Discharge Management Plan

2013-2014 Canterbury Basin and Deepwater Taranaki Basin Exploration Program

Anadarko New Zealand Company and Anadarko NZ Taranaki Company

October, 2013

www.anadarko.com

Released under the Official Information Act 1982

Discharge Management Plan

2013-2014 Canterbury Basin and Deepwater Taranaki Basin Exploration Program

October, 2013

Prepared by:

Environmental Resources Management
www.erm.com
Report Reference: 0124825R02

Released under the Official Information Act 1982

TABLE OF CONTENTS

1.0 INTRODUCTION 1
- 1.1 PURPOSE 1
- 1.2 SCOPE 1
- 1.3 LIMITATIONS 2
- 1.4 CONSULTATION 2

2.0 EXPLORATION AREAS 3
- 2.1 ROMNEY PROSPECT 3
- 2.2 CARAVEL PROSPECT 3

3.0 VESSEL DETAILS 6
- 3.1 GENERAL ARRANGEMENT OF THE RIG 6
- 3.2 VESSEL STORAGE CAPACITIES 8

4.0 DRILLING ACTIVITIES 12
- 4.1 SCHEDULE 12
- 4.2 EXPLORATION DRILLING 12
  - 4.2.1 Mobilization 12
  - 4.2.2 Drilling 12
  - 4.2.3 Well Installation 13
  - 4.2.4 Formation Evaluation 17
  - 4.2.5 Demobilization 17
  - 4.2.6 Drilling Support Operations 18
- 4.3 HARMFUL SUBSTANCE INVENTORY 19
- 4.4 PRODUCTION OILS 19

5.0 VESSEL OPERATIONS AND MANAGEMENT SYSTEMS 20
- 5.1 SANITARY WASTE 20
- 5.2 DOMESTIC WASTE 20
- 5.3 BILGE WATER 20
- 5.4 DRAINAGE 20

6.0 RECEIVING ENVIRONMENT 22
- 6.1 ROMNEY PROSPECT AREA 22
  - 6.1.1 Physical Environment 22
  - 6.1.2 Biological Environment 23
  - 6.1.3 Sensitive Areas and Coastal Information 27
- 6.2 CARAVEL PROSPECT AREA 38

Released under the Official Information Act 1982

6.2.1 Physical Environment 38
6.2.2 Biological Environment 39
6.2.3 Sensitive Areas and Coastal Information 43

7.0 ASSESSMENT OF ENVIRONMENTAL RISK FROM DISCHARGES 52
7.1 OPERATIONAL DISCHARGES 53
7.1.1 Drilling Fluids and Cutting 53
7.1.2 Sanitary and Domestic Wastewaters 56
7.1.3 Other Miscellaneous Solid and Liquid Wastes 57
7.1.4 Other Miscellaneous Discharges 58
7.2 SPILL SCENARIOS 60
7.2.1 Accidental Discharge of Trash and Debris 63
7.2.2 Collision or Sinking 63
7.2.3 Fuel/Oil Spills 64
7.2.4 Natural Disasters 67
7.3 MONITORING 67

8.0 EMERGENCY SPILL RESPONSE PROCEDURES 68
8.1 EMERGENCY RESPONSE PLAN 68
8.2 SHIP OIL POLLUTION EMERGENCY PLAN 68
8.3 SPILL EQUIPMENT 68
8.4 TRAINING AND EXERCISES 69

9.0 REPORTING AND RECORD REQUIREMENTS 70
9.1 TRAINING 70
9.2 TESTING AND REVIEW OF EMERGENCY RESPONSE PROCEDURES 70
9.3 OPERATIONS 70
9.4 EVENT REPORTING 72

10.0 REFERENCES 73

Released under the Official Information Act 1982

ANNEXES

A ***Vessel Documents***

Noble Bob Douglas IOPP Certificate

Noble Bob Douglas General Arrangement and Tank Capacity Plan

Noble Bob Douglas Bunkering Fuel Oil Procedure

Maintenance Procedures

Noble Bob Douglas Garbage Management Plan

Noble Bob Douglas Drainage Layout

Harmful Substances Storage Layout

Hazardous Substance Inventory and MSDS

B ***Baseline Environment***

PEP 38451 (Romney Well)

PEP 38264 (Caravel Well)

C ***Drill Cuttings Dispersion Modeling***

D ***Oil Spill Modeling Reports***

E ***Emergency Response Plans***

Anadarko ERP

Anadarko OSCP

Noble ERP

Noble SOPEP

F ***Well Control Contingency Plan***

Summary

WCERP

SCERP

Logistics Plan

G ***Environmental Monitoring for Exploration Activities***

H ***Marine Protection Rules Part 170 Appendix***

LIST OF TABLES

Table 1.1:	*Consultation*	*2*
Table 2.1:	*The Romney Prospect Area Details*	*3*
Table 2.2:	*The Caravel Prospect Area Details*	*3*

Released under the Official Information Act 1982

Table 3.1:	Specifications of the Noble Bob Douglas	7
Table 3.2:	Storage Capacity of the Noble Bob Douglas	11
Table 4.1:	Romney Well Drilling Fluid Program and Projected Discharges	16
Table 4.2:	Caravel Well Drilling Fluid Program and Projected Discharges	16
Table 6.1:	Marine Mammals Potentially Present in PEP 38451	26
Table 6.2:	Sensitive Sites and Coastal Environments Detailed in Regional Marine Oil Spill Contingency Plans	37
Table 6.3:	Marine Mammals Potentially Present in the Caravel Prospect Area	42
Table 6.4:	Sensitive Sites and Coastal Environments Detailed in Regional Marine Oil Spill Contingency Plans	43
Table 7.1:	Overall Significance Criteria for Impacts in the EIA	53
Table 7.2:	Unplanned Event Impact Significance Criteria	53
Table 7.3	Estimated Amounts of Sanitary, Domestic Wastewater and BOD per day for Operations of 120 and 240 Days	56

LIST OF FIGURES

Figure 2.1:	Location of the Romney Prospect, PEP 38451	4
Figure 2.2:	Location of the Caravel Prospect, PEP 38264 and Surrounding PEP Blocks	5
Figure 3.1:	The Noble Bob Douglas	7
Figure 6.1:	Locations of Protected Natural Areas in the Vicinity of the Romney Prospect Area	37
Figure 6.2:	Locations of Protected Natural Areas in the Vicinity of the Caravel Prospect Area	51

Released under the Official Information Act 1982

LIST OF ABBREVIATIONS

Anadarko	Anadarko New Zealand Company and Anadarko NZ Taranaki Company
bbls	barrels
ALARP	As low as reasonably practicable
BOD	Biochemical oxygen demand
BOP	Blow-Out Preventer
DMP	Discharge Management Plan
DoC	Department of Conservation
EEZ	Exclusive Economic Zone
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
ERM	Environmental Resources Management
EEZ	Exclusive Economic Zone
ERP	Emergency Response Plan
ESR	Emergency Spill Response
FMA	Fisheries Management Area
Ha	Hectare
kg	kilograms
km	kilometer
km^2	square kilometers
l	liters
m	meter
m^3	cubic meters
mg/l	milligrams per liter
MMS	Marine Mammal Sanctuary
Maritime NZ	Maritime New Zealand
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
MPI	Ministry for Primary Industries
MSS	Marine seismic survey
NABF	Non-aqueous Based drilling Fluid
NIWA	National Institute of Water and Atmospheric Research Ltd
Nm	nautical miles
PEP	Petroleum Exploration Permit
RMA	Resource Management Act 1991
ROV	Remotely Operated Vehicle
Ppm	Parts per million
RC	Response Centre
SOPEP	Ship Oil Pollution Emergency Plan
WBF	Water based drilling fluids

Released under the Official Information Act 1982

1.0 INTRODUCTION

1.1 PURPOSE

This Discharge Management Plan (**DMP**) has been prepared for Anadarko New Zealand Company and Anadarko NZ Taranaki Company (**Anadarko**) by Environmental Resources Management (**ERM**), a recognized independent international environmental consulting company.

This DMP has been prepared to fulfill Anadarko's requirements under Part 200 of New Zealand (**NZ**)'s Marine Protection Rules: Part 200 – Offshore Installations – Discharges (hereafter "Part 200"). This DMP is part of the overall planning effort for Anadarko's oil and gas exploration activities in New Zealand, which are being conducted in accordance with the applicable New Zealand laws and regulations at the time of issue, international guidelines and procedures, and with Anadarko's Environment, Health and Safety (**EHS**) Policies.

1.2 SCOPE

This DMP has been prepared in accordance with the requirements of Schedule 1 of Part 200 for the oil and gas exploration drilling activities to be undertaken by Anadarko at two locations within New Zealand's Exclusive Economic Zone (**EEZ**). The DMP has been developed to recognize environmental risks associated with the operational or accidental discharges of harmful substances from the installation and establish procedures and practices to be implemented that will minimize impacts. Harmful substances considered in this DMP include those that are ecotoxic to aquatic organisms (classified in Schedule 6 of the *Hazardous Substances (Classification) Regulation 2001*) and oil.

The project activities will be undertaken by a single drilling vessel and as such a single DMP has been developed to cover drilling activities at both locations. The two locations where exploration activities will occur are:

- The 'Romney' prospect. Located within New Zealand Petroleum Exploration Permit (**PEP**) Block 38451 of the Deepwater Taranaki Basin, also known as the Outer Taranaki Basin, off the west coast of the North Island of New Zealand; and

- The 'Caravel' prospect. Located within New Zealand PEP Block 38264 of the Canterbury Basin, off the eastern coast of the South Island of New Zealand.

Released under the Official Information Act 1982

1.3 LIMITATIONS

The work described herein was conducted following accepted procedures consistent with the current standard of practice in New Zealand, as well as the objectives and scope of work agreed upon with Anadarko. In accordance with the agreed scope of work, this DMP was prepared on the basis of published information in existence at the time of report issuance (August 2013) that could be readily obtained from relevant online and local sources. The conclusions and recommendations presented herein are based on these data and New Zealand expert technical review of these and other data. Baseline field studies were not completed as part of this work.

1.4 CONSULTATION

In accordance with Rule 200.6 of Part 200 consultation with the relevant parties was undertaken as summarized in *Table 1.1*.

Table 1.1: Consultation

Party	Details	Date of Correspondence
Regional on-scene commander	Jim Dilley (Environment Canterbury); Bruce Pope (Taranaki Regional Council); Dave Lovatt (Waikato Regional Council); Mick Courtnell (Maritime New Zealand, Auckland Region); Jeff Donaldson (Otago Regional Council)	22 July 2013 – 4 August 2013
Maritime New Zealand	Dayne Maxwell; Paul Vorwerk; Paul Buisson and others	Various stages throughout the planning of the program and development of the DMP

Released under the Official Information Act 1982

2.0 EXPLORATION AREAS

2.1 ROMNEY PROSPECT

The Romney prospect is located within New Zealand PEP 38451, which extends to the northwest of the Taranaki shelf edge, approximately 115 km off the western coast of New Zealand's North Island and across the slope and into the head of the New Caledonia Basin, a major present-day bathymetric trough approximately 4,000 km long (Uruski, 2008) (see *Table 2.1* and ***Figure 2.1***).

Table 2.1: *The Romney Prospect Area Details*

PEP	Approximate PEP Area	Water Depth (m)	Distance Offshore (km)
PEP 38451	16,380 km²	1,000 – 1,500 m	Approx. 115 km north-west of New Plymouth

Latitude and Longitude of the Four Corners of the PEP	
171° 00′ E, 37° 30′ S	173° 22′ E, 38° 03′ S
171° 00′ E, 38° 00′ S	173° 22′ E, 38° 10′ S

2.2 CARAVEL PROSPECT

The Caravel prospect is located within PEP 38264, which extends from approximately 65 km southeast of Dunedin, Otago to the south to 160 km east from Waimate, Canterbury in the north and covers a total area of 17,492 km² (see *Table 2.2* and *Figure 2.2*).

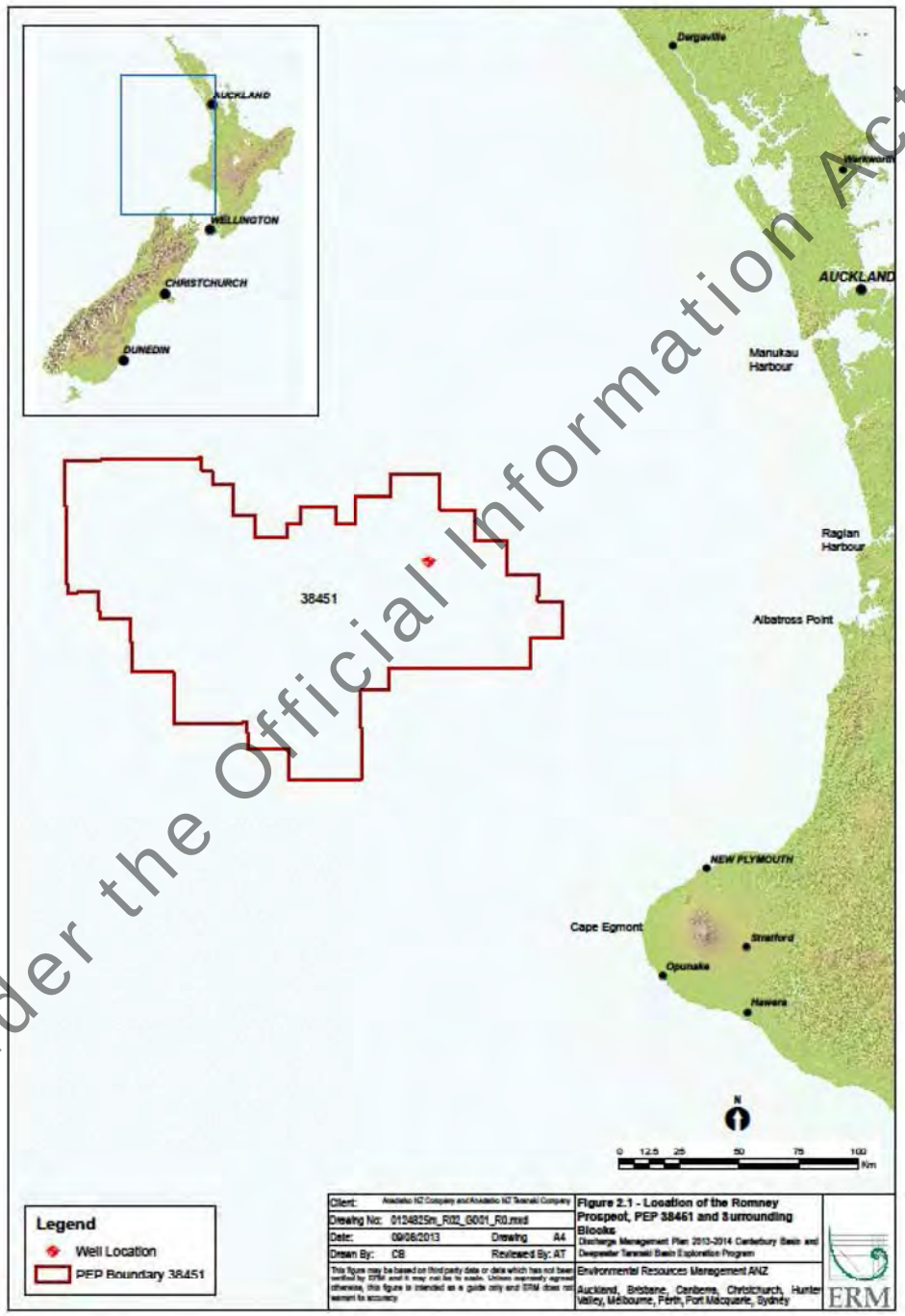
Table 2.2: *The Caravel Prospect Area Details*

PEP	Approximate PEP Area	Water Depth (m)	Distance Offshore (km)
PEP 38264	17,492.86 km²	200-1,200 m	20-180 km

Latitude and Longitude of the Four Corners of the PEP	
171° 00′ E, 45° 50′ S	174° 10′ E, 44° 45′ S
171° 00′ E, 46° 02′ S	172° 54′ E, 46° 00′ S

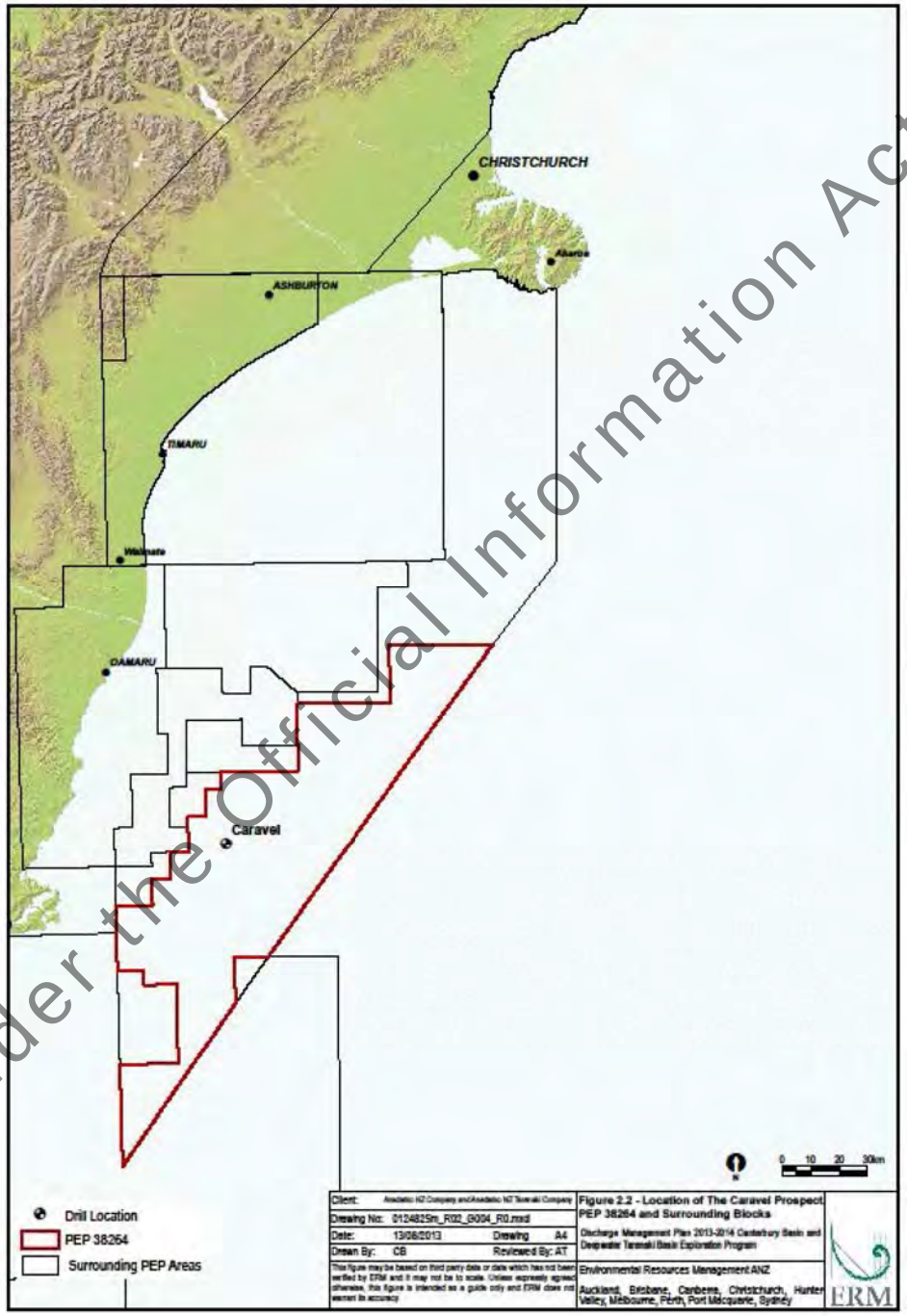
Released under the Official Information Act 1982

Figure 2.1: Location of the Romney Prospect, PEP 38451



Released under the Official Information Act 1982

Figure 2.2: Location of the Caravel Prospect, PEP 38264 and Surrounding PEP Blocks



Released under the Official Information Act 1982

3.0 VESSEL DETAILS

3.1 GENERAL ARRANGEMENT OF THE RIG

The drilling activities are limited to those required for the exploration of the two prospect areas. The drilling will be executed on behalf of Anadarko by specialist drilling contractors, Noble Drilling Services Inc., using the new-build drillship *Noble Bob Douglas* (see *Figure 3.1*). The general arrangement of the vessel is provided in *Annex A*. As a sixth-generation dynamically positioned drilling vessel, the *Noble Bob Douglas* allows for drilling of wells with minimal subsea disturbance, and has been selected as the most appropriate option based on the required drill depths and program specifications. Vessel specifications are provided in *Table 3.1*.

