-General of Conservation is required in the following situations:

- If the qualified observers consider that higher numbers of cetaceans and/or Species of Concern than predicted in the MMIA are encountered at any time during the survey;
- If there are any instances of non-compliance with the Code;

- The PAM system becomes non-operational;
- If PAM is being repaired, and operations continue without active PAM for a maximum of 2 hours 20 minutes per event; and
- If there are any observations of any dead marine mammals in the Operational Area.

If such situations arise and the Director-General of Conservation determines that additional measures are required, these will be implemented without delay.

2.2 *COMMUNICATION DETAILS FOR DOC*

During the survey the first point of contact for non-urgent communications with DOC, via EHOL, is to be to marine@doc.govt.nz. For urgent communications, the contact personnel at DOC are:

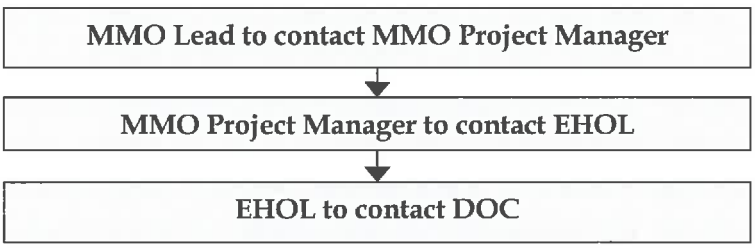
- During normal working hours - Dave Lundquist (Phone: +64 4 4713204); and
- Outside of normal working hours - Ian Angus (Phone:

If Ian Angus is unavailable by phone, call 0800DOCHOT (0800 362 468), request the National Office Marine Species and Threats Team and state the following details:

- Name of the MMO/PAM Operator;
- Seismic survey being conducted and the vessel name;
- Time and date;
- The issue or enquiry to forward onto Ian Angus; and
- Your contact information for reply.

2.3 *COMMUNICATION PROTOCOL FOR DOC*

The communication protocol for reporting **general non-urgent matters** to DOC is as follows:



If the matter is **urgent,** qualified MMO can contact DOC direct if the following requirements are met:

- The qualified MMO, prior to making this call, informs the MMO Lead, MMO Project Manager and EHOL of the matter at hand and keeps them appraised of discussions and events that follow;
- If communication is via email, the MMO Lead should follow-up with a call to DOC to advise them of the matter; and
- If communication is via phone, written confirmation of the matter should be sent via email to DOC and EHOL.

3 *MEASURES REQUIRED UNDER THE CODE*

EHOL will adhere to requirements of the Code and specific provisions relating to a Level 1 Survey. Furthermore, operations will commence in accordance with additional mitigation measures proposed by EHOL throughout the MMIA process. This section describes these requirements and associated management measures.

3.1 *PRE-SURVEY PLANNING*

EHOL is required to prepare and submit an MMIA to the Director-General of Conservation one month prior to commencing seismic activities. Furthermore, where additional mitigation measures have been agreed on through consultation with DOC and contracted MMOs, EHOL is required to develop a specific MMMP. EHOLs MMIA and this MMMP fulfil these requirements.

3.2 *OBSERVER REQUIREMENTS (MMOS AND PAM OPERATORS)*

In accordance with the requirements of a Level 1 Survey, EHOL will have **two qualified MMOs and two qualified PAM Operators on-board at all times during the survey**. Qualified observers will meet training and experience requirements specified in *Section 3.4* of the Code.

The qualified observers will be dedicated in that their roles on the vessel are strictly for the detection and data collection of marine mammal sightings, and instructing crew on their requirements when a marine mammal is detected within the relevant mitigation zone. Any qualified observers on duty have the authority to delay the start of operations or shut down the acoustic source according to the *Section 3.8.4* of the Code and provisions of this MMMP.

At all times while the acoustic source is in the water in the Operational Area, there will be at least one qualified MMO (during daylight hours) and one qualified PAM Operator at all times on watch. Observations by qualified observers will be encouraged at all other times where practical and possible. If the acoustic source is in the water but inactive, the qualified observers have the discretion to stand down from active observational duties and resume at an appropriate time prior to recommencing seismic operations. However, this limited exception will only be used for necessary meal or refreshment breaks or to attend to other duties directly tied to their observer role on board the vessel, such as adjusting or maintaining PAM or other equipment, or to attend mandatory safety drills.

If the MMO has adequate understanding of the PAM system and is not required for visual observation duties, they may provide temporary cover in place of a qualified PAM Operator to ensure continuation of 24 hour monitoring. However, this limited exception will only be applied in order to

allow for any necessary meal or refreshment breaks. In such instances, a direct line of communication will be maintained between the MMO and the supervising PAM Operator at all times, and the qualified PAM Operator will remain ultimately responsible for the duration of the duty watch.

