

EXPLORATION LICENCE

Moana Minerals Limited EL3

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Published by Seabed Minerals Authority, Avarua, Cook Islands, 2022

Exploration Licence



1. Introduction

This is a Licence granted by the responsible Minister on behalf of the Crown authorising the Licence Holder to carry out exploration activities for which a Licence is required under Part 4 of the Act.

1.1 Licence number

The licence number for this Licence is EL3

1.2 Licence Holder

The Licence Holder is the company set out below:

Company name	Moana Minerals Ltd
Company registration number	C10178
Registered address	Clarke's Building
	Parekura Place
	Avarua
	Rarotonga, Cook Islands
E-mail address	hsmit@omlus.com
Designated representative	Hans Smit
Position within company	Chief Executive Officer

1.3 Licence Term

Version	EL3
Licence start date	23 February 2022
Licence end date	23 February 2027
Date of original issue	23 February 2022
Date of variation issue	

1.4 Licence validity

- (a) This version of this Licence is valid from this Licence's start date until this Licence's end date.
- (b) This version of this Licence supersedes any earlier version of this Licence.

1.5 Licence Holder rights

During the term of this Licence, the Licence Holder, subject to the Act and the Regulations, has the exclusive right to:

- (a) conduct exploration over the Licensed Area;
- (b) apply for successive renewals of the Licence;
- (c) request a retention in respect of specified blocks; and
- (d) apply for a mining licence over the Licensed Area.

1.6 Specified seabed minerals covered by this Licence

This Licence authorises exploration for polymetallic nodules in the Licensed Area.

2. General

2.1 Interpretation

(a) In this Licence, terms are as defined in section 6 of the Act and the Regulations and—

Act means the Seabed Minerals Act 2019.

Annexures means the documents listed at clause 12 of this Licence.

Application means the application submitted to and approved by the Authority on 8 February 2022 and/or as varied with the Authority's approval in writing.

Approved Work Plan means the summary work plan annexed to this Licence. If any inconsistency arises between the terms of the Licence Holder's Application and its Approved Work Plan, the terms of the Licence Holder's Application prevail.

Licence means this Licence.

Licensed Activities means the exploration activities and associated regulated activities set out in the Annexures to this Licence and the terms of the Licence Holder's Application. If any inconsistency arises between the terms of the Licence Holder's Application and the Annexures to this Licence, the terms of the Licence Holder's Application prevail.

Licensed Area means the area allocated to the Licence Holder under this Licence, i.e., the area defined by the coordinates listed in Annexure 1 to this Licence but excluding all Relinquished Areas.

Licence Holder means the company named in clause 1.2 above to whom this Licence is granted.

Regulations means the Seabed Minerals (Exploration) Regulations 2020.

Relinquished Areas means all areas relinquished in accordance with the schedule set out in Annexure 7 to this Licence.

(b) All geographical co-ordinates in this Licence are in WGS84 format (latitude and longitude degrees and minutes to three decimal places) unless stated otherwise.

3. Authority contact

Except where otherwise indicated, the Authority's address for email and postal correspondence and the serving of notices under the Act and the Regulations is:

Attention— Seabed Minerals Commissioner

The Cook Islands Seabed Minerals Authority

Avarua, Rarotonga, Cook Islands PO Box 733

Tel-(+682) 29 193

Email— sbma@cookislands.gov.ck

4. Licensed Activities

4.1 Licensed Activities authorised

The Licensed Activities under this Licence must be carried out in accordance with this Licence, and only in the Licensed Area.

5. General Licence conditions

5.1 General duties and responsibilities of Licence Holders

- (a) The general duties of Licence Holders set out in Schedule 2 of the Act are incorporated by reference in this Licence.
- (b) The Licence Holder, its employees and agents, and its affiliates and associates must comply with:
 - (i) the Act, Regulations and all applicable laws of the Cook Islands;
 - (ii) the terms and conditions of this Licence, including all Annexures;
 - (iii) all standards the Authority has issued or issues during the term of this Licence;
 - (iv) the Licence Holder's Application in all respects.
- (c) With respect to all of the Licence Holder's obligations in paragraphs (a) and (b) above, the Licence Holder is responsible for:
 - (i) all of its affiliates' and associates' compliance with their obligations; and
 - (ii) all acts and/or omissions of its affiliates and associates.
- (d) The Licence Holder is not discharged from any obligation arising under this Licence by contracting a third party to perform the relevant obligation.