The drillship provides living quarters for all personnel involved in the drilling operation. The vessel also include offices, a radio room, emergency medical equipment, drilling fluid laboratory and facilities, galley, mess hall, meeting rooms, recreational rooms, and laundry facilities. Other principal components for the *Noble Bob Douglas* include:

- Derrick, draw-works and top drive;
- Casing and pipe racks;
- Normal use and emergency generators;
- Drilling fluid circulation and solids removal equipment;
- Bulk storage containers for fuel, drilling fluids, cement, fresh water, brine, mineral oil, etc.;
- Safety and fire-fighting equipment;
- Potable water system;
- Safety devices, including Blow-Out Preventers (**BOPs**) and control system;
- Cranes and pipe handling equipment;
- Sewage treatment system; and
- Personnel accommodations and support facilities.

Released under the Official Information Act 1982

Circulation of drilling fluid and cuttings is powered by electric pumps, which also power air compressors. Well control equipment includes a BOP (refer to *Section 4.2.3* for details). The drilling activity is continually monitored using a system of instruments, gauges and sensors.

The drillship will comply with the *Import Health Standard for Ships' Ballast Water from All Countries (Biosecurity Act 1993), Maritime Transport Act 1994, the International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978* (MARPOL), and the relevant *New Zealand Marine Protection Rules* in having current International Oil Pollution Prevention Certificates and International Sewage Pollution Prevention Certificates, applicable certifications and current inspections for the vessel class, pollution control equipment and systems, discharges at sea, crewing standards and requisite liability insurances.

Figure 3.1: The Noble Bob Douglas

Source: http://www.noblecorp.com/rig-fleet/rig?rig=NBD

Table 3.1: Specifications of the Noble Bob Douglas

Type	Sixth Generation Drillship: Noble Bob Douglas
Length (overall)	229 m
Breadth	36 m

Released under the Official Information Act 1982

Depth	19 m
Operating Draft	11 m
Ocean Transit Draft	0 m
Water Depth Maximum	3,048 m
Drilling Depth	12,200 m
Accommodation	210 berths

Source: Noble (no date)

3.2 VESSEL OPERATIONAL LIMITS

During the drilling condition the riser is connected and the drilling operations are being conducted. The "Maximum" metocean condition defines the design condition for the connected/drilling operations. The "Typical", "High Eddy" and "Sudden Squall"" metocean conditions including the "Maximum" Metocean conditions shall be utilized for station keeping performance calculations for the connected/drilling operations.

Metocean Parameters	**Connected / Drilling Design Metocean Conditions**			
	Typical	**High Eddy**	**Sudden Squall**	**Maximum (Continuous)**
Wind (1-min mean	21.1 m/s	17.7 m/s	31..4 m/s	25 m/s
Significant wave height, Hs	4.9m	3.5m	1.5m	6.0m
Peak wave period	10.0 sec	9.0 sec	5.90 sec	10~13 sec
Current at surface	0.30 m/s	1.40m/s	0.30 m/s	0.8 m/s
60 m below surface	0.30 m/s	1.40m/s	0.30 m/s	
76 m below	0.30 m/s	1.40m/s	0.30 m/s	

Released under the Official Information Act 1982

surface				
77 m below surface	0.15 m/s	1.40m/s	0.15 m/s	
100 m below surface	0.15 m/s	1.40m/s	0.15 m/s	
150 m below surface	0.15 m/s	1.10m/s	0.15 m/s	
200 m below surface	0.15 m/s	0.80m/s	0.15 m/s	
300 m below surface	0.15 m/s	0.60m/s	0.15 m/s	
500 m below surface	0.15 m/s	0.30 m/s	0.15 m/s	
Near bottom	0.15 m/s	0.20 m/s	0.15 m/s	

3.3 VESSEL STAND-BY CONDITION

During the stand-by condition the riser remains connected but the drilling operations have been discontinued. The "Winter Storm" metocean condition defines the design condition for the stand-by operations. The "100-yr Eddy" metocean condition including the "winter Storm" metocean condition shall be utilized for station keeping performance calculations for the stand-by operations.

Metocean Parameters	**Connected / Drilling Design Metocean Conditions**	
	Winter Storm	**100-yr Eddy**
Wind (1-min mean)	30 m/s	17.7 m/s
Significant wave height, Hs	8.5 m	3.5 m

Released under the Official Information Act 1982

Peak wave period	15 18 sec	9.0 sec
Current at surface	0.80 m/s	2.00 m/s
60 m below surface		2.00 m/s
76 m below surface		2.00 m/s
77 m below surface		2.00 m/s
100 m below surface		2.00 m/s
150 m below surface		1.50 m/s
200 m below surface		1.20 m/s
300 m below surface		0.80 m/s
500 m below surface		0.40 m/s
Near bottom		0.20 m/s

3.4 VESSEL STORAGE CAPACITIES

To provide adequate supplies of material for continuous operations and emergency conditions, the vessel maintains on-board bulk storage capacity for several weeks of activity. *Table 3.2* details the storage and utility capacities of the *Noble Bob Douglas* and *Annex A*.

Released under the Official Information Act 1982

Table 3.2: Storage Capacity of the Noble Bob Douglas

Material	Capacity
Water ballast tanks	19,604 m^3
Liquid mud pits	3,221.7 m^3
Fuel oil tanks	7,078 m^3
Lubricating oil tank	68 m^3
Gear oil tanks	29 m^3
Brine tanks	1,257 m^3
Base oil tanks	1,144 m^3
Drill water tanks	3,350 m^3
Fresh water tanks	1,216 m^3
Potable water tank	401 m^3
Dirty oil tank	217 m^3
Bilge water tanks	876 m^3
Mud treatment module	74 m^3
Thruster clean gear oil tanks	15 m^3

Source: Noble Bob Douglas Tank and Capacity Plan 2G-7000-004 Rev No Z0

Released under the Official Information Act 1982

4.0 DRILLING ACTIVITIES

4.1 SCHEDULE

The exploration drilling will be undertaken during the 2013-2014 New Zealand drilling season, commencing November/December 2013. The first well to be drilled will be at the Romney prospect at location 172°43'52.57" E, 37°53'39.46" S.

Following successful completion of the Romney well, the drilling vessel will mobilize and drill the Caravel prospect at location 171°30'9.96" E, 45°38'18.98" S, (see *Table 2.1* and *Table 2.2* above).

4.2 EXPLORATION DRILLING

The expected exploration drilling program elements to be undertaken are described below. Broadly these include:

- Mobilization;
- Drilling;
- Well installation;
- Formation evaluation; and
- Demobilization.

4.2.1 *Mobilization*

The *Noble Bob Douglas* will mobilize to drilling locations fully equipped to initiate drilling activities.

Mobilization routes for the drilling vessels within New Zealand waters have not been finalized; however it is recognized that entry of exploration vessels within the 12 Nm limit may require additional biosecurity provisions. If the vessel is to transit through the Cook Strait, consideration will be given to mechanisms by which risks of damage to sub-sea infrastructure and interactions with other shipping can be avoided.

4.2.2 *Drilling*

Once in position, the casing and drilling assembly will be prepared and placed into position for drilling using suitable capacity cranes, hoists, winches, hoses, pipes and pumps. Prior to the start of drilling a Remotely Operated Vehicle (**ROV**) will survey the pre-drilling conditions of the seafloor to ensure the drill

Released under the Official Information Act 1982

location is absent from slopes or ridges that may affect the stability of the drilling operations.

The drilling will consist of a standard rotary system with a top drive. This comprises a derrick mounted on the drill floor and a hoisting drum mounted at the base of the derrick.

The drilling line (made up of wire rope) passes from the hoisting drum to the top of the derrick through an arrangement of pulleys (the 'crown block'), and is finally fastened via another series of pulleys (the 'traveling block') to a hook. The top drive is suspended from the hook, which is fastened to the drill string. When the drilling starts, a rotary drill bit is fastened to the lower end of the drill pipe and lowered by the hoisting drum through a rotary table attached to the floor. The top drive supplies the rotary motion for the drill bit.

4.2.3 *Well Installation*

4.2.3.1 *Well Construction*

Well construction will be achieved by jetting a 36-inch structural casing with subsequent casing strings cemented in place. These strings will be of consecutive smaller sizes and will be used to cover troublesome lithologies and achieve higher frac gradients to allow necessary mud weights to control anticipated formation pressures.

The marine riser will convey drilling fluids and cuttings from the well, isolating it from the sea, up to the drilling vessel. Subsea well control equipment (BOP as described below), is also connected to the riser and latched to the high pressure housing. Based upon logging results the well will be either cased, temporarily abandoned or the well will be decommissioned (see *Section 4.2.5*).

The Romney well will be drilled to a depth of approximately 3,055 m below the seabed or 4,575 m below sea level (in a water depth of approximately 1,520 m), as follows:

- 36-inch casing will be jetted down to approximately 72 m below the seabed (1,592 m below sea level) using seawater. The hole will be swept clean of cuttings at intervals with high viscosity guar gum and gel sweeps;

- The 26-inch interval will be drilled to 790 m below the seabed (~2,310 m below sea level) with seawater. The hole will be swept clean of cuttings with high viscosity guar gum and gel sweeps. A 20 inch conductor pipe will be run and cemented to isolate this section;

Released under the Official Information Act 1982

- The BOP stack will be run and tested after cementing the 20- inch casing in place;
- The 17-inch X 20-inch segment will be drilled to 1,490 m below the seabed (~3,010 m below sea level) with Non-Aqueous Based Drilling Fluid (**NABF**);
- 16-inch casing will be run and cemented in place;
- The 14-3/4-inch X 20-inch segment will be drilled to 1,855m below the seabed (~3,375m sea level) with NABF;
- 13-3/8-inch casing will be run and cemented in place;
- A segment of 12-1/4-inch will be drilled up to 3,055 m below the seabed (~4,575 m below sea level) with a NABF;
- The well will undergo wireline testing; and
- Based on the results of the wireline testing, the well will be permanently decommissioned or temporarily abandoned.

The Caravel well will be drilled to a depth of approximately 1670 m below the seabed or 2775 m below sea level (in a water depth of approximately 1105 m), as follows:

- 36-inch casing will be jetted down to approximately 72 m below the seabed (1,177m below sea level) using seawater. The hole will be swept clean of cuttings at intervals with high viscosity guar gum and gel sweeps;
- The 26-inch interval will be drilled to 670 m below the seabed (~1,775 m below sea level) with seawater. The hole will be swept clean of cuttings with high viscosity guar gum and gel sweeps. A 20-inch conductor pipe will be run and cemented to isolate this section;
- The BOP stack will be run and tested after cementing the 20- inch casing in place;
- The 17-1/2-inch segment will be drilled to 1,235 m below the seabed (~2340 m below sea level) with NABF;
- The well will undergo wireline testing; and
- 13-3/8 inch casing will be run and cemented in place;

Released under the Official Information Act 1982

- A segment of 12-1/4 inch will be drilled up to 1670 m below the seabed (~2775 m below sea level) with a NABF;
- The well will undergo wireline testing; and
- Based on the results of the wireline testing, the well will be permanently decommissioned or temporarily abandoned.

Consistent with international industry practice, Anadarko will establish a minimum 500 m radius buffer zone around the drilling vessel, which will be advised through a Notice to Mariners issued through Maritime New Zealand (**Maritime NZ**). The buffer zone will be kept clear of all unauthorized vessels, primarily through direct communication with vessels approaching the rig's location which will be monitored by radar and visual observation, with additional assistance from the support vessels if deemed necessary.

4.2.3.2 *Drilling Fluids*

During the drilling process, drilling fluid will be pumped down the inside of the drill pipe and exit at the drill bit. The drilling fluid program includes the use of water based drilling fluids (**WBFs**) and synthetic non-aqueous based drilling fluids (**NABFs**), which may include low-toxicity mineral oil, internal olefins, linear alpha olefins, esters, and/or poly-alpha olefins.

Table 4.1 and *Table 4.2* show the drilling fluid program and expected discharges for the exploration wells (Romney and Caravel prospects respectively) based on current information. Any significant variation to this that results from unexpected drilling conditions will be notified to Maritime NZ.

Released under the Official Information Act 1982

Table 4.1: Romney Well Drilling Fluid Program and Projected Discharges

Bit (inches)	Depth Below Seabed	Fluid Type	Estimated Discharges			
			Cuttings (bbls*)	WBM Discharged (bbls)	Residual on Cuttings Discharged (bbls)	Discharge Location
36	From top of sea bed to 72m	seawater	297.4	590.4	-	Seafloor
26	72-790m	seawater	2,288.4	7,614.7	-	Seafloor
20	790-1,490m	NABF	1,026.4	-	70.8	Overboard Drilling Vessel
17	1,490-1,855m	NABF	386.7	-	26.7	Overboard Drilling Vessel
12.25	1,855-3,055m	NABF	631.4	-	43.6	Overboard Drilling Vessel
Total			**4,630.3**	**8,205.1**	**141.1**	

Notes:
* *1 bbl (US Oil) = 0.158987 m³.*

Table 4.2: Caravel Well Drilling Fluid Program and Projected Discharges

Bit (inches)	Depth Below Sea Bed	Fluid Type	Estimated Discharges			
			Cuttings (bbls*)	WBM Discharged (bbls)	Residual on Cuttings Discharged (bbls)	Discharge Location
36	From top of sea bed to 72m	seawater	297.4	590.4	-	Seafloor
26	72-670m	Seawater	1,900.5	6,358.0	-	Seafloor
17.5	670-1,235m	NABF	634.3	-	43.8	Overboard Drilling Vessel
12.25	1,235-1,670m	NABF	228.9	-	15.8	Overboard Drilling Vessel
Total			3061.1	6948.4	59.6	

Notes:
* *1 bbl (US Oil) = 0.158987 m³.*

Drill cuttings and fluids returning to the drilling vessel will pass through solids control equipment (shale shakers) prior to discharge to reduce the retention of drilling fluids on the cuttings. Additionally, centrifuges and/or a cuttings dryer will be used. Cuttings discharged overboard will be tested periodically to ensure the efficiency of the solids control equipment and to ensure appropriate standards (i.e. provisions outlined in below) are met.

Released under the Official Information Act 1982

The NABF itself will not be discharged, other than small amounts (maximum average of 6.9% by weight retention on cuttings) that adhere to discharged materials. Recovered NABF will be collected and transported to shore for storage/recycled for use on future wells.

4.2.3.3 *Well Control and Blowout Prevention*

A BOP will be installed in addition to vigilant monitoring and management of the fluids and installation of casing in each section of a well. BOPs will be installed on the wellhead at the seabed after the top hole sections have been drilled. The BOP stack is certified to international standards, including API 16A, 16C, 6A, NACE MR 0175/ISO 15156-1 and DNV-OS-E101.

Although the Romney and Caravel wells are not expected to encounter any zones of abnormal pressure, the BOP used will be rated for well pressures in excess of those expected to be encountered in the wells. In an emergency, the BOP can be controlled from the drilling vessel. Testing of the BOP will be conducted during drilling operations; thus, small amounts of BOP fluid may be discharged. The BOP fluid (Erifon HD603 HP (No Dye)) is a water-based liquid with a small amount of additives to improve lubricity and for corrosion control. This fluid is considered by Anadarko to be environmentally safe (see *Annex A* for the BOP fluid MSDS).

4.2.4 *Formation Evaluation*

Each well drilled will be evaluated and detailed records logged. Logging tests that may be undertaken include standard, electric, acoustic, radioactivity, and density induction. In the event that the applied logging technique involves radioactive sources (e.g. wire logging), stringent policies and procedures are in place for these operations. These policies and procedures cover the handling, storage, transportation, and use of radioactive sources during the operation. Requirements will meet regulatory standards for safety and the environment under the New Zealand *Radiation Protection Regulations 1982*.

Core samples will be collected to analysis of hydrocarbon potential and other relevant characteristics.

No cased hole drill stem test will be conducted, therefore no discharges associated with these activities will occur (i.e., flaring).

4.2.5 *Demobilization*

Following drilling, the well will be either temporarily or permanently abandoned depending on the data which were collected during drilling and testing. Wellheads will be left in place, as the water depth precludes damage by other maritime activities and this allows for future utility of the wellbore.

Released under the Official Information Act 1982

4.2.5.1 *Well Abandonment or Decommissioning*

Temporary well suspension or abandonment will be performed in accordance with industry and international best practices. If a well is deemed productive, then it may be suspended by installing redundant cement and/or mechanical plugs to isolate the hydrocarbon intervals. In this case, the well would be fitted with a suspension cap to allow re-entry to the well at a later date (for completion and production).