If agreement is made prior to the survey commencing, it is acceptable for there to be one qualified observer and one trained observer in each observation role (MMO/PAM) on board. This will allow the qualified observer to act as a mentor to the trained observer for the duration of the voyage.

It is recommended that:

- **The maximum on-duty shift duration for observers will not exceed 12 hours in any 24 hour period (including time for completion of reporting requirements);**
- **Where possible, both MMOs are on watch during pre-start observations and soft starts; and**
- **Effort should be made to arrange observer rosters so that personnel are able to attend alternate vessel safety drills, thus allowing for mitigation measures to be maintained.**

3.2.1 *MMO Duties*

While acting in their designated role, MMOs will complete the following duties:

MMO Duties

- Give effective briefings to crew members, and establish clear lines of communication and procedures for on-board operations;
- Continually scan the water surface in all directions around the acoustic source (not the vessel) for presence of marine mammals, using a combination of the naked eye and high-quality binoculars, from optimum vantage points for unimpaired visual observations with minimum distractions;
- Use GPS, sextant, reticle binoculars, compass, measuring sticks, angle boards, or any other appropriate tools to accurately determine distances/bearings and plot positions of marine mammals whenever possible throughout the duration of sightings;
- Record and report all marine mammal sightings, including species, group size, behaviour/activity, presence of calves, distance and direction of travel (if discernible);

- Record sighting conditions (Beaufort Sea State, swell height, visibility, fog/rain, and glare) at the beginning and end of the observation period, and whenever the weather conditions change significantly;
- Record acoustic source power output while in operation, and any mitigation measures taken;
- Communicate with the Director-General to clarify any uncertainty or ambiguity in application of the Code, and
- Record and report any instances of non-compliance with the Code.

3.2.2 *PAM Operator Duties*

While acting in their designated role, PAM Operators will:

PAM Operator Duties

- Give effective briefings to crew members, and establish clear lines of communication and procedures for on-board operation;
- Deploy, retrieve, test and optimise hydrophone arrays;
- On duty watch, concentrate on continually listening to received signals and/or monitoring PAM display screens in order to detect vocalising cetaceans, except for when required to attend to PAM equipment;
- Use appropriate sample analysis and filtering techniques;
- Record and report all cetacean detections, including, if discernible, identification of species or cetacean group, position, distance and bearing from vessel and acoustic source;
- Record type and nature of sound, time and duration heard;
- Record general environmental conditions;
- Record acoustic source power output while in operation, and any mitigation measures taken;
- Communicate with the Director-General to clarify any uncertainty or ambiguity in application of the Code; and
- Record and report any instances of non-compliance with the Code.

3.2.3 *Operating without PAM*

PAM is defined in the Code as *"calibrated hydrophone arrays with full system redundancy"*. Contracted PAM Operators will therefore provide 3 full sets of PAM equipment for this survey to ensure that in the unlikely event of a malfunction there is supplementary equipment for use.

Section 4.2.1 of the Code specifies that in the event of a PAM system malfunction the survey may operate without PAM for a maximum of **2 hours 20 minutes** only if the following conditions are met:

Requirements Allowing Operation without PAM
1 It is daylight hours and the sea state is less than or equal to Beaufort 4;
2 No marine mammals were detected solely by PAM in the relevant mitigation zones in the previous **2 hours;**
3 Two MMOs maintain watch at all times during operations when PAM is not operational;
4 DOC is notified via email as soon as practicable with the time and location in which operations began without an active PAM system; and
5 Operations with an active source, but without an active PAM system, do not exceed a cumulative total of **4 hours** in any **24 hour period**

3.3 *CREW OBSERVATIONS*

In accordance with *Section 3.8.6* of the Code, if a crew member on-board any vessel involved in survey operations (including chase or support vessels) observes what may be a marine mammal, he or she will promptly report the sighting to the qualified MMO, and the MMO will try to identify what was seen and determine their distance from the acoustic source. In the event that the MMO is not able to view the animal, they will provide a sighting form to the crew member and instruct on how to complete the form. Vessel crew can relay either the form or basic information to the MMO. If the sighting was within the mitigation zones, it is at the discretion of the MMO whether to initiate mitigation action based on the information available. Sightings made by members of the crew will be differentiated from those made by MMOs.

3.4 MANAGEMENT PROCEDURES

3.4.1 *Operational Area*

The Operational Area, defined in *Section 1.1.2* of this MMMP, is the designated area in which all acoustic source activation including soft-starts and any necessary seismic source testing will occur. The acoustic seismic source will not be activated outside this Operational Area at any time.

Both the MMO and PAM operator are to check the location of the vessel by GPS and confirm with bridge personnel that the vessel is inside the Operational Area prior to any seismic source testing or other activation of the seismic source.