If no commercial quantities of hydrocarbons are found, wells will be permanently plugged and abandoned. Wells are plugged with cement or mechanical plugs to prevent flow of any hydrocarbons and fluids to the surface. In addition, zones in the wellbore known to contain moveable hydrocarbons will also be plugged and isolated. A site clearance survey will be conducted after drilling operations to ensure that potentially harmful metal debris from drilling activities is removed from the seafloor around each drill site. The wellhead will be left in place. Its exposed dimensions above the seafloor are expected to be approximately 1 m wide by 3 m high.

4.2.5.2 *Remote Operated Vehicle Survey*

Prior to demobilization from the drill site, an ROV will be deployed from the drill ship to perform a video inspection of the drill site. The ROV will be used to check if any equipment or debris has been left in place and to verify site conditions.

4.2.6 *Drilling Support Operations*

The *Noble Bob Douglas* will arrive at the drilling locations with most of the necessary supplies to drill the wells. However, drilling operations will require supplementary support vessels and an onshore support base as described below.

4.2.6.1 *Onshore Support Base*

The shore-base will be located in New Plymouth. Supplies that may be purchased through the onshore support base include drilling materials, fuel, and fresh food.

4.2.6.2 *Support Vessels and Aircraft*

The drilling operation will include supplementary support vessels:

- Three (3) support vessels that will transfer materials, personnel and equipment between the drilling vessel and the shore-base; and

Released under the Official Information Act 1982

- One (1) or more helicopters to transfer crew between to/from the drilling vessel. The helicopters may also be used for emergency situations as deemed necessary.

The route of transport will be a direct line between the shore and the offshore drilling location, so support vessels involved in the exploration activities will follow appropriate shipping lanes.

4.2.6.3 *Crew Change*

The *Noble Bob Douglas* has a helideck, and crew change transfers between the mainland and the drilling vessel will take place by vessel or helicopter. The crew will normally work on a 28 days on and 28 days off basis, staggered to suit the logistic requirements of the drilling program.

4.3 HARMFUL SUBSTANCE INVENTORY

Substances considered harmful in Schedule 6 of the *Hazardous Substances (Classification) Regulation* that will be carried on-board the *Noble Bob Douglas* are itemized in *Annex A*.

4.4 PRODUCTION OILS

The primary purpose of the exploration is to identify the characteristics and/or presence of subsurface materials and as such there is limited information specific to the prospect area production oils. However, the below oils are expected based on surrounding well information and the modeling of the petroleum system at both locations:

- Romney Well – Light Oil (API 31)
- Caravel Well – Gas/Condensate (API 57)

Released under the Official Information Act 1982

5.0 VESSEL OPERATIONS AND MANAGEMENT SYSTEMS

There are a number of other activities and management involved to facilitate the operation of the *Noble Bob Douglas* systems as described below. All discharges will be consistent with relevant annexes of MARPOL and relevant New Zealand regulations.

5.1 SANITARY WASTE

All sanitary waste will be processed on board within the Omnipure 5538 Sewage Treatment Plant (designed 34.338 m^3/day hydraulic loading and 20.1 kg/day organic loading). The maintenance schedule for the sewage treatment plant is provided in *Annex A* noting schedule actions daily, every three (3) days and every three (3) months.

5.2 DOMESTIC WASTE

The vessel is equipped with a Tuff Gut No. 52 External Drive Offshore Food Disposer that is designed to withstand outdoor elements. The maintenance schedule is provided in *Annex A* noting schedule actions with every use and on a monthly basis.

The vessel is equipped with Dolphin Trash Compactor No. 53.

The *Noble Bob Douglas* Garbage Management Plan is provided in *Annex A*. The document outlines requirements of garbage management that will be followed to comply with applicable regulations of Annex V of MARPOL 73/78.

5.3 BILGE WATER

Bilge water will be treated and discharged in accordance with MARPOL Annex I. All bilge waters, including machinery space waste and deck drainage that may contain hydrocarbon residues will be pumped to holding tanks, filtered through an oily water separator (TURBULO Mechanical Phase Breaker-MPB) in compliance with MARPOL Annex I, Regulations 9 and 12, and discharged overboard with oil in water levels not exceeding 15 parts per million (**ppm**).

5.4 DRAINAGE

The drainage of the vessel is designed to contain run-off and prevent oily drainage from being discharged. Drainage flow is diverted to separation systems. *Annex A* shows the drainage system for hazardous and non-hazardous areas. Drainage from machine areas (potentially containing lubricating grease and lubricating oil) is pumped to holding tanks, filtered, and discharged overboard with oil in water levels not exceeding 15 ppm. The vessel is fitted with

Released under the Official Information Act 1982

an oily water separator (TURBULO Mechanical Phase Breaker-MPB) for discharge of machinery space drainage. Separated oil sludge will be temporarily stored on board and disposed at an approved onshore disposal facility.

Released under the Official Information Act 1982

6.0 RECEIVING ENVIRONMENT

Anadarko has completed Environmental Impact Assessments (EIAs) for both the Romney prospect and Caravel prospect exploration projects. Details of the receiving environment (e.g. biological features) and influencing factors (metocean conditions) relevant to the risks associated with the exploration discharges are summarized below. For full details regarding the baseline environment please refer to the extracts from each of the EIAs included in *Annex B*.

6.1 ROMNEY PROSPECT AREA

6.1.1 Physical Environment

6.1.1.1 Climate

Detailed climatological data, such as mean temperature and precipitation, are unavailable for PEP 38451, so the following description is based on data from the onshore west coast of New Zealand, in the Taranaki region and specifically for the town of New Plymouth (approximately 115 km from the PEP 38451 boundary). Taranaki is affected by weather systems that have crossed the Tasman Sea. It is usually sunny and windy, with a well-distributed annual rainfall and moderate temperatures. Rainfall ranges from 8,000 mm at North Egmont to 2,000 mm at inland Whangamōmona, 1,600 mm at New Plymouth and 1,200 mm at Pātea. Mt Taranaki causes a rain-shadow effect, with less rain to its south and east.

6.1.1.2 Metocean Conditions

A study of metocean conditions in the Deepwater Taranki Basin was undertaken by Fugro Global Environmental and Ocean Sciences in 2010 (Fugro, 2010). The report utilizes existing data sources and numerical modeling to characterize the marine environment, including expected waves, winds, currents and ocean temperatures in the Project Area for operational planning conditions.

The annual wind rose of 10 minute mean wind speed at 10 m above sea level generated from WorldWaves data calibrated using satellite data shows a prevailing wind from the southwest. Further details of the MetOcean Conditions are provided within *Annex B*.

6.1.1.3 Wave Height

The all-year percentage occurrence of most frequent significant wave height and peak period is 1.5-2.0 m and 12-13 s respectively. The prevailing wave direction

Released under the Official Information Act 1982

is from the south west (Fugro, 2010). Further details of the wave heights experienced in the Deepwater Taranaki Basin are provided within *Annex B*.

6.1.1.4 *Bathymetry*

The south eastern area approximates the 250 m bathymetric contour and represents the shallowest region of the prospect. The seafloor drops rapidly to the northwest of this contour to a depth of 1250 m at which point the gradient reduces, reaching a greatest depth of close to 2000 m at the northwest corner of the prospect. The bathymetry to the southwest of the Romney Prospect area presents a shallower and flatter profile than in the northern region, remaining predominantly at depths of 250 to 750 m. There is a steep rise in the central north segment of the prospect.

6.1.1.5 *Currents*

The West Coast of the North Island is presumed to block the eastward flow of the subtropical gyre, and it is therefore thought that flows off the West Coast of the North Island are weak and unstructured. The main current in the region is the West Auckland Current, although this is also generally weak and highly variable. Models show a northwards flow near the coast and east of 171°E on average, but generally very weak flow elsewhere (Reid *et al.*, 2005). The currents west of the North Island are expected to be dominated by the tides and local wind-driven variability inshore, with a component due to the mesoscale eddy field increasing offshore (Reid *et al.*, 2005).

6.1.2 *Biological Environment*

Sensitive biological receptors to potential discharges from the installation include plankton, commercial fisheries, listed fish species, the benthic community, marine mammals, marine reptiles, seabirds and deep sea corals.

6.1.2.1 *Plankton*

The distribution and abundance of plankton is heavily influenced by the ambient nutrient conditions of their environment. New Zealand's ocean productivity results from a combination of factors including its location within the Pacific, the benthic landscape, ocean currents and climate (MPI, 2010a). During spring, upwelling plumes from the Kahurangi Shoal (on the South Islands west coast) move cold, nutrient rich water towards the north, altering the properties of the water column within vicinity of PEP 38451. This creates ideal conditions for phytoplankton (MPI, 2010a). This phytoplankton rich water increases the primary productivity of the area, altering the food chain and attracting species such as the blue whale (*Balaenoptera musculus*) feeding on krill (*Nyctiphanes australis)* that are in abundance episodically throughout the year around the Taranaki Basin. As the phytoplankton grow in abundance, nutrient levels in the

Released under the Official Information Act 1982

water decrease, resulting in high concentrations of Chlorophyll *a*, an indicator of plankton productivity. This change in nutrient and plankton levels is a cyclic process occurring during both spring and summer.

6.1.2.2 *Fish Species*

There is currently no comprehensive dataset on the occurrence or distribution of listed fish species within PEP 38451, however some species listed in the 2005 Department of Conservation (**DoC**) threatened species listing may be found within the area.

New Zealand's west coast (mostly off the South Island) provides around 30 percent of the country's total fish catch. Much of this occurs when fish gather to spawn in winter and spring (MPI, 2008). North Taranaki is the base for a regionally-significant commercial fishing industry. The EIA identified a number of commercial fish species potentially present in PEP 38451. These mainly included finfish. *Table 6.1* highlights the likely presence of commercially important fish in the exploration drilling area during life history stages and the scheduled activity. The 2009 export value of these fisheries is also provided within *Table 6.1* where the data is available; however it should be noted in many cases, species catch (and value) data is aggregated across a number of Fisheries Management Areas (FMA). For example, skipjack tuna data is aggregated across all FMAs within New Zealand. The most recent estimate of the total export value of commercial fisheries from FMA 9, in which the Romney well is located, was $208m in 2009 (MPI, 2013a). The total seafood export value in 2008 was estimated at $1.35b (MPI, 2013b).

The NABIS database (MPI, 2013c) identified 15 shark species with distributions that include the Project Area. The dark ghost shark (*Hydrolagus novaezealandiae*) is endemic to New Zealand, yet it is listed as not threatened (DoC, 2005). The great white and basking sharks, are ranked as '*gradual decline*', indicating that they are at risk of extinction, but that their population decline rates are slow and long-term (WWF, 2010a).

Table 6.1: Likely Presence of Commercially Important Fish in the Exploration Drilling Area, During Life History Stages and the Scheduled Activity

Species	Feeding	Spawning/ Calving	Migration	Export Value (2009, NZ$m)	Likely Presence within Project Area during scheduled ED (Summer)
Jack mackerel	Year round	Spring-summer	-	35.14** (JMA7)	✓
Skipjack tuna	Summer–autumn	-	Summer-Autumn	7.87** (SKJ1)	✓
Blue mackerel	Year round	-	-	3.99** (EMA7)	✓

Released under the Official Information Act 1982

Species	Feeding	Spawning/ Calving	Migration	Export Value (2009, NZ$m)	Likely Presence within Project Area during scheduled ED (Summer)
Barracouta	Year round	Late winter-spring	-	9.74** (BAR7)	✓
Frostfish	Year round	-	-	No data (FRO9)	✓

Notes:

* *Conservative approach taken based on limited information for these species.*

** *Species specific fishery area extends beyond FMA3*

Source: MPI 2010a, and WWF, 2010a-f

6.1.2.3 *Benthic Community*

The NABIS database (MPI, 2013b) highlights black corals are only sparsely distributed within the Taranaki Basin and the north west and north east coast of the North Island. According to Consalvey *et al.* (2006), the closest known presence of black corals and gorgonian corals to the Romney well location is on the Aotea Knoll (30 km from the northwest boundary of the PEP 38451).

Red corals and bubblegum corals have not been identified within the vicinity of the Romney prospect (Consalvey *et al.*, 2006). All species are protected under the *Wildlife Act 1953.*

Gorgonian corals are poorly known and some species are very rare such as the *Anthomastus robustus* and members of the Ifalukelidae family.

6.1.2.4 *Marine Mammals*

The marine waters off New Zealand support a diverse community of marine mammals. According to the NABIS database (MPI, 2013c), stranding records and literature reviews the marine mammals listed in *Table 6.2* are potentially present or transitory in the vicinity of the Romney prospect.

Released under the Official Information Act 1982

Table 6.2: Marine Mammals Potentially Present in PEP 38451

Whales	Dolphin Family	Pinnipeds
Baleen Whales Humpback whale (*Megaptera novaeangliae*) Blue whale (*Balaenoptera musculus*) Minke whale (*Balaenoptera bonaerensis*) Sei whale (*Balaenoptera borealis*) Southern right whale (*Eubalaena australis*)	Dusky dolphin (*Lagenorhynchus obscurus*) Common dolphin (*Delphinus delphis*) Killer whale (*Orcinas orca*) False Killer whale (*Pseudorca crassidens*) Long-finned and short-finned Pilot whales (*Globicephala macrorhynchus* and *Globicephala melas edwardii*) Bottlenose dolphin (*Tursiops truncates*) Maui's dolphin (*Cephalorhynchus hectori maui*)	New Zealand fur seal (*Arctocephalus forsteri*)
Toothed Whales Sperm whale (*Physeter macrocephalus, Kogia breviceps, Kogia simus*)		

Eight species of marine mammals identified in New Zealand waters are included in the New Zealand Threat Classification List (Baker *et al.*, 2009) as critically endangered, nationally endangered, or range restricted. As a result of the 2008-2011 update, the threat status of two species worsened, with the New Zealand sea lion (*Phocarctos hookeri*) upgraded to Nationally Critical and the bottlenose dolphin (*Tursiops truncates*) upgraded to Nationally Endangered. Four of these listed species have been identified which could be present in PEP 38451, due to certain characteristics of their life histories or behaviors:

- Maui's dolphin (*Cephalorhynchus hectori maui*) (Critically Endangered);
- Killer whale (*Orcinus orca*) (Critically Endangered);
- Southern right whale (*Eubalaena australis*) (Endangered); and
- Bottlenose dolphin (*Tursiops truncates*) (Endangered).

6.1.2.5 Marine Reptiles

Seven species of marine reptiles are known to occur off New Zealand's coast (WWF, 2010b). With the exception of the leatherback turtle, marine reptiles are characteristically found in warm temperate seas, so most of New Zealand's marine reptiles are concentrated in the warm waters off the northeast coast of the North Island (WWF, 2010b). Leatherback turtles are thought to have resident feeding grounds within the New Zealand region and sightings have been

Released under the Official Information Act 1982

recorded on the west coast of the South Island, Kaikoura, Banks Peninsula and as far south as Otago Peninsula and the Chatham Islands (WWF, 2010b).

6.1.2.6 *Seabirds*

A total of 86 species of seabirds have been recorded breeding along New Zealand coasts, including albatrosses, cormorants and shags, fulmars, petrels, prions, shearwaters, terns, gulls, penguins, and skuas (DoC, 2010b).

Of these species, NABIS (MPI, 2013c) identifies the offshore waters in the vicinity of PEP 38451 as a 'Hot Spot' for two species:

- Flesh-footed shearwater (*Puffinus carneipes*); and
- Grey-faced petrel (*Pterodroma macroptera*).

6.1.3 *Sensitive Areas and Coastal Information*

6.1.3.1 *Regional Oil Spill Contingency Plan*

The Taranaki Regional Council's Marine Oil Spill Contingency Plan (MOSCP) is its operational plan for responding to marine oil spills (Taranaki Regional Council, 2012). Annex 4 of the MOSCP provides details of sensitive sites and coastal environments within the Taranaki region. Other regional councils adjacent to PEP 38451 include the Waikato Regional Council and Auckland Council, both of which have similar MOSCPs. Sensitive sites and coastal environments documented in the three regions are highlighted in *Table 6.3* below.