3.4.2 *Acoustic Source Tests*

Acoustic source tests will be subject to the relevant soft start procedures for each survey level, though the 20 minute minimum duration does not apply. Where possible, power will be built up gradually to the required test level at a rate not exceeding that of a normal soft start.

Acoustic source tests will only be activated in the Operational Area and will not be used for mitigation purposes, or to avoid implementation of soft start procedures.

3.4.3 *Operational Capacity*

The operational capacity of the acoustic source is identified in the MMIA and *Section 1.1.5* of this MMMP. This operational capacity should not be exceeded, except where unavoidable for source testing and calibration purposes. In the unlikely event that an exceedance does occur (during source testing and calibration activities) the acoustic operator shall immediately notify the qualified observer who will document this exceedance in observation reports.

It is common practice in other jurisdictions to fire redundant airguns during soft-starts, however this may lead to an exceedance of the approved operational capacity and result in non-compliance with the Code. MMOs should ensure that acoustic operators are aware of the need to not exceed the approved operational capacity at any time, including during soft-starts.

3.4.4 *Sighting Conditions*

Sighting conditions are intrinsic to the successful observation and detection of marine mammals during seismic surveys. The following sighting conditions are defined in the Code:

Good sighting conditions means in daylight hours, during visibility of more than 1.5 km, and in a seas state of less than or equal to Beaufort 3.

Poor sighting conditions means either at night, or during daylight visibility of 1.5 km or less, or in a sea state of greater than or equal to Beaufort 4.

3.4.5 *Pre-Start Observations*

Normal Requirements

EHOL will only activate the Level 1 acoustic source within the Operational Area, and if no marine mammals have been observed or detected in the relevant mitigation zones as outlined in *Section 3.4.9* below.

The acoustic source will not be activated during daylight hours unless the following requirements are met:

No Activation of Acoustic Source During Daylight Hours Unless the Following Requirements are met	
1	At least one qualified MMO has continuously made visual observations all around the source for the presence of marine mammals, from the bridge (or preferably an even higher vantage point) using both binoculars and the naked eye, and no marine mammals (other than fur seals) have been observed in the relevant mitigation zone for **at least 30 minutes**, and no fur seals have been observed in the relevant mitigation zones for **at least 10 minutes**; and
2	PAM for the presence of marine mammals has been carried out by a qualified PAM Operator for **at least 30 minutes** before activation and no vocalizing cetaceans have been detected in the relevant mitigation zones.

The acoustic source will not be activated during night-time hours or poor sighting conditions unless the following requirements are met:

No Activation of Acoustic Source During Night-Time Hours or Poor Sighting Conditions Unless the Following Requirements are met	
1	PAM for the presence of marine mammals has been carried out by a qualified PAM operator for **at least 30 minutes** before activation; and
2	The qualified observer has not detected vocalizing cetaceans in the relevant mitigation zones.

Additional Requirements for Start-up in a New Location in Poor Sighting Conditions

In addition to the normal pre-start observation requirements outlined above, when arriving at a new location in the survey program for the first time, EHOL will not undertake the initial acoustic source activation at night or during poor sighting conditions unless either of the following requirements are met:

No Activation of Acoustic Source in a New Location in Poor Sighting Conditions Unless the Following Requirements are met:
1 MMO have undertaken observations within 20 nautical miles of the planned start up position for **at least the last 2 hours** of good sighting conditions preceding proposed operations, and no marine mammals have been detected. If marine mammals are detected during this period activation cannot proceed;
2 Only where there have been **less than 2 hours** of good sighting conditions preceding proposed operations (within 20 nautical miles of the planned start up position), the source may be activated if: • PAM monitoring has been conducted for **2 hours** immediately preceding proposed operations; • Two MMO have conducted visual monitoring in the **2 hours** immediately preceding proposed operations; • No Species of Concern have been sighted during visual monitoring or detected during acoustic monitoring in the relevant mitigation zones in the **2 hours** immediately preceding proposed operations; • No fur seals have been sighted during visual monitoring in the relevant mitigation zone in the **10 minutes** immediately preceding proposed operations; and • No other marine mammals have been sighted during visual monitoring or detected during acoustic monitoring in the relevant mitigation zones in the **30 minutes** immediately preceding proposed operations.

3.4.6 Soft Starts

EHOL will not activate a Level 1 acoustic source at any time except by soft start. The only exception is when the acoustic source is being reactivated after a single break in firing (not in response to a marine mammal observation within a mitigation zone) of less than 10 minutes immediately following normal operations at full power, and the qualified observers have not detected marine mammals in the relevant mitigation zones.

Soft starts are used to allow for animals to leave the area by gradually increasing the acoustic source power, starting with the lowest capacity gun until it reaches the specified operational capacity, over a period of at least 20 minutes and for no more than 40 minutes.

It is not permissible to repeat the 10 minute break exception from soft start requirements by sporadic activation of acoustic sources at full or reduced power within that time. Soft starts will be scheduled so as to minimise, as far as possible, the interval between reaching full power operation and commencing a survey line.

It is important to note that at least one random soft start sample per swing should be recorded in DOCs standardised format (see Appendix 2 of the Code and Section 2 of this MMMP).

3.4.7 *Line Turns*

The acoustic source will be shut down during line turns, to reduce unnecessary marine noise, and reactivated in accordance with soft start procedures and pre-start observations.

Note that the guns may be maintained during an unplanned interruption that does not entail a line turn for up to 30 minutes.

3.4.8 *Species of Concern*

Species of Concern are defined in *Schedule* 2 of the Code and presented in *Annex A* of this MMMP. Other Marine Mammals are defined in the Code as marine mammal not specified as a Species of Concern and in New Zealand waters this would most frequently be New Zealand fur seal (*Arctocephalus forsteri*), common dolphin (*Delphinus delphis*) and dusky dolphin (*Lagenorhynchus obscurus*).

3.4.9 *Mitigation Zones*

The Code has specified three mitigation zones that will be implemented in this survey, they are:

- Species of Concern with calves within a mitigation zone of 1.5 km;
- Species of Concern within a mitigation zone of 1 km; and
- Other Marine Mammals within a mitigation zone of 200 m.

Figure 3.1 shows a schematic of these mitigation zones in relation to the acoustic source.

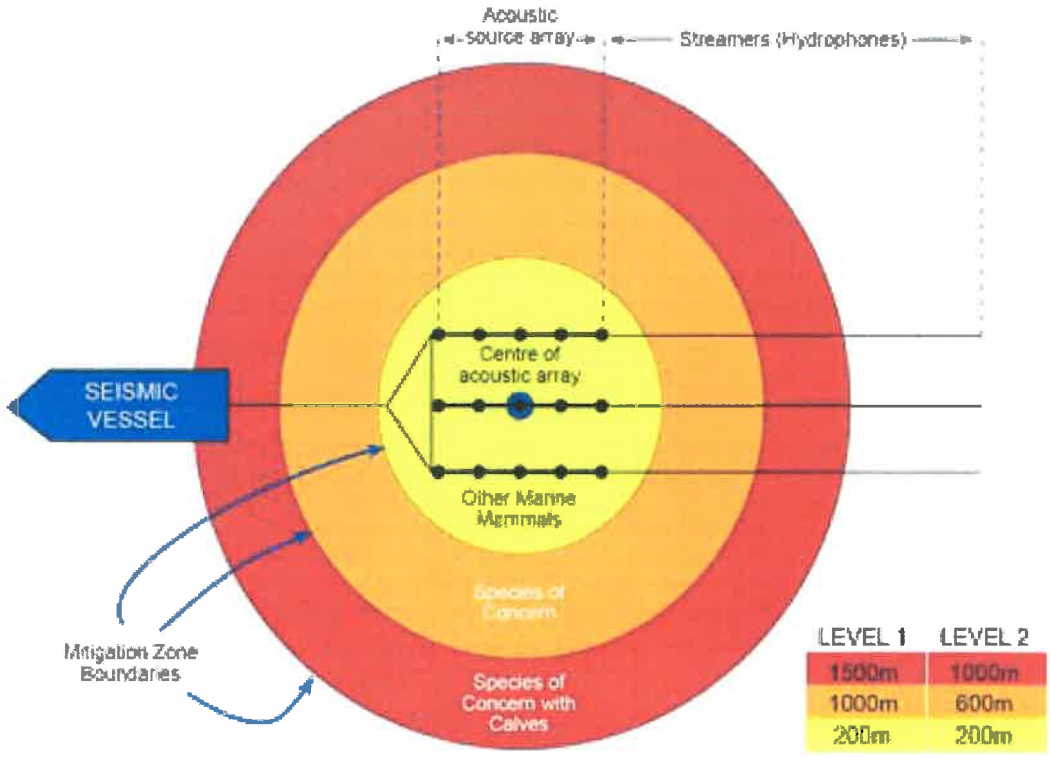


Figure 3.1 ***Mitigation Zones for Delaying Starts or Triggering Shutdowns***

3.5 COMMUNICATION FLOW ON-BOARD

When marine mammals are observed within the mitigation zones, the PAM Operator and MMO will liaise directly with the relevant seismic survey personnel (usually the seismic navigator or observer) to notify them of the sighting and any requirements for shut down of the seismic source. *Figure 3.2* summarizes the communications process between the MMO and survey personnel in the event of marine mammal sightings.

The EHOL Client Representative onboard will support the PAM Operator and MMO to ensure that all instructions are promptly acted upon.