Table 6.3: Sensitive Sites and Coastal Environments Detailed in Regional Marine Oil Spill Contingency Plans

Sensitive Site	Important Ecological Characteristics
Taranaki Region	
Mokau-Mohakatino (Epiha Reef)	This area has the most extensive intertidal reef system in North Taranaki, supporting encrusting organisms including mussels, limpets and barnacles. Coastal cliffs are a significant natural area, with communities of native flax-shrubland and native herbs.
Mohakatino Estuary	This area is a regionally significant protected wetland supporting notable fauna and flora. Notable fauna includes bittern and spotless crake, and possibly petrel burrows. Notable flora includes raupo and flax, a coastal herbfield and tussock shrubland, and Tainui, a nationally vulnerable tree grow on the edge of the swamp. Australian bittern, Caspian tern, and variable oystercatcher roost on sandflats and in the wetland. The river supports whitebait, flounder and shellfish, and native freshwater fish spawning areas are likely to be present
Te Kawau Pa	This area's cliffs have high interpretive and scientific values for coastal

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
	processes. Blue penguins are common around the area, and other seabirds nest on the cliffs and offshore stacks. Grey faced petrels and fluttering Shearwaters are also found within this area.
Te Puia	This area is one of the few remaining natural areas on the uplifted marine terrace. This area also has vigorously regenerating coastal vegetation, one of few natural remaining on the uplifted Marine Terrace land system, above sea level.
Rapanui	This area supports threatened flora, including the raupo and Hypolepis dicksonioides. Grey faced petrels and fluttering shearwaters are known to breed in the area.
Tongaporutu Estuary	This area supports an abundance of shellfish with high species diversity. Several small areas of wetland and saltmarsh are found within this location, with species uncommon to the Taranaki region. This area also supports spawning sites for inanga and whitebait.
Tongaporutu Coast	This area has extensive caves and offshore stacks along the coastline, featuring strong horizontal strata and frequent waterfalls. These offshore stacks and cliff edges have breeding colonies of grey-faced petrels, fluttering shearwater and white fronted terns, northern blue penguin have been recorded as nesting in the area. Breeding occurs up high but birds raft on water. This area also supports excellent saltmarsh communities and small sand dunes. This area is known to be nationally important for geology; with fossils of the Miocene Epoch (halostratotypes of the Tongaporutuan stage) present.
Parininihi Marine Reserve	This area supports diverse and abundant marine life and underwater habitats. Large rock lobster populations occur as well as rare and exotic sponge gardens that carpet the reef.
Whitecliffs (Parininihi)	This area is the best remaining examples of primary coastal hardwood and podocarp hardwood forest on the west coast of the North Island. The adjoining land is a significant natural area and the sand dunes at Waipingau Stream are known as a threatened plant site (Pingao – Desmoscheonus spiralis). This area supports fluttering shearwaters, which breed on the cliffs and blue penguins, burrow near stream mouths. Whitecliffs (Parininihi) has a geologically important 'B' rating on geo-preservation inventory.
Parlokariwa Reef and Opourapa Island	This area supports an abundance of marine life. There is a diversity of encrusting (attached) marine animals including sponges, shellfish, crustaceans and a large variety of fish. There is also seabird roosting areas and fur seal haul out areas.
Pukearuhe	No known ecological characteristics.
Waiiti Beach	This area is known for internationally important shark and whale bone fossils found in the intertidal zone. This areas previously buried forest is now exposed on the reef. Stabilized sand dunes, with marram, some tall karo, taupata, and native herbs. This area supports fluttering shearwaters and grey faced petrels on the cliffs and stacks, northern blue penguins, a huge protected kahikatea and a mussel reef.
Mimi Estuary	This area has dunes/sand spit south side of estuary, supports habitat of migratory and wading birds, intertidal and estuary, and periodically a blue penguin breeding site. This area provides a spawning ground for white

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
	bait, a feeding ground for snapper and trevally and a nursery area for juvenile species.
Urenui Estuary and Beach	This area supports a whitebait spawning ground in the upper reaches, snapper and trevally spawn offshore and feed in the estuary, also an important flounder fishery. Migratory birds roost and feed within this area. Hector's dolphin occasionally sighted offshore. Good coastal kohekohe and karaka trees are known from the area.
Onaero Estuary and Beach	Within this area, northern blue penguins nest in the cliffs, fossils are present in the cliffs and large historic puriri tree are found in the Pukemiro Reserve.
Buchanans Bay	This areas tidal reef system is rich in marine life with a snapper and trevally spawning ground around 2-4 nm off shore and paua and kina found within the waters.
Motunui Beach	No known ecological characteristics.
Waitara Estuary	This area supports small areas of native vegetation near the river mouth, with regionally uncommon indigenous plants including saltmarsh ribbonwood. This area is an important habitat for migratory wading birds with a wetland area adjacent to the estuary. A notable Norfolk Island Pine occurs on the road reserve.
Waitara, Waiongana and Airedale Reefs	Airedale reef contains the roots and trunks of a buried forest.
Waiongana Estuary	This area is an important area for migratory wading birds and a breeding location for the New Zealand Dotterel and Oystercatcher. Whitebait spawning habitat within this area. This area has dunes and dune lakes, cliffs of geological interest, banding and a petrified forest buried by the Pouakai Volcanic Eruptions and an offshore reef system adjacent to river mouth.
Bell Block Beach and Waipu Lagoons	This area supports threatened bird species including the Australiasian bittern and habitat for other wetland birds.
Waiwhakaiho Estuary	This area contains a Inanga spawning site, diverse freshwater shrimp habitat and important habitat for wading birds.
Fitzroy Beach	No known ecological characteristics.
East End Beach	No known ecological characteristics.
New Plymouth Foreshore	No known ecological characteristics.
Kaweroa Park	No known ecological characteristics.
Ngamotu Beach	This area supports an assortment of seabirds including gulls, terns and oystercatchers. Fur seals have also been sighted in the area.
Nga Motu/Sugar Loaf Islands Marine Protected Area	This area has the oldest volcanic formations in Taranaki. There is diverse and abundant marine life and underwater habitats. Important nesting habitat for many sea birds, as well as a New Zealand fur-seal breeding ground. Moturoa and Motumahanga islands are free of exotic predators.
Tapuae Marine Reserve	This area has the oldest volcanic formations in Taranaki. There is diverse and abundant marine life and underwater habitats. Little Blue Penguins are common along the coast and nest in burrows around stream mouths. Waikaranga rock is an important haul out for New Zealand fur seal. Tokatapu and Waikaranga house large crayfish populations.
Paritutu/Back	Penguins are known to occur within the area.

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Beach	
Tapuae Stream Mouth	This area supports scattered colonies of spinifex on dunes and dune wetland areas.
Oakura Beach	This area supports several historic trees and the largest population of pohutukawa in its southerly range. Australasian bittern and the gold-striped gecko are also known from the area.
AhuAhu, Weld and Timaru Road Beaches	This area supports several historic trees, with the largest pohutukawa in its southerly range.
Tataraimaka	This area is believed to be an important breeding area for Northern Blue Penguins. Notable Pohutukawa trees also occur.
Leith/Perth Road Beaches	The Maitahi Scientific reserve contains uncommon plants, and a good variety of coastal vegetation, including patches of wetland above mean high water. Threatened sea birds regularly use the area and blue penguins are also known to occur.
Stony River	This area is supports a feeding ground for gulls and terns. Brown trout runs out to sea.
Komene Road Beach	This area is important for rare and threatened bird species such as golden plover, sharp-tailed sand piper and wrybill and is a breeding location of New Zealand Dotterel and Banded Dotterel. Sand dunes and a regionally significant wetland – the Komene lagoon are found in the area.
Puniho Road Beach	No known ecological characteristics.
Paora Road Coast	No known ecological characteristics.
Stent Road	This area supports a herbfield containing Lepidium flexicaule (recently discovered and only known site in Taranaki and only known natural location outside of West Nelson-North Westland area). This area also contains *Crassula manaia*, which is endemic to the Egmont- Waverley coast.
Bayly Road	This area has the most extensive and well-preserved geomorphic surface of a volcanic debris avalanche deposit in New Zealand, on shoreline boulder. A threatened plant site on exposed bank 35m long x 3m wide (*Euphorbia glauca*) is found above mean high water on cliff. A herbfield, with *Crassula manaia*, (which is endemic to the Egmont-Waverley coast) also occurs.
Cape Egmont	This area has a geologically important (internationally) mound field, created by volcanic debris avalanche deposits. This area also supports areas of coastal herbfield from Cape Egmont to Otahi Stream and a complex and unique marine environment.
Kina Road and Oaonui Beach	This area supports a regionally significant dunedield, with important habitat for the black backed gull colony, and the green gecko as well as a breeding location of New Zealand Dotterel and Banded Dotterel.
Arawhata Road Beach	This area supports habitat for the herb *Crassula manaia,* (a nationally rare species), and *Myosotis pygmaea var pygmaea*. The endemic moth *Notoreas* sp has also been found at this location.
Middleton's Bay	This is an important area geologically as it shows complete lahar sequence, and contains buried forest and lignite in bays. This area is also an important habitat for waterfowl.
Opunake Beach	This is an important area geologically as it shows complete lahar sequence, and contains buried forest and lignite in bays.
Mangahume Beach	This area supports *Euphorbia glauca,* located on back dunes (a nationally

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
	rare plant)
Puketapu Road End	This area supports a coastal herbfield towards the headland, which is habitat for the moth *Notoreas* sp, on the top of cliffs. *Crassula peduncularis* (a threatened plant) has been found onsite. Paua is found within this area.
Oeo Cliffs	This area supports coastal herbfields.
Rawa Stream Mouth	This area supports coastal herbfields.
Otakeho Beach	This area is the site of nationally threatened plant *Craspedia* "Otakeho" (found in only two sites in the North Island, both being in Taranaki, the only other sites being around Nelson)
Kaupokonui Stream	This area contains a Inanga spawning site, moa and bird remains and sand dunes.
Sutherland/ Normanby Road Ends	This area supports threatened plants and is one of the most important botanical sites in the region.
Inaha Beach	No known ecological characteristics.
Waingongoro River Mouth, Ohawe Beach, and Four Mile Reef	This area supports an abundance of diverse marine life on the reef and an inanga spawning site. This area also contains a patch of nationally rare *Euphorbia glauca*, moa and bird remains, a rare example of coastal scrub and a distinctive form of native angelica (*Scandia rosifolia*) only known location in Taranaki.
Waihi Beach	This area is part of an internationally important sequence of uplifted marine terraces. Fossilised bivalves and gastropods have been found in the cliffs. A herbfield also exists on site.
Manawapou-Tangahoe River Mouths and Cliff Tops	This area contains a representative area of coastal vegetation, with the presence of coastal herbs and other halophytes in sand pockets on cliff edges.
Kakaramea Beach	This area supports a herbfield, and a Black-backed gull colony.
Patea Beach and River Mouth	This area supports threatened plants, including Pingao on dunes and taupata at base of cliffs (*Coprosma repens*). Wading birds are also found within this area.
Waitore Swamp	No known ecological characteristics.
Whenuakura Estuary	This area contains a relatively unmodified estuary supporting habitat for threatened caspian tern and rare variable oyster catcher. A nationally important population of a Royal spoonbill and a whitebait spawning area is known to occur within the area. A large area of sand dunes, with a loud frog population in the dune swales occurs.
North and South Traps	This area supports large kelp (*Ecklonia*) forests and diverse and abundant marine life.
Waipipi Dunelands	This area has a regionally significant wetland with vulnerable flora species and one of the best remaining examples of pingao and spinifex sand dune vegetation in South Taranaki.
Waverley Beach	This area contains the Ototuku Conservation Area, a remnant sand dune. A rare plant species (*Leptinella dispersa rupestris*) and native herbfields occur.
Waitotara Estuary and Dunes	This area supports an unmodified, representative estuary, with dune lake, wetland, sand dunes and damp dune flats adjacent (a regionally significant wetland). An important habitats for bird and insect species occurs, including the threatened Australian bittern, New Zealand shoveller, black

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
	swan. This area is a stopover for migratory wading birds including the royal spoonbill and the banded dotterel as well as international migrant birds such as the eastern bar-tailed godwit. Notable flora within this area includes the pingao and *Eleocharis neozelandica*, and a large number of different plant communities. Sub-fossil totara stumps in estuary (unique artefacts) are known to occur.

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Waiinu Beach and Reef	This area is dominated by extensive sand dunes. Rare venitifacts (rocks shaped by wind and sand erosion) occur in the area. The reef has an abundance of marine invertebrates, plants and fish, with a rock platform of Pleistoncene origin containing many well-preserved fossils.
Waikato Region	
Mokau River Estuary	This area provides habitat for resident and frequenting rare and threatened wildlife including waders, freshwater and coastal birds (the threatened reef heron, New Zealand dotterel, North Island fernbirds and the rare variable oystercatcher) This area also provides breeding habitat for Northern Blue and White-flippered penguins and whitebait. Maui dolphins have been recorded from the river mouth estuarine bar and this area is a haul out for New Zealand fur seals.
Awakino River Estuary	This area provides habitat for resident and frequenting rare and threatened wildlife including waders, coastal and freshwater birds and the Maui dolphin. Whitebait spawning habitat occurs within the area.
Marokopa River Estuary	This area provides habitat for resident and frequenting rare and threatened wading and coastal bird species (including the threatened reef heron, banded rail, New Zealand dotterel and caspian tern) and Maui dolphin. The area around Tirua Point is a winter haul out station for New Zealand fur seals and the estuary is a regionally significant whitebait fishery and a locally significant kahawai fishery.
Taharoa Beach (New Zealand Steel mine site)	This area provides habitat for migratory wading birds including the Pied Oyster Catcher, Bar Tailed Godwit, New Zealand Dotterel, as well as habitat for whitebait.
Albatross Pt and adjoining coastline	The coastline is used as a haul out site and breeding area for New Zealand fur seals, and is one of the largest and most northern sites off the West Coast. This site is along the annual migration route for New Zealand pied oystercatchers and sightings have been recorded of both Maui and common dolphins.
Kawhia Harbour	This are is of high value to international and national migratory waders, shore and wetland bird fauna including the endemic black stilt, an endangered species in New Zealand, the threatened New Zealand dotterel, banded dotterel, wrybill, caspian tern, variable oystercatcher, reef heron, white heron and royal spoonbill. Extensive seagrass and saltmarsh communities as well as mangroves occur within the area. Maui dolphins have been regularly recorded within the area and Orcas visit twice per year.
Aotea Harbour	This area has extensive seagrass communities and provides habitat for resident/migratory rare and threatened waders and coastal bird fauna including New Zealand dotterel, banded dotterel, caspian tern, white fronted tern, banded rail, North Island fernbird, spotless crake, reef heron, variable oystercatcher, wrybill and endangered black stilt. Maui dolphins have been recorded off the harbor entrance.
Gannet Island	This area is an island wildlife sanctuary and is a major rookery and breeding site for the Australasian gannet, with breeding populations exceeding 20,000 birds through November to February. An important haul out and breeding site for New Zealand fur seals with up to 200 animals recorded regularly.
Raglan Harbour	This area provides habitat for resident and frequenting rare and threatened wading and coastal bird fauna including New Zealand dotterel, banded

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
	dotterel, White fronted tern, little black shag, North Island fernbird, threatened banded rail, caspian tern, reef heron, New Zealand dotterel and royal spoonbill and the endangered white heron. Maui dolphins are regularly recorded at the harbor entrance and killer whales visit the harbor twice per year.
Waikato River mouth and estuary	This area provides habitat for resident and frequenting rare and threatened waders, coastal and threatened birds with the sand spit and islands used by breeding populations of New Zealand dotterels, Caspian terns, oystercatchers and white fronted terns. Other threatened visitors include, banded dotterel, reef heron, wrybill North Island fernbird and the endangered black stilt and the white heron. Maui dolphins have been often sighted off the river mouth. The threatened plant species Pinago is present on the foredunes. Nationally significant whitebait and native fishery are present within this area.
Auckland Region	
Manukau Harbour	Mangroves & Saltmarsh: areas of high productivity providing food and shelter for wide range of organisms including shelter for eggs and young (nursery habitat). Tidal sand/ mud flats: areas of very high productivity supporting large numbers of animals such as shellfish, worms etc. These are key feeding grounds for fish and also wading birds, including threatened and migratory species. Rocky shores: are home to a wide diversity of flora (e.g. seaweeds) and fauna (e.g. limpets, barnacles, sponges), including those found in rock pools. Seaweeds also provide shelter and food for fauna such as fish, or sea urchins. Manukau Harbour overall is also an internationally important wetland.
Omanawanui	Includes Whatipu wharf and important rocky shore habitat with nationally unique marine life
Huia and Cornwallis	Boulder beaches and rocky shores with nationally unique marine life. Tidal flats are also an important bird feeding area
Big and Little Muddy Creeks	Seagrass and algae covered tidal flats extend up into mangroves, shell beach or rocky shore.
Wairopa Channel, Mangere Inlet and Ambury Park	Area of primarily tidal flats. These provide: o Important feeding areas for wading birds including threatened species. o Roosting areas for wading birds including threatened and international migratory species. o The area also includes mangroves & saltmarsh. o Important geological features. o Additionally, the Onehunga commercial wharf is located in this area.
Airport to Drury	A diverse area of tidal mud/sand flats and mangroves & saltmarsh. These provide: o Important feeding & roosting areas for wading birds, including threatened and international migratory species. o Habitat for threatened coastal plants and birds. o Additionally, there are important geological features. o Pukaki/ Waiokauri Creeks are Tangata Whenua Management Areas
Ellets to Clarkes	An area of expansive fine sand tidal flats and shell banks bordered by

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Beach	mangrove and saltmarsh. These provide: o Important feeding & roost areas for wading birds, including threatened and international migratory species. o Whatapaka Creek is a Tangata Whenua Management Area
Taihiki River	A more pristine area of the harbour including areas of tidal flats, and mangroves & saltmarsh. Considered an important nursery area for flounder (pātiki) and mullet (aua).
Waiuku River	Mangrove & saltmarsh areas border intertidal flats. Key sites with shell banks and sand spits provide: o Important feeding & roost areas for wading birds, including threatened and international migratory species. o Additionally, there is an important geological feature.
Matakawau Point, Hudsons Beach to South Head	An area of tidal flats bordering a varying shore habitat including sand beaches rocky shore and mangroves & saltmarsh. o Including an area of suitable habitat for coastal and international migratory birds, as well as threatened coastal fringe species. o The rocky shore near South Head has a high variety of marine life.
West Coast	Rocky shores: are home to a wide diversity of flora (e.g. seaweeds) and fauna (e.g. limpets, barnacles, sponges), including those found in rock pools. Seaweeds also provide shelter and food for fauna such as fish, and sea urchins. Sand beaches: particularly around low tide mark are equally important as home to wide diversity of fauna (e.g. tuatua), often not visible.
Oaia Island	Breeding site for gannets and a haul out area for New Zealand fur seals, the endangered Cook's Scurvey Grass grows here
Muriwai to Karekare beaches	Includes areas of important geological rocky shore as well as sand beaches with a wide range of associated marine and coastal life. o Sand beaches with shell fish located around the extreme low tide level. o Several beaches are home to the threatened grass, pingao. o Rocky shores consist of geological features including those of international importance also with an associated wide diversity of marine life; seaweeds and animals. o Important feeding areas for coastal and sea birds.
Whatipu	Rocky shore and sand beach with important areas of flora and fauna, including threatened species of land plants and endangered birds such as the white fairy tern (tara).:
South of Manukau Heads	A long shoreline with 50-100m cliffs backing sand beach. Isolated areas of geologically important sands and threatened coastal plants.