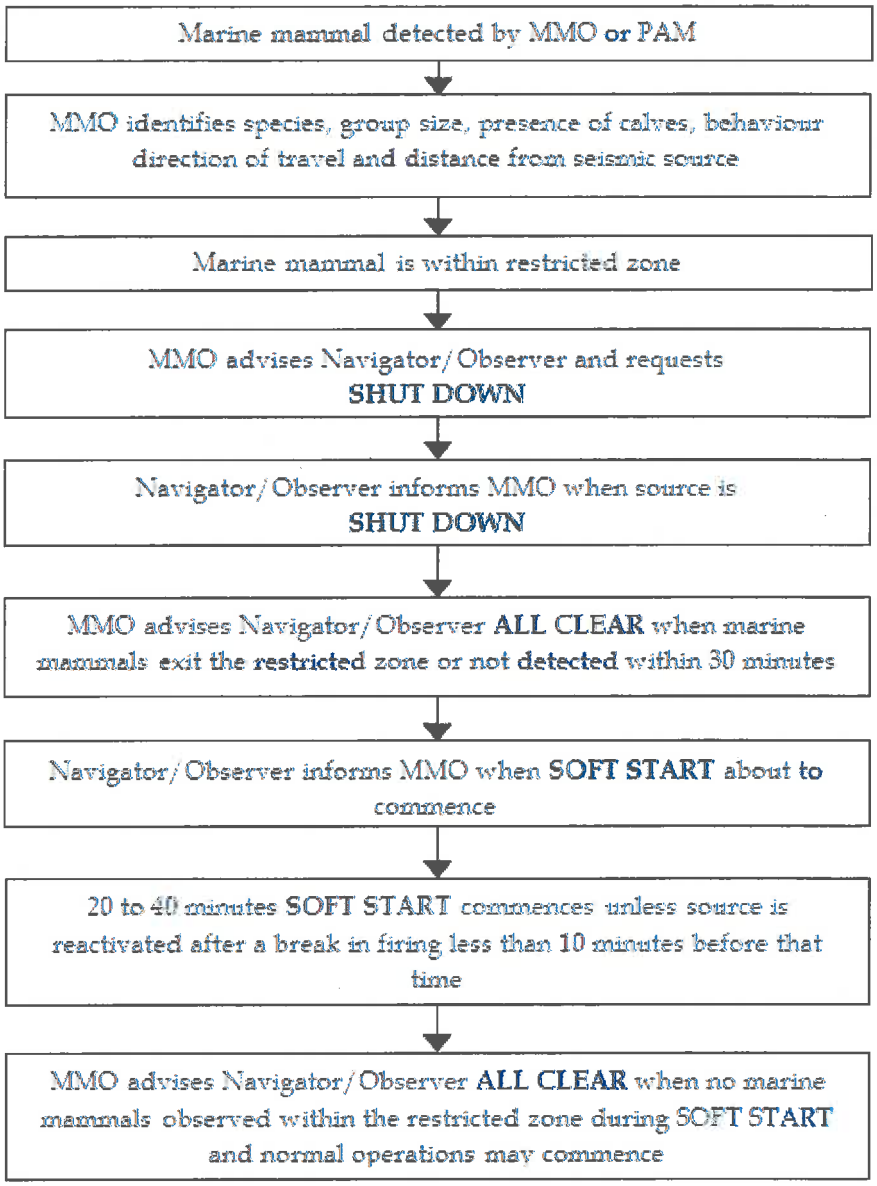


Figure 3.2 MMO Observation Protocol

Figure 3.3 below summarises the management procedures of a Level 1 Survey. The Sections below describe these procedures in detail

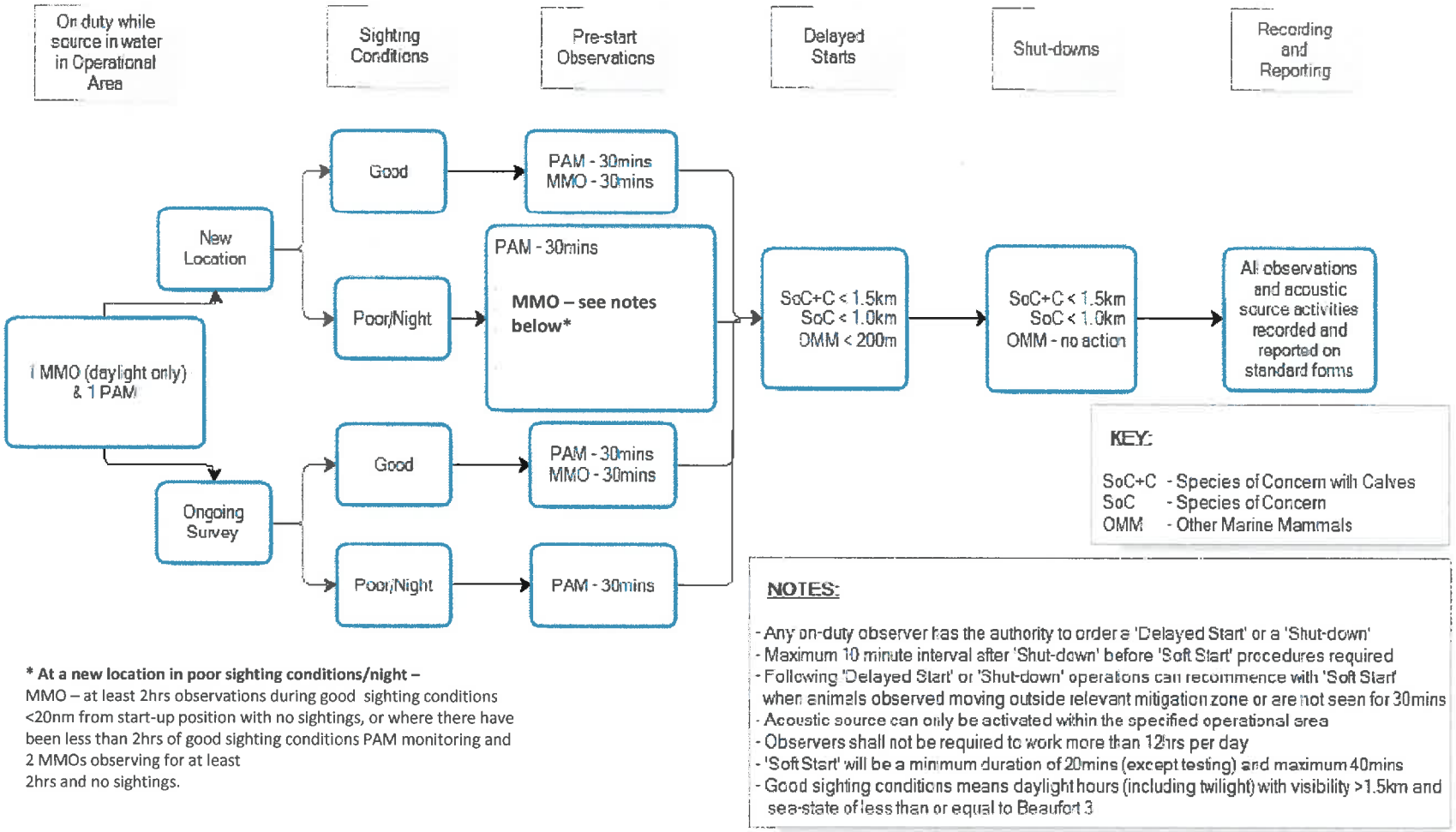


Figure 3.3 ***MMO* Schematic illustrating the Management Procedures for a Level 1 Survey**

Source: DOC Seismic Code, 2013

3.6 *MANAGEMENT ACTIONS*

If Species of Concern with or without calves, or other marine mammals are detected within the relevant mitigation zones, qualified observers will delay the start of operations or shut down the acoustic source and not reactivate the source until following requirements are met.

3.6.1 *Species of Concern with Calves*

If during pre-start observations or while the acoustic source is activated (which includes soft starts), a qualified observer detects at least one cetacean with a calf within 1.5 km of the source, start-up will be delayed or the source will be shut down and not be reactivated until:

1. A qualified observer confirms the group has moved to a point that is more than 1.5 km from the source; **or**

2. Despite continuous observation, 30 minutes has elapsed since the last detection of the group within 1.5 km of the source, and the mitigation zone remains clear.

It is important to note that:

- **This requirement applies to the entire group of cetacean containing the mother and calf pair, because a pod of cetaceans containing one calf is likely to contain multiple; and**

- **If PAM cannot distinguish calves from adults, the Code requires the proponent to take a precautionary approach and apply the more stringent mitigation zone of 1.5 km, unless determined otherwise by the MMO during good sighting conditions.**

3.6.2 *Species of Concern without Calves*

If during pre-start observations or while the acoustic source is activated (which includes soft starts), a qualified observer detects a Species of Concern within 1 km of the source, start-up will be delayed or the source will be shut down and not reactivated until:

1. A qualified observer confirms the Species of Concern has moved to a point that is more than 1 km from the source; **or**

2. Despite continuous observation, **30 minutes** has elapsed since the last detection of the Species of Concern within 1 km of the source, and the mitigation zone remains clear.

It is important to note that due to the limited detection range of current PAM technology for ultra-high frequency cetaceans, any such bioacoustic detections will require an immediate shutdown of an active survey or will delay the start of operations, regardless of signal strength or whether distance or bearing from the acoustic source has been determined. Shutdown of an activated acoustic source will not be required if visual observations by a qualified MMO confirm that the acoustic detection was of a species falling into the category of 'Other Marine Mammals'.