6.1.3.2 *Protected Natural Areas in the Vicinity of PEP 38451*

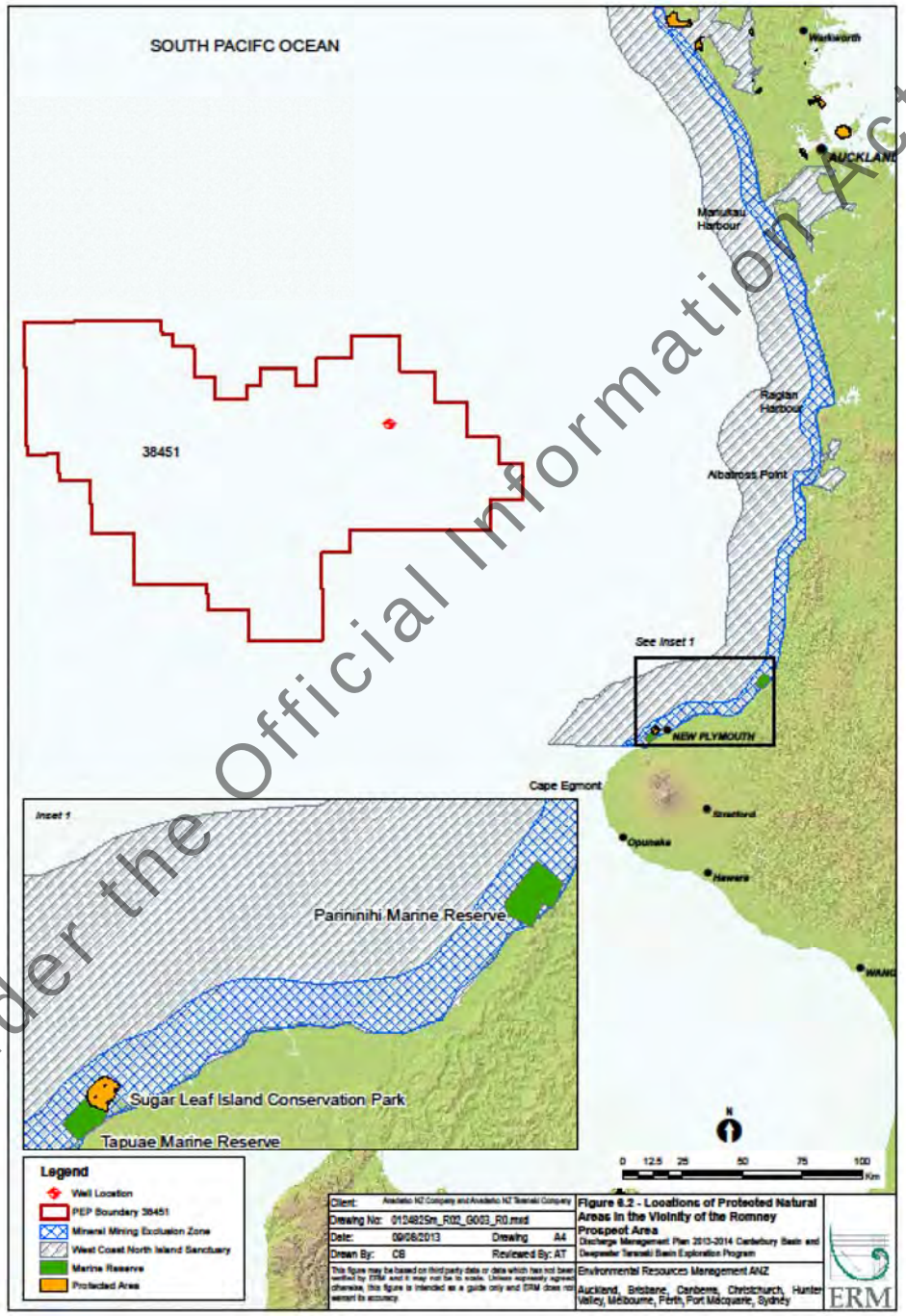
According to available information, there are no Protected Natural Areas located within PEP 38451 (Protected Planet, 2013). A number of protected areas have been identified along the coastline and offshore from Taranaki, which are listed below and shown on *Figure 6.1*. Protected areas include:

Released under the Official Information Act 1982

- Benthic Protection Area "Challenger North" located approximately 34 km south west of PEP 38451;
- West Coast North Island Marine Mammal Sanctuary located along the west coast of the North Island, approximately 56 km from PEP 38451;
- Protected Natural Area "Nga Motu /Sugar Loaf Islands", a Marine Protected Area (Site ID 305964) located just offshore from New Plymouth, approximately 106 km from PEP 38451, between the Port Taranaki breakwater and Herekawa Stream, Back Beach;
- Paraninihi Marine Reserve is 1800 hectare (**ha**) reserve located off the coast of Pukearuhe, 43 km north of New Plymouth and 121 km from PEP 38451; and
- Tapuae Marine Reserve covers 1404 ha and is located along the Taranaki Coast just south of New Plymouth, approximately 108 km from PEP 38451, adjoining the Sugar Loaf Island Marine Protected Area (DoC, 2010a).

Released under the Official Information Act 1982

Figure 6.1: Locations of Protected Natural Areas in the Vicinity of the Romney Prospect Area



Released under the Official Information Act 1982

6.2 CARAVEL PROSPECT AREA

6.2.1 Physical Environment

6.2.1.1 Climate

Detailed climatological data, such as mean temperature and precipitation, are unavailable for PEP 38264, so the following description is based on data from the onshore east coast of the South Island, in the Canterbury region of New Zealand.

The climate of the region is dominated by an irregular succession of anticyclones that move eastward, travelling in a more northerly direction during spring and a more southerly direction during autumn and winter. Between the anticyclones, troughs of low pressure occur, bringing north-westerly winds, clouds and rain, followed by cold south westerly winds. The eastern side of the South Island records some of the lowest rainfall averages in New Zealand, with some areas having less than 110 rainfall days per year compared to over 130 rainfall days in the North Island (Origin Energy, 2008).

6.2.1.2 Metocean Conditions

The mean wind speed over the period 1998-2007 shows a well-defined gradient from the northwest to the southeast, with stronger winds (on average) in the southern parts of the permit areas. However the maximum wind speed observed over the 10-year period, shows the signature of several storms centered on the southern parts of the Canterbury Basin, adjacent to the Otago coast. The vector-averaged wind speed / direction are predominance of westerly-sector winds in this part of NZ. Further details of the MetOcean Conditions are provided within *Annex B*.

6.2.1.3 Wave Height

The mean significant wave height shows a gradient in wave energy across the project areas. On average, the wave heights are greater in the southeastern sector and decrease to the east and north. The maximum observed significant wave height shows the signature of several storms that developed off the Otago/Canterbury coast, generating significant wave heights exceeding 12 m in the southeastern parts of the basin. It is possible that topographic constriction of the weather system led to the localized intensification of the wind field and resultant wave height extremes. Further details of the wave heights experienced in the Canterbury Basin are provided within *Annex B*.

Released under the Official Information Act 1982

6.2.1.4 *Bathymetry*

The Canterbury Basin is located at the edge of New Zealand's continental shelf and encompasses areas of continental slope and deep seabed. Consequently, there is a wide variation in depth encountered in PEP 38264, ranging from approximately 200 m below mean sea level in the west of the area to greater than 1200 m below mean sea level to the east.

6.2.1.5 *Currents*

The coastal current system in New Zealand is driven by three major oceanic surface current systems – the Tasman Current, West Wind Drift (south of the subtropical convergence zone which lies immediately east of PEP 38264) and the Trade Wind Drift (Brodie, 1959).

There is evidence of surface currents to the north of PEP 38264 with a hot spot of stronger currents (1 – 2 m/s) around the Banks Peninsula; however these are not expected to have an effect on the activities at the Caravel prospect (Origin Energy, 2008).

6.2.2 ***Biological Environment***

Sensitive biological receptors to potential discharges from the installation include plankton, commercial fisheries, listed fish species, the benthic community, marine mammals, marine reptiles, seabirds and deep sea corals.

6.2.2.1 *Plankton*

Warm subtropical surface waters surrounding the North Island and west coast of the South Island meet colder sub-Antarctic surface waters surrounding the rest of the South Island and offshore islands to the south and east. Here, nutrient rich waters from the south mix with the warmer northern waters to create the Subtropical Front (MPI, 2007). The primary area of this convergence is the Chatham Rise, New Zealand's most productive and important fishing ground (located approximately 50 km to the north of PEP 38264 at the closest point). This is a particularly significant area for oceanic productivity, including for phytoplankton and zooplankton and the animals (fish, baleen cetaceans) that feed on these.

6.2.2.2 *Fish Species*

There is currently no comprehensive dataset on the occurrence or distribution of listed fish species within PEP 38264, however some species listed in the 2005 DoC threatened species listing may be found within the area.

Released under the Official Information Act 1982

PEP 38264 falls within New Zealand Ministry for Primary Industries (**MPI**) Southeast Coast Fisheries Region – Fisheries Management Area (**FMA**) 3 (MPI, 2013c). The customary and recreational significance as well as the environmental importance of this region is rated as high by MPI. The commercial catch of this region is reported to be 6177 tones[1].

Deepwater fishing activity occurs from 12 Nm from shore out to the 200 Nm limit of the EEZ, which incorporates PEP 38264. The majority of the fishing vessels operating in New Zealand's deepwater fisheries are large factory trawlers. The EIA identified a number of commercial fish species potentially present in PEP 38264. These included finfish, squid and crustacean species.

Table 6.4 highlights the likely presence of commercially important fish in the exploration drilling area during life history stages and the scheduled activity. The 2009 export value of these fisheries is also provided within *Table 6.4* where the data is available, however it should be noted in many cases, species catch (and value) data is aggregated across a number of FMAs. For example, hoki data is aggregated across all FMAs within New Zealand. The most recent estimate of the total export value of commercial fisheries from FMA 3 was $8.95m in 2009 (MPI, 2013d). The total seafood export value in 2008 was estimated at $1.35b (MPI, 2013b).

Table 6.4: Likely Presence of Commercially Important Fish a in the Exploration Drilling Area, During Life History Stages and the Scheduled Activity

Species	Feeding	Spawning/ Calving	Migration	Export Value (2009)	Likely Presence within Project Area during scheduled ED (Summer)
Hoki	Year round	Winter	-	96.70** (HOK1)	✓
Hake	Year round	Winter	-	10.83** (HAK1)	✓
Ling	Year round	Spring - Summer	-	5.51 (LIN3)	✓
Oreo	Year round	Spring – Summer	-	1.36 (OEO3A)	✓
Orange Roughy	Year round	Winter	-	36.29** (ORH3B)	✓
Squid	Year round	Winter	-	1.68** (SQU1J)	✓
Jack Mackerel	Year round	Spring - Summer	-	2.24** (JMA3)	✓
Southern Blue	Year round	Winter - Spring	-	0.0085** (SBW1)	✓

[1] Reported commercial catch is calculated for the 12 month period to 30/9/2010.

Released under the Official Information Act 1982

Species	Feeding	Spawning/ Calving	Migration	Export Value (2009)	Likely Presence within Project Area during scheduled ED (Summer)
Whiting					
Scampi	Year round	Spring - Summer	-	No data (SCI3)	✓
Deepwater crabs	Year round	Summer - Autumn	-	No data (CHC3, GSC3 and KIC3)	✓

Notes:
** Conservative approach taken based on limited information for these species*
*** Species specific fishery area extends beyond FMA9*

Source: MPI 2010a, and WWF, 2010a-f

6.2.2.3 *Benthic Community*

A comprehensive inventory of the benthic community offshore New Zealand is not available. However, two deep sea benthic invertebrates support commercial deepwater fisheries in PEP 38264 – scampi and deep water crabs.

The Chatham Rise is identified as one of the main scampi fishery locations. Scampi stocks are fished mainly by small vessels (20-40 m) utilizing light bottom trawl gear (MPI, 2010a).

6.2.2.4 *Marine Mammals*

The marine waters off New Zealand support a diverse community of marine mammals. According to the NABIS database (MPI, 2013c), stranding records, literature reviews and DoC (Lilley and Boren, pers. comm.), the marine mammals listed in *Table 6.5* could be present or transitory in the vicinity of PEP 38264.

Released under the Official Information Act 1982

Table 6.5: Marine Mammals Potentially Present in the Caravel Prospect Area

Whales	Dolphin Family	Pinnipeds
Baleen Whales Humpback whale (*Megaptera novaeangliae*) Blue whale (*Balaenoptera musculus*) Minke whale (*Balaenoptera bonaerensis*) Sei whale (*Balaenoptera borealis*) Southern right whale (*Eubalaena australis*)	Dusky dolphin (*Lagenorhynchus obscurus*) Common dolphin (*Delphinus delphis*) Hector's dolphin (*Cephalorhynchus hectori*) Killer whale (*Orcinas orca*) False killer whale (*Pseudorca crassidens*) Long-finned and short-finned pilot whales (*Globicephala macrorhynchus* and *Globicephala melas edwardii*) Bottlenose dolphin (*Tursiops truncates*)	New Zealand fur seal (*Arctocephalus forsteri*)
Toothed Whales Beaked whales (12 species identified in New Zealand waters) Sperm whale (*Physeter macrocephalus, Kogia breviceps, Kogia simus*)		

Source: MPI (2010a)

Eight species of marine mammals identified in New Zealand waters are included in the New Zealand Threat Classification List (Baker *et al.*, 2011) as critically endangered, nationally endangered, or range restricted. As a result of the 2008-2011 update, the threat status of the bottlenose dolphin (*Tursiops truncates*) was up-listed to Nationally Endangered. Three species listed in the New Zealand Threat Classification List (Baker *et al.*, 2011) have been identified in the EIS with potential to be present in PEP 38264 due to certain characteristics of their life histories or behaviors:

- Killer whale (*Orcinus orca*) (critically endangered);
- Southern right whale (*Eubalaena australis*) (endangered); and
- Bottlenose dolphin (*Tursiops truncates*) (endangered).

6.2.2.5 Marine Reptiles

Seven species of marine reptiles are known to occur off New Zealand's coast. However, it is considered unlikely that marine reptiles would be encountered in PEP 38264.

Released under the Official Information Act 1982

6.2.2.6 *Seabirds*

The marine waters off New Zealand support a total of 86 species of sea birds, including albatrosses, cormorants and shags, fulmars, petrels, prions, shearwaters, terns, gulls, penguins, and skuas (DoC, 2010b). Most of New Zealand's seabird species breed on coastal headlands and islands off the New Zealand coast and some would use PEP 38264 as foraging habitat. Of those species listed as endangered or critically endangered, the following three species have been identified which utilize PEP 38264 for foraging habitat.

- Chatham albatross (*Thalassarche eremite*) (critically endangered);
- Northern royal albatross (*Diomedea sanfordi*) (endangered); and
- Black-browed albatross (*Thalassarche melanophrys*) (endangered).

6.2.2.7 *Deep Sea Corals*

Records of coral by-catch are held by MPI in three databases. The records show no incidence of black coral by-catch within PEP 38264 and limited by-catch of other coral species in the past ten years.

6.2.3 *Sensitive Areas and Coastal Information*

6.2.3.1 *Regional Oil Spill Contingency Plan*

Environment Canterbury's MOSCP for the Canterbury Region (Environment Canterbury, 2013) provides a list of 33 sites identified as being potentially highly sensitive to an oil spill. These sites are outlined in *Table 6.6* below along with sensitive sites identified in the neighboring Otago Regional Council's MOSCP.

Table 6.6: Sensitive Sites and Coastal Environments Detailed in Regional Marine Oil Spill Contingency Plans

Sensitive Site	Important Ecological Characteristics
Canterbury Region	
Clarence River Mouth	The delta area has a breeding population of banded dotterel and is visited by caspian terns, both of which are nationally threatened.
Waipapa to Irongate	Reef heron, a nationally threatened species is present along this coast. Ohau Point is a haul out and breeding site for New Zealand fur seals. Marine mammals are common offshore.
Kaikoura Peninsula	The peninsula has two significant seal haul out areas and seals are present in smaller numbers elsewhere. The red-bill gull colony is the largest in the South Island. Other gulls nest in association with these birds. The nationally threatened Reef heron and the rare White-faced heron breed on the peninsula. Other marine birds are also present and marine mammals are common offshore.

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
South Bay to Peketa	Nationally threatened Banded dotterel is present in low numbers and nationally threatened Black-fronted tern flock at the Kowhai River mouth. Nationally threatened Huttons shearwater nest inland but large flocks congregate just offshore. Other marine birds are also present and marine mammals are common offshore.
Kahutara River to Oaro	Two nature reserves are in this area, both being important breeding sites for red-billed gulls, spotted shags and white-fronted terns. The nationally threatened reef heron nests on Riley's lookout, a small island offshore. Other marine birds such as southern black-backed gulls are also present, as are seals and other marine mammals.
Oaro to Haumuri Bluffs	The area provides haulout sites for large numbers of New Zealand fur seals. Elephant seals and leopard seals have also been observed.
Conway River Mouth Lagoons	Sand tussocks and native sedges that are unique to the region grow at the southern end of the lagoon. A large number of bird species are present including the nationally threatened banded dotterel, black swans, white-faced herons, pied shags, and paradise and mallard ducks.
Waiau River Mouth and Shag Rock Coastline	The Shag rock area supports nesting colonies of seabirds, including spotted shags, red-billed gulls, and has a large and expanding fur seal colony with the occasional elephant seal. The lagoon provides breeding habitat for white-fronted terns, and nesting and roosting for other seabirds including gulls and the vulnerable banded dotterel.
Napenape	The area of significant conservation value consists of steep limestone coastal features and includes areas of rare native grasses. A large and expanding seal colony is present south of the Napenape Bluff. The coast supports a number of coastal bird species including the rare variable oystercatcher.
Motunau Island	Motunau Island is of international significance as a seabird habitat for a large number of threatened and other bird species including half the world's breeding population of the New Zealand white faced storm petrel. It is the most important island for seabird nesting between the Marlborough Sounds and Foveaux Strait.
	The island has an important breeding colony of white flippered little blue penguin, breeding colonies of fairy prion, sooty shearwater, the rare variable oystercatcher, southern black-backed gull, red-billed gull, and white-fronted tern. The island is also a night roost for other species including the white-faced heron and the South Island pied oystercatcher. The south east of the island is a haulout site for the New Zealand fur seal.
Motunau Cliffs and River Mouth	There is an important breeding site for pied shag in macrocarpa trees on the north east bank of the river mouth
Ashley River/Rakahuri Mouth and Saltwater Creek Estuary	The estuary is of national importance as a spawning/nursery ground for marine and freshwater fish species including the rare Canterbury mudfish.
	The beach area provides nesting sites for South Island pied oystercatcher, variable oystercatcher. The lagoon ponds and wetlands provide habitat for a wide variety of birds including: little black shag, scaup, marsh crake, spotless crake, grey teal, New Zealand shoveler, breeding black-backed gulls, caspian terns and eastern bar-tailed godwit.
	The Ashley Spit similarly supports a large number of resident and migratory threatened and other bird species including the banded dotterel.
Brooklands-Waimakariri River	The Brooklands Lagoon and Waimakariri River mouth is nationally important as a prime feeding site and habitat for a large number of birds

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Mouth	including godwits, threatened banded dotterels and pied stilts. The lagoon is an important wintering site and feeding stop for birds migrating up the coast. The lagoon provides an important habitat for the rearing and spawning of marine and fresh-water fish. Salmon fishing is also important.
Avon-Heathcote Estuary	The Avon-Heathcote Estuary has high value as a coastal wetland with an international significance for wildlife, with a significant variety of bird and fish life. It supports 5 to 6 % of the world's population of the South Island pied oystercatcher, and a significant proportion of other New Zealand wetland bird species.
Scarborough Cliffs and Godley- Head	The Godley-Sumner Heads are nationally important with large colonies of spotted shags and scattered nesting of threatened white-flippered little blue penguins. There is also a population of sooty shearwater.
Lyttelton Harbour/Whakaraupo	The vegetation of the salt marshes has high botanical value. The salt marshes and the tidal flats also have high biological value for providing important roosting sites for a variety of wading birds and waterfowl. They are an important nursery ground for many fish species. The cliffs on Quail and King Billy Islands support populations of white flippered little blue penguin. Three endemic genera of brachiopod occur on Ripapa Island and are only known in New Zealand at this location. They are of international significance, being the only place in the world where three such species coexist.
Okains Bay Estuary	Okains Bay is at the north east tip of Banks Peninsula. It contains a long narrow estuary with highly significant examples of saltmarsh vegetation. The estuary provides important spawning and nursery grounds for several fish species.
Pa Island to Ducksfoot Bay	The area contains many haul-out zones for non-breeding fur seals and provides nesting for sooty shearwater, fairy prion and other birds.
Crown Island Coast, Hickory Bay to Goughs Bay	The area contains many haul-out zones for non-breeding fur seals and provides nesting for sooty shearwater, fairy prion and other birds. The cliffs and bays support populations of little blue penguin, the endangered yellow-eyed penguin and spotted shag.
Stony Bay	This area is of national importance for providing a habitat and only breeding site on the peninsula for the endangered yellow-eyed penguin. White-flippered little blue penguin also roost in the area.
Redcliffe Nook to Damons Bay	The area (Dyke Head)contains a haul-out zone for non-breeding fur seals and provides nesting for sooty shearwater, fairy prion and other birds. The slopes of Flea Bay provide the most important habitat of white-flippered little blue penguin on Banks Peninsula and are of national significance for this reason. The cliffs and bays also support spotted shag and Damons Bay contains some pairs of the endangered yellow eyed penguin.
Akaroa Harbour	The cliffs and coves in this area support breeding populations of little blue penguin, black-backed and red-billed gulls, white-fronted terns and large colonies of spotted shag. The area also harbours 2 or 3 pairs of endangered yellow-eyed penguin. The white-flippered little blue penguin also roost on the Onawe Peninsula at the head of the harbour. The tidal flats in bays at the head of the harbour are of national importance for their saltmarsh ecosystem and bird habitat. They provide feeding areas and roosts for a diversity of wading birds and waterfowl including large

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
	numbers of the South Island pied oystercatcher, the threatened banded dotterel, pied stilt, white-faced heron, white heron, black, little and spotted shags, paradise shelduck, and grey duck. They are also a nursery ground for marine fish. There are rare beds of seagrass that have almost been lost in Lyttelton Harbour/Whakaraupo.
Scenery Nook	This area is inhabited by fur seals and contains roosting for a variety of seabirds including the white-flippered little blue penguin, spotted shags, white fronted terns, black backed gulls and red-billed gulls. Rare intertidal seaweed grows at the foot of the cliffs.
Te Waihora (Lake Ellesmere) and Kaitorete Spit-	This area is one of New Zealand's most important wetland systems, and is of international importance because of its wildlife values. It contains a very large variety and number of birdlife. Over 50,000 birds have been counted on the lake at one time, including 30,000 water fowl. 158 species of bird have been recorded, at least 8 of which are internationally significant, and 22 nationally significant, including 6 threatened species. The lake is also an important native and introduced fish habitat. The dune system of the spit also contains one of the largest remaining populations of pingao, a fibrous plant used by Maori, left in New Zealand.
Coopers Lagoon/Muriwai and Coastline	This area is significant for the breeding, roosting and feeding activities of wetland birds. The lagoon has extensive saltmarsh habitat, it supports high bird diversity and is a freshwater fish habitat. 51 species of bird have been recorded including populations of many threatened species including a nationally important population of mute swan, one of only two introduced bird species to receive specific protection.
Rakaia River Mouth	This area holds an important recreational salmon fishery with a wide variety of birds potentially exposed to any spill. The lagoon is also a fish spawning and nursery area. At least 28 species of wetland bird have been recorded including the following threatened species: banded dotterel, wrybill, black-fronted tern and caspian tern.
Ashburton River/Hakatere Mouth	The area provides an important bird habitat with many wetland and migratory species. The lagoon is also a fish spawning and nursery area. At least 50 species of bird have been recorded including the following threatened species: little black shag, golden plover, banded dotterel, wrybill, black-fronted dotterel, black-fronted tern and caspian tern.
Orari River Mouth and Lagoons	This area is a nationally important bird habitat and fish spawning and nursery ground. 14 species of wetland bird species have been recorded including the following threatened species: banded dotterel, black-fronted tern and caspian tern.
Opihi River Mouth and Lagoon	It is a nationally important bird habitat and fish spawning and nursery ground. 24 species of wetland bird species have been recorded including the following threatened species: white heron, banded dotterel, black-fronted tern and caspian tern.
Washdyke/Waitarakao Lagoon and adjacent Coastline	The lagoon is a nationally important wetland with a significant saltmarsh ecosystem and important bird habitat. The lagoon supports over 3,000 birds at times including the following threatened species: banded dotterel, wrybill, black stilt, variable oystercatcher, white-winged black tern, caspian tern, white heron, black-fronted dotterel and Australasian bittern.
Patiti Point to Tuhawaiki Point	This area to the south of Timaru contains a volcanic reef system with a regionally important and unusual assemblage of flora and fauna.

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Wainono Lagoon to Waihao River Mouth	The lagoon is a wetland of national importance for its birdlife and fish habitat. Fur seals occasionally haul out along the beach. The lagoon supports a high diversity and numbers of birdlife. Threatened species present include: white heron, royal spoonbill, banded dotterel, wrybill, Australasian bittern, marsh crake, black-fronted tern and caspian tern.
Waitaki River Mouth	The mouth is an important recreational salmon fishery. It is a wetland habitat of national significance with a wide variety of wading and migratory birds potentially exposed to any spill. At least 40 species of wetland bird have been recorded, many of them threatened species including: reef heron, white heron, Australasian bittern, marsh crake, banded dotterel, wrybill, sharp-tailed sandpiper, black stilt, black-fronted tern and caspian tern. The lagoon is also of national significance as a fish spawning and nursery area with at least 3 threatened species of native fish; banded kokopu, giant kokopu and blue-gilled bully.
Otago Region	
Oamaru Harbour	Historical harbour. Breakwaters. Fishing facilities. Recreational facilities. Blue Penguin colony.
Oamaru	Breeding area for blue penguins.
Cape Wanbrow	Internationally significant volcanic deposits, significant headland. Habitat for Stewart Island shags, sooty shearwater, blue penguins and spotted shags. Visited by reef herons, Fiordland crested penguins and Caspian terns. Haul out site for New Zealand fur seals.
Awamoa Creek	Important archaeological site. Nationally important fossil site.
Kakanui Beach	Recreational Values. Breeding area for yellow-eyed penguins.
Kakanui River	Mouth. Internationally important mineral site. Hector's dolphins.
Campbells Beach Fossils	Nationally important fossil site.
Bridge Point – Aorere Fossils	Nationally important fossil site. Important plants.
Lookout Bluff	Breeding area for yellow-eyed penguins. Haul-out site for New Zealand fur seals.
Kakaho Creek	Nationally important fossil site.
Moeraki Beach	Kai Tahu cultural and spiritual values. Internationally important landform.
Moeraki	Recreational values. Fishing facilities. Recreational facilities. Moorings.
Moeraki Peninsula	Internationally important landforms at Tawhiroko Point and Moeraki Peninsula. Breeding area for yellow-eyed penguins, blue penguins, Stewart Island shags, spotted shags and royal spoonbills. Visited by crested penguins. Breeding area for New Zealand fur seals. Haul out site for Hookers sea-lions, elephant seals and leopard seals.
Maukiekie Island	
Katiki Beach	Recreational values. Breeding area for yellow-eyed penguins.

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Shag Point	Kai Tahu cultural and spiritual values and Kaitiki boulders. Habitat for sooty shearwaters, spotted shags, Stewart Island shags, yellow-eyed penguins, reef herons. Haul out site for Hookers sea-lions and New Zealand fur seals.
Shag River Estuary	Kai Tahu cultural and spiritual values. Estuarine values.
Stony Creek Estuary	Estuarine values.
Bobbys Head	Breeding area for yellow-eyed penguins. Haul out site for New Zealand fur seals.
Pleasant River Estuary	Kai Tahu cultural and spiritual values. Estuarine values.
Hawksbury Inlet	Kai Tahu cultural and spiritual values. Estuarine values.
Waikouaiti – Karitane	Recreational values.
Waikouaiti River Estuary	Kai Tahu cultural and spiritual values. Estuarine values.
Karitane Point	Kai Tahu cultural and spiritual values.
Karitane Spit	Kai Tahu cultural and spiritual values. Coastal cliffs and blowholes and landform "Karitane tombolo".
Puketeraki	Kai Tahu cultural and spiritual values.
Warrington Spit – Doctors Point	Recreational values.
Blueskin Bay, Waitati Inlet	Kai Tahu cultural and spiritual values, estuarine values. Commercial cockle harvesting. Recreational shellfish harvesting (cockles, pipis, oysters, tuatuas).
Orokonui Inlet	Kai Tahu cultural and spiritual values.
Mapoutahi	Kai Tahu cultural and spiritual values. Estuarine values.
Purakanui Inlet	Kai Tahu cultural and spiritual values. Estuarine values. Recreational shellfish harvesting.
Aramoana	Kai Tahu cultural and spiritual values. Estuarine values. Recreational shellfish harvesting.
Otakou	Kai Tahu cultural and spiritual values. Estuarine values.
Taiaroa Head	Kai Tahu cultural and spiritual values. Significant headland. Internationally important Royal Albatross Colony. Important breeding area for penguins, shags. Breeding area for fur seals. Haul out site for sea-lions and seals (Pilots Beach).
Pipikaretu Point	Kai Tahu cultural and spiritual values.
Otago Peninsula	Breeding area for yellow-eyed penguins (16 sites) and New Zealand fur seals (various sites). Haul out site for New Zealand fur seals. Kai Tahu cultural and spiritual values. Outstanding scenic quality, including "lovers leap" and "The Chasm". Significant earthflow at Sandfly Bay. Significant headlands.
Te Whakarekaiwi	Kai Tahu cultural and spiritual values.
Papanui Inlet	Kai Tahu cultural and spiritual values. Estuarine values. Commercial and recreational shellfish harvesting.

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Hoopers Inlet	Kai Tahu cultural and spiritual values. Estuarine values.
Tomahawk-St Clair	Recreational values.
Tunnel Beach	Sandstone cliffs, significant headland.
Kaikorai Inlet	Kai Tahu cultural and spiritual values. Estuarine values.
Green Island	Breeding areas for 11 marine bird species including yellow-eyed penguins and blue penguins. Haul out site for New Zealand fur seals.
Brighton Beach	Recreational values.
Taieri River Mouth	Recreational values.
Taieri Island (Moturata)	Breeding area for blue penguins and sooty shearwaters.
Akatore Creek Estuary	Kai Tahu cultural and spiritual values. Estuarine values.
Quoin Point	Breeding area for New Zealand fur seals.
Chrystalls Beach	Kai Tahu cultural and spiritual values. Cooks Head Rock.
Watson Beach	Internationally important geological site.
Tokomairiro Estuary	Kai Tahu cultural and spiritual values. Estuarine values.
Clutha River, Matau Branch	Kai Tahu cultural and spiritual values.
Kaka Point	Recreational values.
Nugget Point	Proposed marine reserve. Haul out site for New Zealand fur seals, elephant seals, Hookers sea-lions. Visited by leopard seals. Breeding area for yellow-eyed penguins, blue penguins. Visited by erect crested penguins, Fiordland crested penguins. snares crested penguins, and rockhopper penguins. Diverse range of physical and biological intertidal and subtidal features. Outstanding scenic coastline. Significant headland.
Cannibal Bay – Surat Bay	Haul out site for Hookers sea-lions. False Islet stacks well defined landforms of scientific value.
Surat Bay	Kai Tahu cultural and spiritual values.
Catlins Lake Estuary	Estuarine values.
Hayward Point – Jacks Bay	Breeding area for yellow-eyed penguins.
Tuwhaiki Island	Haul out site for New Zealand fur seals, breeding area for sooty shearwaters and yellow-eyed penguins.
Penguin Bay	Breeding area for yellow-eyed Penguins. Haul out site for New Zealand fur seals.
Duff Island – Castle Rock	Haul out site for New Zealand fur seals.
Hinahina Cove	Breeding area for yellow-eyed penguins. Haul out site for New Zealand fur seals.
Purakanui Bay – Cosgrove	Haul out site for Hookers sea-lions. Breeding area for New Zealand fur seals. Breeding area for yellow-eyed penguins, blue penguins, sooty shearwaters and fairy prions.
Long Point to	Breeding area for yellow-eyed penguins. Haul out site for New Zealand fur

Released under the Official Information Act 1982

Sensitive Site	Important Ecological Characteristics
Chasm Island	seals.
Waiheke Beach	Kai Tahu cultural and spiritual values.
Tahakopa Bay and Estuary	Estuarine values. Archaeological sites. Sand dunes support vegetation of national value.
Skeleton Point and Rainbow Island	Breeding area for yellow-eyed penguins and titi. Haul out site for New Zealand fur seals.
Oyster Bay	Kai Tahu cultural and spiritual values.
Tautuku Estuary	Estuarine values. Fisheries breeding ground, salt marsh communities.
Waipiti Beach	Haul out site for Hookers sea-lions.
Waipati Estuary and Kinakina Island	Estuarine values. Kai Tahu cultural and spiritual values.
Chaslands Mistake	Haul out site for New Zealand fur seals.
Wallace Head	Haul out site for New Zealand fur seals.
Waiparu Head	Breeding area for yellow-eyed penguins. Recreational values.
Te Ahi Mate Bay	Kai Tahu cultural and spiritual values.
The Brothers	Breeding area for yellow-eyed penguins.

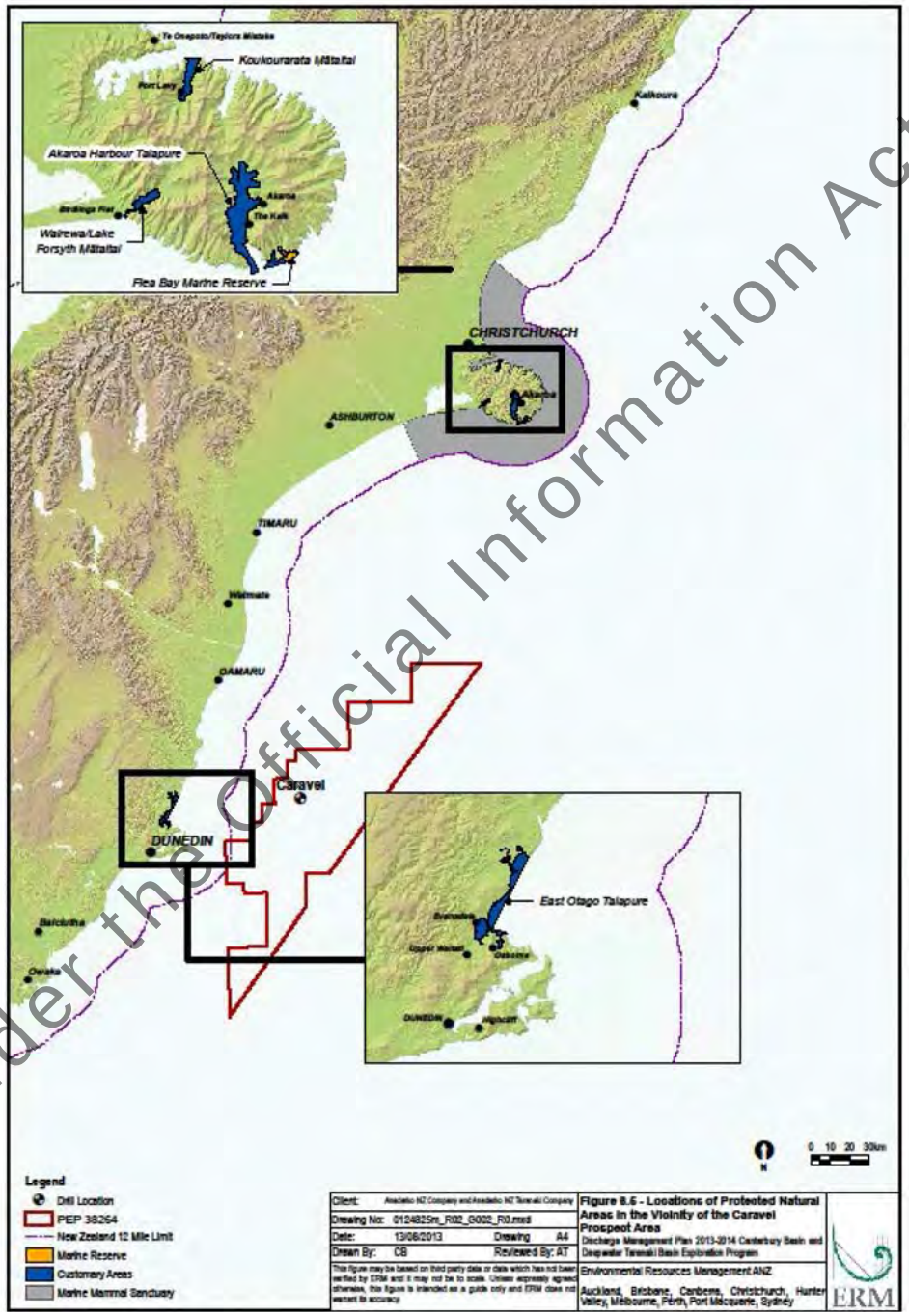
6.2.3.2 *Protected Natural Areas in the Vicinity of PEP 38264*

According to available information, there are no Protected Natural Areas located within PEP 38264 (UNEP and IUCN, 2009). A number of protected areas have been identified along the coastline of the east coast of the South Island, which are listed below and shown on *Figure 6.2*. These protected areas include:

- Protected Natural Area is the Pōhatu (Flea Island) Marine Reserve located on the south-east side of Banks Peninsula, approximately 230 km from the PEP 38264;
- Mātaitai and Taiapure customary local fisheries grounds. These consist of the East Otago and Akaroa Harbor Taiapures located approximately 85 km and 230 km from the Caravel Prospect area respectively , and the Rapaki, Koukourarata, and Wairewa/Lake Forsyth mātaitais located 230-250 km from PEP 38264;
- Benthic Protection Area "Mid Chatham Rise" located approximately 500 km to the north east of PEP 38264;
- Banks Peninsula Marine Mammal Sanctuary (**MMS**) located approximately 230 km north from the proposed drill location.