3.6.3 *Other Marine Mammals*

If during pre-start observations prior to initiation of the acoustic source soft start, a qualified observer detects a marine mammal within 200 m of the source, start-up will be delayed until:

1. A qualified observer confirms the marine mammal has moved to a point that is more than 200 m from the source; **or**

2. Despite continuous observation, **10 minutes** has passed since the last detection of a New Zealand fur seal within 200 m of the source and **30 minutes** has elapsed since the last detection of any other marine mammal within 200 m of the source, and the mitigation zone remains clear.

If all mammals detected within the relevant mitigation zones are observed moving beyond the respective areas, there will be no further delays to initiation of soft start.

It is important to note that the presence of other marine mammals within 200 m of the acoustic source while it is active will not result in a shutdown, but can only result in a delay to start-up of the source.

3.7 *Energy Holdings Offshore Limited's Additional Management Measures*

3.7.1 *Measures to Reduce Impacts of Underwater Noise on Marine Mammals and Fisheries*

In addition to the measures described above, EHOL will implement the following:

- Avoidance of the Bellona Trough, where marine mammal numbers are expected to be more abundant than in the operational area for this survey;

- Avoidance of undersea banks and ridges known to be of importance to commercial fisheries;
- Programming the survey to take place outside the peak fishing period for those species targeted on nearby banks and ridges where practicable;
- Notification to fishing operators in advance of the survey commencing;
- With respect to specific mitigations to minimise potential impacts to beaked whales the only practical mitigation to allow this deeper diving marine mammal species greater opportunity to move away from noise disturbance is to increase the soft start period. Where there is an interruption or need to commence or re-commence acquisition within deeper areas of the intra-basin, EHOL will increase the soft-start to a minimum period from 20 to 30 minutes. In the very unlikely event that EHOL is experiencing exceptional unforeseen circumstances and/or beaked whales are observed within the basin, then EHOL will revise the soft start mitigation measures in consultation with DOC;
- When entering the survey area the support vessel will opportunistically (as available) precede the seismic vessel and maintain an active watch for marine mammals and notify the MMOs on board the survey vessel; and
- EHOL agree to sponsor the independent scientific necropsy of marine mammals that strand between Kaipara Harbour to Cape Reinga in Northland during and within two weeks following the completion of the seismic survey.

3.7.2 *Measures to Avoid or Manage Vessel Spills*

With respect to spills from vessels and the potential effects on marine mammals, EHOL and their contractors will implement the following vessel safety measures aimed at reducing the potential risk of accidental fuel, oil or chemical spills:

Refuelling Procedures

- No refuelling of vessels will be undertaken at sea except in an emergency;
- Refuelling at port will use established port bunkering facilities for which a current Tier 1 oil spill contingency plan (OSCP) and equipment are in place;
- Refuelling during the hours of darkness will be avoided where possible;
- Vessels will use only marine diesel or marine gas oil;
- Review of job hazard analysis for bulk transfer of diesel before transfer commences;

- Use of a detailed checklist to confirm correct valve line up, quality of equipment and communications arrangements;
- Pressure testing of hoses before use;
- Continuous visual monitoring of hoses, couplings and the sea surface during refuelling or transfer;
- Continuous monitoring of flow gauges on both the seismic vessel and supply vessel; and
- Continuous contact between the seismic vessel and the supply vessel.

Refueling Equipment Design

- Quick disconnect couplings for all transfer hoses used for refuelling in port;
- Use of dry break couplings and drip trays;
- Double valves on all systems prone to leakage; and

All fuel, oil and chemicals will be stored in special bunded and lined areas designed to hold the full volume of the product being stored.

Vessel Management

- Project vessels will have a valid SOPEP in accordance with MARPOL Annex I requirements, with all crew trained in their roles and responsibilities under the plans and regular exercises of the plans in accordance with the IOPPC requirements;
- Project vessels will be equipped with appropriate Tier 1 oil spill containment and clean-up equipment;
- Any spills will be immediately reported to Maritime New Zealand, together with the response actions taken; and
- There will be very limited chemicals held on board vessels, consisting principally of small quantities of substances required for cleaning and maintenance. Potentially hazardous chemicals (e.g. paint and solvents) will be stored in secure areas on the vessel. Therefore there will be limited eco-toxicological impacts to the environment in the event of a spill.