Released under the Official Information Act 1982

Figure 6.2: Locations of Protected Natural Areas in the Vicinity of the Caravel Prospect Area



Released under the Official Information Act 1982

7.0 ASSESSMENT OF ENVIRONMENTAL RISK FROM DISCHARGES

There are a number of processes and activities associated with the exploration which present a risk of environmental impact. These activities include both operational and unplanned discharges. The risks relating to operational and unplanned discharges during the Project are summarized in the section below along with management measures to be undertaken. The significance of the impacts has been described in terms of:

- *Negligible* impact – where a resource, receptor, or community will not be affected by a particular activity or the predicted effect is deemed to be 'imperceptible';
- *Minor* impact – where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value. An inconvenience may be caused, but with little or no consequences to long-term livelihoods, culture, quality of life, or resources;
- *Moderate* impact – where an effect will be within accepted limits and standards. Also applies where livelihoods, culture, quality of life, or resources are notably impacted, affecting a small number of households, and where those affected will be able to adapt to the new conditions;
- *Major* impact – where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. Major significance also applies where there are widespread, severe, and irreversible consequences for livelihoods, culture, quality of life or resources and where those affected will be unable to adapt to the new conditions.

Significance ratings have been generated considering the magnitude of the potential change and the nature/sensitivity of the receptor, using the significance matrix in *Table 7.1*. Additional detail on the approach to determining significance of impact and definitions of matrix criteria can be found in the respective Project EIA documentation.

To assess risk of unplanned events the assessment considers the likelihood of an unplanned event occurring, and its likely consequence on the environment and public health and safety if it does occur. *Table 7.2* shows the matrix applied for these scenarios.

Released under the Official Information Act 1982

Table 7.1 Overall Significance Criteria for Impacts in the EIA

		Sensitivity/Value 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 7.2: Unplanned Event Impact Significance Criteria

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

7.1 OPERATIONAL DISCHARGES

7.1.1 Drilling Fluids and Cutting

During the jetting of the 36 inch top interval of the borehole and 26 inch section of the well, cuttings and WBF will be discharged directly to the sea floor from the hole. In subsequent hole sections, either WBF or low-toxicity NABF will be recirculated in the drill string and reused until these are spent (no longer suitable for reuse). Spent NABF will be removed from the cuttings and stored in secured appropriate containers for reprocessing and use in another drilling program. However, if the NABF is influenced by hydrocarbons (refer to next paragraph for process) from the formation then the NABF will not be able to be use in

Released under the Official Information Act 1982

another drilling program. In this case the NABF will be injected into a lower formation according to appropriate New Zealand regulations.

The following process will be followed to determine if NABF has been influenced by hydrocarbons.

- The retort effluent will be visually analyzed for the presence of hydrocarbons on the drillship three (3) times per day.
- Samples will be sent onshore to have a gas chromatograph run on the liquid phase to confirm the lack of hydrocarbons in the fluid portion of the mud on a monthly basis.
- Additional gas chromatograph analysis will be conducted if an oil bearing interval is drilled or an oil kick is taken while drilling the well.

To quantify the magnitude of the impact of cuttings discharges a cuttings dispersion modeling study was undertaken (see *Annex C*).

For both Caravel and Romney, results of this modeling study depicts a low risk of impacts based on the estimated discharges in terms of thickness of materials deposited and total suspended solids (TSS). Though short-term elevated sedimentation rate is predicted in the vicinity around both wells below the bottom discharge, no sensitive coral have been identified at these locations. The maximum depositional footprint thickness at Caravel ranges from 13 to 15 mm depending on the season modeled, whilst the maximum depositional footprint thickness at Romney was modeled as 44.5mm.

According to Neff *et al*. (2000), the principal impact of drilling cuttings discharge is a result of cuttings piles formed near the discharge point. This can lead to a smothering effect for benthic organisms caught beneath the cuttings. Additionally, when using NABF (such as is proposed for the lower sections of the wells), the discharged cuttings contain a small quantity of adhering fluid. This leads to minimally increased concentrations of hydrocarbons on the seafloor, especially in the places where cuttings have accumulated. Increased levels of hydrocarbons can provide a source of organic carbon that leads to increased rates of biological activity of benthic organisms. This may result in minor short-term oxygen level changes in the sediments, benthic organism habitats and water column, however these are unlikely to be significant given the anticipated high current flow and the short duration and spatial extent of exploration drilling activities. As the impacts will be short term and localized in nature, the magnitude of this impact is considered to be small.

Released under the Official Information Act 1982

Discharges of cuttings will cause a localized increase in water turbidity and minor, localized changes in water quality. The sensitivity of the water column to these impacts is rated as low given the volume of the surrounding ocean environment where localized temperature increase and low level trace oils and chemicals can be quickly absorbed.

The benthic environment of the prospect areas provide habitat for benthic invertebrates that support commercial deepwater fisheries (scampi and deepwater crab species). There are no recorded incidences of black coral or gorgonians within either PEP 38451 or PEP 38264. The closest distributions of both to either prospect have been identified as approximately 30km from PEP 38451 (the location of Romney prospect) on the Aotea knoll. Black corals are sensitive to disturbance, are protected under the *Wildlife Act 1953* and are considered of high ecological importance. As a result of these factors, coupled with the relative lack of knowledge relating to their life cycle, the sensitivity of cold-water corals to these impacts is considered medium.

Prevention and Mitigation

To mitigate the impacts of drill cuttings discharges on benthic organisms, Anadarko will implement the following measures:

- Use solids control equipment to maximize recovery of drilling fluids and reduce drilling fluid discharge volumes;
- Use low-toxicity NABF;
- Use barium with low concentrations of contaminant metals; and
- Discharge cuttings only after sufficient treatment to reduce NABF residual concentrations.

Whilst the presence of black coral and gorgonians is not recorded within either prospect areas, these communities have been identified approximately 30 km from PEP 38451 (block containing the Romney well). Given the sensitivity of this receptor, the following precautionary measures will be implemented by Anadarko at both well locations to ensure sensitive corals are not present prior to drilling operations commencing:

- Shallow hazards mapping was performed to determine physical characteristics of the drill site for drilling purposes. This information may be used to assist in the evaluation of whether coral may be present. Cairns and Stanley (1981) identify that black coral have a preference for habitats that have: hard substrata; vigorous current activity; and cool water temperature; and

Released under the Official Information Act 1982

- A program of sea bed sampling prior to drilling is also proposed (see *Section 7.3*) that will provide an indication of the baseline environment within a 3 km radius of the drill center.

- Use of ROV to visually inspect the seafloor prior to the commencement of exploration drilling activities. Should sensitive corals be identified in the area, the drilling location will be adjusted.

- In addition to the receptor focused mitigation methods highlighted above, potential sources of impact have also been mitigated through the use of a dynamically positioned drilling vessel that does not require the use of anchors.

Residual Impacts

With the inclusion of the above mitigation measures the likely impact magnitude is reduced to negligible. Accordingly, while receptor sensitivities remain the same the overall significance of this impact is considered to be ***negligible.***

7.1.2 *Sanitary and Domestic Wastewaters*

The amount of wastewater generated and discharged from the drilling vessel depends on the number of persons on board. For the purposes of this assessment it is assumed that one person generates 100 l/day of sanitary wastewater (from toilet facilities) and 220 l/day of domestic wastewater (grey water from showers, sinks, laundries, and galleys, as well as from safety shower and eye-wash stations). It is predicted that sanitary wastes will have an associated biochemical oxygen demand (**BOD**) of 240 mg/l.

It is estimated that the *Noble Bob Douglas* will normally have between 130 and 150 persons on board during the Project. In order to assess the highest environmental impact, there was assumed that the largest number of people will be on board.

Table X3 shows the estimated amount of sanitary wastewater that will be generated on the *Noble Bob Douglas* and the associated BOD, given an estimated average of 150 persons on board per shift and operational activities of either 120 or 240 days.

Table 7.3 Estimated Amounts of Sanitary, Domestic Wastewater and BOD per day for Operations of 120 and 240 Days

Personnel on Board: 150 Length of Operations	Sanitary Waste (l)	BOD (kg)	Domestic Wastewater (l)
1 day	15,000	3.6	33,000
120 days	1,800,000	432	3,960,000

Released under the Official Information Act 1982

240 days	3,600,000	864	7,920,000

Such discharges will create a local level of biological and chemical oxygen demand due to the presence of harmful microorganisms and organic material. Sanitary wastes will either be processed using an IMO-compliant on board sewage processing facility, to ensure the 5-day average BOD is maintained at < 25 mg/l, or in the event that treatment standards are not achieved, the rate of discharge will be reduced to minimize loading on the local environment. Due to the localized nature of this impact and the short duration of the activity, the magnitude of this impact is considered to be negligible.

The sensitivity of the water column to these impacts is rated as low given the volume of the surrounding ocean environment within which these discharges will quickly diffuse.

Prevention and Mitigation

Effluent will be treated prior to discharge into the sea. As per MARPOL Annex IV, all sewage discharged to the sea will be treated through the sewage treatment plant or will be comminuted and disinfected when the vessel is more than three nautical miles from the nearest land. Sewage which is not comminuted or disinfected will be discharged at a managed rate, at a distance of more than 12 nautical miles from the nearest land.

Residual Impacts

With the applications of the above mitigation measures, the significance of the impact from sanitary and domestic wastewater discharge on seawater quality is considered to be *negligible*.

7.1.3 *Other Miscellaneous Solid and Liquid Wastes*

Routine operations on the drilling vessel will generate solid wastes, including garbage and deck waste, debris and scrap waste. Disposal of solid wastes to sea can adversely impact water quality and marine wildlife.

All solid waste, other than food scraps, will be transported to the onshore support base for disposal at approved facilities. Hazardous wastes will be properly handled, stored, and disposed of according to New Zealand requirements and current industry protocols at an approved disposal site.

Food wastes will also be discharged in accordance with MARPOL Annex V requirements directly to the sea following maceration. All food waste will be macerated into pieces <25 mm diameter prior to discharge. No other garbage will

Released under the Official Information Act 1982

be discharged at sea. Details of domestic waste disposal aboard the *Noble Bob Douglas* are provided in Section 5.2.

Given the disposal of miscellaneous solid and liquid wastes will occur with the use of managed and certified waste facilities subject to land-based resource consent conditions under the *Resource Management Act 1991* (RMA), the sensitivity of the receptors is considered to be low.

Prevention and Mitigation

Discharge/disposal anywhere at sea of plastic-derived garbage is prohibited under MARPOL Annex V, and there will be no discharge of any garbage other than treated food wastes from the *Noble Bob Douglas*. Wastes will be disposed of in accordance with the *Noble Bob Douglas* Garbage Management Plan (*Annex A*).

Residual Impacts

By adhering to the above conventions, waste generation impacts are considered to be *negligible*.

7.1.4 Other Miscellaneous Discharges

Other generated discharges include:

- Uncontaminated bilge water;
- Wash water from cement tub cleanup (only if cement does not contain HNSO Classification of 9.1A, 9.1B, or 9.1C chemicals);
- 300 bbl of Test Tail Cement (does not include HNSO Classifications 9.1A, 9.1B, or 9.1C chemicals)

In the open ocean, these discharges will be diluted rapidly to ambient concentrations and conditions within tens of meters of the discharge point. Due to the localized nature of this impact and the short duration of the activity, the magnitude of this impact is considered to be negligible.

The sensitivity of the water column to these impacts is rated as *low* given the volume of the surrounding ocean environment within which these discharges will quickly diffuse.

Released under the Official Information Act 1982

7.1.4.1 *Discharge of Bilge Water*

There will be discharges of bilge water that might contain hydrocarbon residues. Bilge waters that may contain hydrocarbon residues will be pumped to holding tanks, filtered through an oily water separator in compliance with MARPOL Annex 1, Regulations 9 and 21, and discharged overboard with oil in water levels not exceeding 15 ppm. Due to the localized nature of this impact and the short duration of the activity, the magnitude of this impact is considered to be negligible.

The sensitivity of the water column to these impacts is rated as low given the volume of the surrounding ocean environment within which these discharges will quickly diffuse.

Following this process, the amounts of oil within the bilge waters will be very small and considering dilution and dispersion effects, it is expected that there will be a *negligible* impact on sea water quality.

7.1.4.2 *Drainage Waters*

Drainage water on the drilling vessel can originate from various sources, including:

- Rainfall (deck runoff);
- Deck washing;
- Clean area floor drains;
- Machine area floor drains;
- Overflow drains;
- Bilge; and
- Bunded areas beneath fuel and chemical storage areas.

Detergents used for washing marine deck spaces will be discharged overboard. In all cases Aqua Break (*see Annex A – Hazardous Substance Inventory*) a low toxicity, biodegradable detergent will be used. Due to the localized nature of this impact and the short duration of the activity, the magnitude of this impact is considered to be negligible.

The sensitivity of the water column to these impacts is rated as low given the volume of the surrounding ocean environment within which these discharges will quickly diffuse.

Released under the Official Information Act 1982

The Noble Bob Douglas is designed to contain run-off and prevent oily drainage from being discharged (see *Annex A* for hazardous and non-hazardous drainage system layouts). The flow is diverted to separation systems depending on the area collected.

All drainage water in machine areas has the potential to contain petroleum hydrocarbons (primarily lubricating grease and lubricating oil). The drilling vessel is fitted with an oil/water separator to enable it to comply with MARPOL Annex 1, Regulations 9 and 21 for discharge of machinery space drainage. Bilge waters from machinery spaces are pumped to holding tanks, filtered, and discharged overboard with oil in water levels not exceeding 15 parts per million. Separated oil sludge will be temporarily stored on board and properly disposed ashore.

There will be no discharge of free oil in deck drainage that would cause a film, sheen, or discoloration on the surface of the water, or a sludge or emulsion to be deposited beneath the water surface. Overboard discharges will not exceed 15 ppm of oil in water. If the deck has hydrocarbons on its surface, deck drainage will be contained by absorbents or collected by a pollution pan under the drilling vessel floor for recycling, treatment, and/or disposal.

Following this process, the amounts of oil within the drainage waters will be very small and considering dilution and dispersion effects, it is expected that there will be a *negligible* impact on sea water quality.

7.2 SPILL SCENARIOS

The below table identifies a number of likely spill scenarios and spill mitigation measure or plans.

Likely Spill Scenarios	Approximate Likely Volume	Spill Mitigation/Plans
Trash and Debris		
Loading/Unloading vessel to vessel (food, tools, plastics, etc.)	<0.2 cubic meters	Noble Rigging & Lifting Manual (Section 6, 21, 22); Noble MODU Operating Manual (Section 10.- Logistics, and Section 11 – Adverse Weather,)
Accidental Discharge (plastic bags, aluminium cans, plastic bottles, etc.)	Small individual items such as food wrappers and soda cans.	Solid waste disposed of onshore; training of personnel, secure storage and segregation of waste; Noble Garbage Management Plan

Released under the Official Information Act 1982

Drop tools/debris in moonpool	<0.2 cubic meters	Safety Policy Manual - 103, Ten Commitments to Safe Operations, #3 & Safety Policy Manual – 809 in Section 9 addresses housekeeping
Collision / Sinking	Refer to table 3.2 (Tank Capacities)	Maritime Rules Part 22: Collision Prevention; Noble SOPEP/ERP, Anadarko OSCP

Released under the Official Information Act 1982

Bunkering		
Fuel/oil	<50 barrels	Noble Bunkering Fuel Oil Procedure, Noble SOPEP/ERP, Anadarko OSCP; Noble MODU Operating Manual (Section 10.- Logistics, and Section 11 – Adverse Weather); Noble Rigging & Lifting Manual (Section 6, 21, 22)
Loss of Well Control (release of Hydrocarbons)	Refer to Oil Spill Modelling (Annex D)	Anadarko WCERP, SCERP, and Logistics Plan; Anadarko OSCP, Maritime NZ National OSCP; Noble ERP (Section 3.4); Oil Spill Modelling Report
Spill of Harmful Substances		
Loading/Unloading Vessel to Vessel	<50 barrels	Noble Rigging & Lifting Manual (Section 6, 21, 22); Noble MODU Operating Manual (Section 10.- Logistics, and Section 11 – Adverse Weather,)
Transport around vessel	<20 Liters	Safety Policy Manual - 103, Ten Commitments to Safe Operations, #3 & 809 in Section 9 addresses housekeeping; Rigging and Lifting Manual Section 24 Forklifts; Noble SOPEP and ERP (section 3.5)
Leaking/cracked containers	<20 Liters	Storage of harmful substances in areas with secondary containment (see Annex A Harmful Substance Storage Layout); Noble SOPEP and ERP (section 3.5); Safety Policy Manual – 903 Spills; Safety Policy Manual – 901 Containment of Hydrocarbons and Chemicals;
Accidental spills (during use of substances)	<20 Liters	Noble SOPEP and ERP (section 3.5); Safety Policy Manual – 903 Spills
Hose Leak/Rupture	<40 Liters	Noble Maintenance Procedures, Noble SOPEP and ERP (section 3.5); Safety Policy Manual – 903 Spills; Waste Management Manual – Deck Drainage; All drains are processed through the oil water separator.
Valve Gasket Leaks	<20 Liters	Noble Maintenance Procedures, Noble SOPEP and ERP (section 3.5); Safety Policy Manual – 903 Spills; Waste Management Manual – Deck Drainage; All drains are processed through the oil water separator.

Released under the Official Information Act 1982

7.2.1 Accidental Discharge of Trash and Debris

Offshore oil and gas activities have historically been a source of floating debris in some regions; however, industry practices have progressed significantly in recent years. Anadarko is committed to meeting international and New Zealand requirements and its own procedures, which include internal waste management standards. However there may be instances of accidental discarding of solid debris offshore during exploration activities. According to Lutcavage *et al.* (1997), ingestion or entanglement with, accidentally discarded solid waste can kill or injure marine organisms. In addition, debris from offshore operations can reach coastal waters and beaches, where birds can ingest or become entangled in it. Marine mammals also can become entangled in debris. Given the risk to protected species the severity of this impact is considered to be medium.

Prevention and Mitigation

To further reduce the potential impacts of accidental waste discharge, a prescribed waste management program to verify that all solid waste, except food waste generated during the drilling activity will be implemented. Wastes will be disposed onshore at the shore base to a suitably licensed waste contractor. Efforts will be made to avoid or minimize the possibility of plastic or other materials being lost overboard, including training of personnel, secure storage and segregation of waste, so the risk of impacts on marine wildlife will be diminished. As a result of these measures, the likelihood of this impact occurring is considered to be unlikely.

Residual Impacts

Given the above mitigation measures, the significance of this impact is considered to be *minor* and as low as reasonably practicable (*ALARP*).

7.2.2 Collision or Sinking

Should drilling or support vessel collisions occur, potential impacts may include loss of containment of bunker fuels and other oil and chemical products on board the vessel. Should a vessel sink, environmental impacts could arise from the vessel contact with the sea floor as well as toxicity resulting from the spillage of on board harmful substances, such as oil and lubricants stores and lithium batteries. The severity of these potential impacts will depend on the quantities of the spills however, should bunker containment be lost, some sensitive receptors near the coastal environments may possibly be affected. The severity of this potential impact is considered to be high.

Released under the Official Information Act 1982

Prevention and Mitigation

The drilling program will comply with *Maritime Rules Part 22: Collision Prevention* (Maritime NZ, 2009), in terms of obligatory appropriate crew qualifications, watchkeeping, navigational aids and good navigational practices and seamanship. The presence of two or more vessels at the site at all times as well as air support during exploration drilling activities will strengthen the above. In terms of the environmental impacts associated with support vessel collision or sinking, the quantities of the hazardous materials carried on the vessels (see *Annex A*) are likely to be rapidly dispersed should accidental spillage occur. Accordingly, the likelihood of this potential impact occurring is considered to be *extremely unlikely*.

Residual Impacts

While the severity of this impact could be *high*, given the above mitigation measures, the likelihood of it occurring is considered to be *extremely unlikely*. As a result, the significance of this impact is considered to be *ALARP*.

7.2.3 *Fuel/Oil Spills*

An oil spill resulting from exploration drilling, although unlikely, is an event which has the potential to have significant environmental and social impacts. Oil spill modeling has predicted potential trajectories of oil spills. Several oil spill scenarios have been modeled, including a blowout of the exploration/appraisal wells (see *Annex D*).

For both Caravel and Romney, a statistical approach was adopted to consider the likely pathways and possible locations of shoreline beaching of oil in the unlikely event of an oil release during the proposed exploration drilling activities. Numerical simulations of oil spill trajectory have been established using high-resolution, spatially-variable current and wind data, spanning an 11-year period from July 1998 to June 2009. By continuously modeling the trajectory of representative oil "particles" for this entire period, a sound statistical basis has been established to quantify the most likely pathways for oil in the unlikely event of a release. From this knowledge, an assessment of the areas that are most likely to experience beaching has been determined. It should be noted that a multi-year simulation does not mean that a release of this duration is anticipated; rather it is a technique used solely to provide information over many seasons and years with different weather patterns.

Released under the Official Information Act 1982

For the Caravel well, results show that weathering of the oil is expected to result in approximately two thirds of the released volume evaporating or being dispersed in the water column prior to the minimum beaching time. The minimum time for an oil release to beach ranges from 45 hours in summer to 35 hours in autumn. The Banks Peninsular shoreline region has the highest potential for beaching. Notably however, the overall probability of beaching remains very low for both seasons; in summer beaching occurs under only 10.00% of events, while in Autumn only 4.73% of events beach. This very low probability of beaching occurs because the predominant transport pathways are directed away from the coastline.

For the Romney well, weathering of the oil is again expected to result in approximately two thirds of the released volume evaporating or being dispersed in the water column prior to the minimum beaching time. The minimum time for an oil release to beach ranges from 67 hours in autumn to 97 hours in summer. The region of coastline between Raglan to the south and Kaipara Harbour to the north has the highest potential for beaching. The overall probability of beaching in summer occurs in 51.82% of events, while in autumn 66.05% of events beach.

Prevention and Mitigation Measures

Detailed oil spill response preparedness and response measures are outlined in the Emergency Spill Response Procedures in *Section 8.0*.

Prevention and mitigation measures will also include:

- Training and exercising in, and efficient implementation of the Emergency Response Plan (**ERP**) (*Section 8.1* and *Annex E*), including processes to verify that response equipment is in place and arrangements with response organizations are operational;
- Installing a BOP to prevent loss of well control resulting in a release of oil to the sea and development of a Well Control Contingency Plan (see *Annex F*);
- Performing frequent checks of equipment including BOP equipment;
- Ensuring hazardous liquids (e.g. paint thinners and hydrocarbon solvents) are stored in sealed containers with secondary containment of adequate volume to help prevent the discharge of spills and debris into the marine environment (see General Arrangement with highlight of chemical and oil storage areas *Annex A*);
- Being ready to implement oil spill and emergency response procedures for bunkering/refueling incidents in accordance with the Noble

Released under the Official Information Act 1982

Emergency Response Plan and Ship Oil Pollution Emergency Plan (**SOPEP**) (*Annex E*);

- Avoiding rough weather or limited visibility conditions (including at night) when refueling/bunkering at sea;
- Adhering to standard operating procedures while refueling equipment or vessels to minimize incidents (*Annex A*);
- Tailoring oil spill response preparations to consider the results of the oil spill trajectory models and sensitive areas along the shoreline most likely to be impacted by a potential major oil spill;
- Coordinating with local officials (including Maritime NZ's Marine Pollution Response Service) prior to commencement of exploration/appraisal drilling;
- Verifying that Tier 1 oil spill equipment is available on board;
- Ensuring that crew members are aware of responsibilities within the spill response procedures;
- Identifying extreme weather patterns or other natural hazards that could impact the area and include planning for such events; and
- Reviewing potential spill trajectories and spill response plans with the Project team and appropriate crew members prior to start-up of drilling activities.

The likelihood of a spill occurring is considered to be extremely unlikely.

Residual Impacts

While the severity of this impact could be *high*, given the above mitigation measures, the likelihood of it occurring is considered to be *extremely unlikely*. As a result, the significance of this impact is considered to be *ALARP*.

Released under the Official Information Act 1982

7.2.4 *Natural Disasters*

New Zealand straddles an active tectonic plate boundary and as such its coastal communities are vulnerable to earthquake and tsunami hazards (NIWA, 2009). Recent incidents with the Asia-Pacific region have also further highlighted the potential for tsunami/earthquake events originating in the Pacific Rim to affect New Zealand waters. The impacts of such incidents on off-shore temporary activities such as exploration/appraisal drilling activities are however considered to be limited, particularly given the water depths within the Project areas. Potential impacts resulting from natural disaster events could include spills (oil and fuel) and/or vessel sinking, both of which are considered have *high* severity of impacts. However, such an occurrence is considered to be *extremely unlikely* and the overall significance is considered to be *ALARP*.

7.3 *MONITORING*

The monitoring program for the exploration program is provided in *Annex G*.

The program has been designed to determine the extent of potential impacts and biological effects from the exploration drilling discharges. This will be achieved by characterizing the environmental conditions in the vicinity of the well sites before and after drilling and comparing the results to assess potential effects on selected environmental components.

Personnel conducting the monitoring will be well-qualified and experienced.

Pre-drill and post-drill reports will be generated as well as a comprehensive monitoring report discussing the results.

Released under the Official Information Act 1982

8.0 EMERGENCY SPILL RESPONSE PROCEDURES

8.1 EMERGENCY RESPONSE PLAN

The *Noble Bob Douglas* ERP (NBD-NDUS-ERP-001 Rev. 0) is provided in *Annex E*.

8.2 SHIP OIL POLLUTION EMERGENCY PLAN

All vessels engaged on the project of 400 tones gross tonnage or more will have a current SOPEP in accordance with Marine Protection Rules Part 130A, which will clearly identify Tier 1 response actions, responsibilities and notification requirements.

The *Noble Bob Douglas* SOPEP (Rev. 0, 17 June 2013) is provided in *Annex E*. The plan provides guidance to the Master, Rig Manager/OIM and officers on board with respect to the steps to be taken when a pollution incident has occurred or is likely to occur.

The plan will be regularly reviewed and updated with revisions submitted to the Administration for approval.

8.3 SPILL EQUIPMENT

Tier 1 spills (small, operational spills) will be managed using equipment on board the drill program vessels. Tier 1 spills will include those that may occur in the vicinity of ports during bunkering, as well as spills at sea e.g. small spills during refueling of generators or hydraulic leaks from onboard equipment. Supply vessels will maintain equipment to address Tier 1 spills (containment). Supply vessel crew will be trained in the use of this equipment in the event of a spill.

For Tier 2 or 3 spills (larger spills where additional resources are needed), Maritime NZ's Marine Pollution Response Services headquartered in Te Atatu, Auckland will take the lead and mobilize existing resources. Anadarko also has in place a contract with Oil Spill Response Limited (www.oilspillresponse.com) to mobilize additional spill equipment to support Maritime NZ in the case that the resources available in New Zealand are not sufficient.

Six environmental spill response kits and one spare will be carried onboard the *Noble Bob Douglas*. The three support vessels will also have spill equipment, as will the New Plymouth shore base. Details of these spill equipment are provided in the OSCP (see *Annex E*).

Released under the Official Information Act 1982

The kit on the drillship includes:

- 15-4' socks, 5-8' socks, 190 pads, 16 pillows;
- 2-10 lb Albzorbit, 15 disposable bags with ties;
- 4 pair nitrile gloves, 4 pair silvershield gloves;
- 4 each splash-resistant goggles, 4-Tyvek coveralls XL;
- 1 non-sparking shovel; and
- 1 emergency response guidebook.

8.4 TRAINING AND EXERCISES

Personnel will be trained in Anadarko and contractor requirements for emergencies. Emergency response training and a drill will be conducted prior to the commencement of the project to ensure personnel are competent and aware of actions to take in the event of an emergency, including their specific roles and responsibilities under the ERP and SOPEP.

Emergency drills will be held on a weekly basis as directed by the Captain of the vessel in accordance with the ERP. All personnel arriving on the *Noble Bob Douglas* will be given a HSE induction.

Released under the Official Information Act 1982

9.0 REPORTING AND RECORD REQUIREMENTS

The ERP and SOPEP have defined reporting and record keep requirements in response to events. In addition, Part 200 identifies a number of reporting requirements specific to offshore installations discharges. The measures for compliance with these are detailed below.

9.1 TRAINING

In accordance with 200.11 appropriate training required to enable personnel assigned responsibilities under the DMP and dealing with spills of oil and other harmful substances to execute their responsibilities must be completed prior to any person commencing operational duties. A record of all training carried out will be maintained by Noble.

9.2 TESTING AND REVIEW OF EMERGENCY RESPONSE PROCEDURES

In accordance with 200.12 testing and review of the emergency spill response (ESR) procedures is undertaken for the *Noble Bob Douglas* no less than every 12 months. The effectiveness of ESR procedures is reviewed as soon as practicable following any test, use or modification to procedures. The Director of Maritime New Zealand will be notified of any test or review no less than 14 days prior to the event with the test/review details and results recorded. The results will be provided to the Director. Any modifications will be submitted to the Director for approval.

9.3 OPERATIONS

In accordance with 200.14 (8) Noble will maintain a record of the oil content of all permitted discharges (before dilution) for supply to the Director if/when requested.

In accordance with 200.15C Noble will maintain a Garbage Record Book readily available for inspection by the Director. Garbage will be grouped into categories for the purposes of the Garbage Record Book as follows:

A Plastic

B Food waste

C Domestic waste

D Cooking oil

E Incinerator ash

Released under the Official Information Act 1982

F Operational waste

G Cargo residue (not relevant to the Project)

H Animal carcass (not relevant to the Project)

I Fishing gear (not relevant to the Project)

Entries shall be made in accordance with the Appendix of the Marine Protection Rules Part 170 (see *Annex H* for details to be recorded) when garbage is discharged to a reception facility ashore or to other ships; when garbage is incinerated; when garbage is discharged into the sea; or when accidental or other exceptional discharges occur.

In accordance with 200.18 (2) Noble will maintain record of the quantities of all oil and oily mixtures retained, offloaded, or discharged.

In accordance with 200.21 Noble will ensure that the installation maintains an oil record book for operations including:

- Discharge of cleaning water from oil fuel tanks;
- Discharge overboard or other disposal of oily water that has accumulated in machinery spaces or other parts of the installation.

Reasons must be recorded for circumstances of:

- Any discharge into the sea of oil or oily mixture for the purpose or securing the safety of the offshore installation; or saving a life at sea;
- Any escape to the sea of oil or oily mixture resulting from damage to the offshore installation or its equipment; or resulting from any other accidental or exceptional occurrence; and
- Any discharge to the sea of substances containing oil when being used for the purpose of combating specific pollution incidents.

Released under the Official Information Act 1982

9.4 EVENT REPORTING

All spills will be immediately reported to the cognizant local, State, or Regional Response Centre (RC) and the Noble Division Office in accordance with the SOPEP (*Annex E*).

Maritime NZ Rescue Coordination Centre

Ph: 0508 222 433

Maritime NZ Operations Centre

VHF: Channel 16

Canterbury Regional On-Scene Commander: 0800 765 588

Taranaki Regional On-Scene Commander: 06 765 7127, 027 442 7492

Waikato Regional On-Scene Commander: 0800 800 401 (request EM01 on duty)

Auckland Harbourmaster Duty Office 09 362 0397

The Master/OIM/RM will have Section 5 Shipboard Oil Pollution Emergency Plan Report Form completed and available when reporting the spill. Reporting is to occur upon:

- Actual discharge;
- Probable discharge; and
- Follow-up reports.

Released under the Official Information Act 1982

10.0 REFERENCES

Baker, C.S., Chilvers, B.L., Constantine, R., DuFresne, S., Mattlin, R.H., van Helden, A. and Hitchmough, R. (2009). Conservation status of New Zealand marine mammals (suborders Cetacea and Pinnipedia), *New Zealand Journal of Marine and Freshwater Research* **44** pp.101 115

Black, A. (2005). Short Note: Light Induced seabird mortality on vessels operating in the Southern Ocean: incidents and mitigation measures. *Antarctic Science* **17(1)** pp 67-68

Brodie., J. W. (1959). Coastal Surface Currents around New Zealand. *New Zealand Journal of Geology and Geophysics* **Vol. 3:** pp 235 – 252.

Cairns, S. D. and Stanley, G. D. (1981). *Ahermatypic coral banks: Living and fossil counterparts.* Presented at the 4th International Coral Reef Symposium

Consalvey, M., MacKay, K. and Tracey, D. (2006). *Information Review for Protected Deep Sea Coral Species in the New Zealand Region.* Report no. WLG2006-85. Prepared by NIWA for the Department of Conservation.

DoC. (2005). New Zealand Threat Classification Lists 2005. http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/nz-threat-classification-system-lists-2005/

DoC. (2010a). *Marine Reserves and other Protected Areas.* http://www.doc.govt.nz/conservation/marine-and-coastal/marine-protected-areas/

DoC. (2010b). *A fisher's guide to New Zealand seabirds.* http://www.doc.govt.nz/publications/conservation/marine-and-coastal/marine-conservation-services/other-publications/a-fishers-guide-to-new-zealand-seabirds/

Environment Canterbury (2013). *Marine Oil Spill Contingency Plan for the Canterbury Region)*

Fugro. (2010). *Metocean Drilling Criteria for Block 38451 Offshore Northwest New Zealand*

Lutcavage, M. E., Plotkin, P., Witherington, B. and Lutz, P. L. (1997). *Human impacts on sea turtle survival*, pp. 387-410. In: P.L. Lutz and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, FL. 432 pp.

Released under the Official Information Act 1982

Maritime NZ. (2009). *Maritime Rules Part 22 – Collision Protection* http://www.maritimenz.govt.nz/Rules/Rule-documents/Part22-maritime-rule.pdf

MetOcean Solutions Ltd and NIWA Ltd. (2009). *Metocean Conditions in the Canterbury Basin New Zealand. A summary of the expected waves, winds, currents and ocean temperatures for drilling operations in PEP 38262 and 38264.* Prepared for Origin Energy Resources NZ Ltd.

MPI. (2007). *Fisheries and their Ecosystems* http://www.fish.govt.nz/en-nz/Environmental/default.htm

MPI. (2008). *Facts and Figures* http://www.fish.govt.nz/en-nz/Fisheries+at+a+glance/default.htm

MPI. (2010b) *Scampi.* http://fs.fish.govt.nz/Page.aspx?pk=7&tk=153&sc=SCI

MPI (2013a). *Region – North West (FMA 9).* http://fs.fish.govt.nz/Page.aspx?pk=41&fyk=58

MPI (2013b). *Our Fisheries.* http://fs.fish.govt.nz/Page.aspx?pk=45&tk=464

MPI (2013c). *National Aquatic Biodiversity Information System (NABIS)* http://www.nabis.govt.nz/Pages/default.aspx

MPI (2013d). *Region – South-east Coast (FMA 3)* http://fs.fish.govt.nz/Page.aspx?pk=41&fyk=39

Neff, J. M., McKelvie, S., and Ayers Jr., R.C. (2000). *Environmental impacts of synthetic based drilling fluids.* Report prepared for MMS by Robert Ayers & Associates, Inc., August 2000. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000-064. 118 pp.

NIWA. (2009). On the Lookout for Tectonic Faults and Underwater Landslides, *Water and Atmosphere*, **15**(3), pp.20-21

Origin Energy (2008). Environmental Plan – Waka 3D and Punt 2D Seismic Surveys PEP 38262 and 38264, South Island, New Zealand.

Protected Planet. (2013). Protected Naturals Areas Search. http://www.protectedplanet.net/#7_-38_170.75_0

Reid, S., Gorman, R., Chiswell, S. and Smith, M. (2005). *Marine Weather and Sea Conditions of the West Coast of the North Island, NZ.* MED/Crown Minerals Petroleum Report Series, PR 3295

Released under the Official Information Act 1982

Taranaki Regional Council (2012). *Marine Oil Spill Contingency Plan.* : http://www.trc.govt.nz/marine-oil-spill-contingency-plan-2/

UNEP and IUCN (2009) *World Database on Protected Natural Areas.* http://www.wdpa.org/Default.aspx

Uruski, C. (2008). *Exploring Deepwater Taranaki Basin.* Report produced for Global Resource Holdings, LLLP of Denver, Colorado. http://www.nzpam.govt.nz/cms/pdf-library/petroleum-conferences-1/2008/2008-conference-proceedings/poster-presentations/c-uruski

WWF. (2010a). *Sharks* http://www.treasuresofthesea.org.nz/sharks-skates-and-rays

WWF. (2010b). *Treasures of the Sea: Sea Turtles and Sea Snakes (Class Reptilia).* http://www.treasuresofthesea.org.nz/sea-turtles-and-sea-snakes

Released under the Official Information Act 1982