3.7.3 *Collision Avoidance Management Measures*

With respect to the unlikely event of a vessel collision and the potential effects on marine mammals, EHOL and their contractors will implement the following measures:

- MMO and PAM Operators will provide notification to the vessel master of any marine mammals in the area of the vessel, including continuing the watch during transits wherever practicable;

- Compliance with *Maritime Rules Part 22: Collision Prevention* (MNZ, 2009), in terms of obligatory appropriate radio, navigational aids e.g. lights, flags and other visible signals, and good navigational practices and seamanship;

- Vessel speeds during the survey will be very slow, generally in the order of 4 to 5 knots;

- Warnings of the proposed survey activities will be issued (Notice to Mariners) and a vigilant watch will be maintained throughout survey activities (radio, Automatic Identification System (**AIS**), radar and visual). Both English and signal code protocols will be employed to allow multi-lingual communication streams;

- Limiting offshore vessel movements to levels that are required for safe and efficient operations;

- No direct approach to marine mammals by vessels and avoidance action taken where possible when a marine mammal is observed in the area of vessel operations;

- Establishing and enforcing a safety buffer zone with a 500 m radius around the Project; and

- Support vessel to act as liaison with any vessels approaching the seismic vessel.

4 *KEY PERSONNEL CONTACT INFORMATION*

Role	Name	Contact Details
EHOL		
Shore-based Project Manager	Grant Batterham / Operations Geophysicist	
On-board Lead	Mick McNulty / David Dong	
MMO Contractor (RPS)		
Shore-based MMO Project Manager	C/O John Stanton (RPS)	
On-board MMO Lead		
PAM Operator Contractor (RPS)		
Shore-based PAM Operator Project Manager	C/O John Stanton (RPS)	
On-board PAM Operator Lead		
Hai Yang Shi You 718		
Captain	TBA	
Party Chief	Zhai Huijie / Xie Kaicheng	
Support Vessel		
Captain	TBA	TBA
First Mate	TBA	TBA
Department of Conservation		
Notifications (working hours)	Dave Lundquist	
Notifications (out of working hours)	Ian Angus	

Annex A

Schedule 2: Species of Concern Potentially Occurring in the Operational Area

SCHEDULE 2: SPECIES OF CONCERN

Latin Name	Common Name	Potentially in PPP 55377
Mesoplodon bowdoini	Andrew's Beaked Whale	Yes
Balaenoptera bonaerensis	Antarctic Minke Whale	Yes
Berardius arnouxi	Arnoux's Beaked Whale	Yes
Mesoplodon densirostris	Blainville's (Dense) Beaked Whale	Yes
Balaenoptera musculus	Blue Whale	Yes
Balaenoptera edeni	Bryde's Whale	Yes
Tursiops truncatus	Bottlenose Dolphin	Yes
Ziphius cavirostris	Cuvier's Beaked Whale	Unlikely
Balaenoptera acutorostrata subsp	Dwarf Minke Whale	Unlikely
Kogia sima	Dwarf Sperm Whale	Yes
Pseudorca crassidens	False Killer Whale	Yes
Balaenoptera physalus	Fin Whale	Yes
Mesoplodon ginkgodens	Ginkgo-toothed Beaked Whale	Yes
Mesoplodon grayi	Gray's Beaked Whale	Yes
Cephalorhynchus hectori	Hector's Beaked Whale	Yes
Cephalorphynchus hectori	Hector's Dolphin	Unlikely
Megaptera novaeangliae	Humpback Whale	Yes
Orcinus orca	Killer Whale	Yes
Globicephala melas	Long-finned Pilot Whale	Yes
Cephalorphynchus hectori maui	Maui's Dolphin	Unlikely
Peponcephala electra	Melon-headed Whale	Unlikely
Arcticephalus fosteri	New Zealand Fur Seal	Yes
Phocarctos hookeri	New Zealand Sea Lion	Unlikely
Stenella attenuata	Pantropical Spotted Dolphin	Yes
Mesoplodon peruvianus	Pygmy/Peruvian Beaked Whale	Unlikely
Balaenoptera musculus brevicauda	Pygmy Blue Whale	Unlikely
Feresa attenuata	Pygmy Killer Whale	Unlikely
Caperea marginata	Pygmy Right Whale	Yes
Kogia breviceps	Pygmy Sperm Whale	Yes
Grampus griseus	Risso's Dolphin	Yes
Balaenoptera borealis	Sei Whale	Yes
Tasmacetus shepherdi	Shepherd's Beaked Whale	Unlikely
Globicephala macrorhynchus	Short-finned Pilot Whale	Yes
Delphinus delphis	Short-beaked Common Dolphin	Yes
Hyperoodon planifrons	Southern Bottlenose Whale	Yes
Eubalaena australis	Southern Right Whale	Yes
Lissodelphis peronii	Southern Right Whale Dolphin	Yes
Mesoplodon traversii	Spade-toothed Whale	Yes
Physeter macrodephalus	Sperm Whale	Yes
Mesoplodon layardii	Strap-toothed Whale	Yes
Stenella coeruleoalba	Striped Dolphin	Yes
Mesoplodon mirus	True's Beaked Whale	Unlikely

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