5.2 Commencement of activities

Unless a variation is applied for and agreed in writing with the Authority, the Licence Holder must:

- (a) commence exploration in accordance with the time schedule stipulated in the Approved Work Plan annexed to this Licence, and
- (b) adhere to any time periods or modifications to time periods provided for by this Licence.

5.3 Implementation of Approved Work Plan

- (a) The Licence Holder must continuously and actively conduct exploration in accordance with the Approved Work Plan, the Licence Holder's Application and good industry practice.
- (b) The Licence Holder must also comply with the following documents annexed to this Licence:
 - (i) the incident response and management plan;
 - (ii) the occupational health and safety plan;
 - (iii) the environmental management programme; and
 - (iv) the local engagement, training and business development plan.

5.4 Expenditure commitments

In carrying out the Approved Work Plan and its activities, the Licence Holder must, in each Licence year, spend at least the amount specified in the Approved Work Plan in actual and direct exploration spending, unless otherwise approved by the Authority.

5.5 Notification of commencement

- (a) The Licence Holder must notify the Authority before any Licensed Activities commence.
- (b) The Authority must receive notice under paragraph (a) above at least twenty (20) days before any Licensed Activities commence.

5.6 Security deposit or financial guarantee

- (a) The Authority may require the Licence Holder to lodge a security deposit or financial guarantee at any time during the term of this Licence.
- (b) The form, amount, subject-matter, timing of lodgement, terms of release, and other conditions of the security deposit or financial guarantee will be recorded in a separate document as appropriate but will form a specific condition of this Licence.
- (c) Where applicable, no Licensed Activities may commence or continue unless the Licence Holder has provided any security deposit or financial guarantee required in accordance with this Licence, the Act and the Regulations.
- (d) The Licence Holder must notify the Authority as soon as practicable of any material change in the Licence Holder's financial capacity as submitted in its Application.

5.7 Vessels

- (a) The Licence Holder must notify the Authority in writing of any vessel being used to carry out any Licensed Activities under this Licence on behalf of the Licence Holder.
- (b) The Authority must receive notice under paragraph (a) above at least twenty (20) days before each cruise commences. Notification must include:
 - (i) the master's name;
 - (ii) vessel type;
 - (iii) vessel IMO number;

- (iv) vessel flag;
- (v) vessel owner or operating company;
- (vi) dates of entry and departure from Cook Island's jurisdiction;
- (vii) any scheduled port of call; and
- (viii) details of all persons aboard.
- (c) The Licence Holder must ensure that a copy of this Licence and any subsequent revision or amendment is read and understood by the master of any vessel being used to carry out any Licensed Activities and that a copy of this Licence is held on board any such vessel.

5.8 Notification of material matters

- (a) The Licence Holder must notify the Authority if the Licence Holder becomes aware of any new information or change in circumstances which materially affects or is likely to materially affect:
 - (i) the basis for granting this Licence;
 - (ii) the viability and appropriateness of the Approved Work Plan; and/or
 - (iii) the Licence Holder's ability to comply with the obligations under this Licence.
- (b) Further to paragraph (a) above, the Licence Holder must notify the Authority at the earliest opportunity, and within no more than five (5) days of becoming aware of the relevant information or circumstance. Failure to do so may lead to enforcement action, including cancellation or suspension of this Licence.

5.9 Samples: licence quantities

- (a) This Licence authorises the removal of material from the seabed or subsoil in the Licensed Area but only in such quantity as is reasonably necessary for the exclusive purpose of sampling, assaying, and analysis of the specified seabed mineral as provided for in the Approved Work Plan or as stipulated in this Licence's conditions.
- (b) The Licence Holder must not sell and must ensure that no person with whom it has any connection, sells or attempts to sell, any material that was removed from the seabed or subsoil.

5.10 Project permit or consent under the Environment Act 2003

This Licence, and the conduct of all Licensed Activities under it, is subject to the Licence Holder obtaining and complying with any environmental approval required and granted under the Environment Act 2003, including any condition attached to any environmental approval.

5.11 Surrender, cancellation or expiry of this Licence

Upon any surrender, cancellation or expiry of this Licence, all rights granted to the Licence Holder under this Licence cease, but the Licence Holder will remain subject to any continuing obligations arising out of this Licence at the date of surrender, cancellation or expiry.

5.12 Review of Approved Work Plan

Subject to the Act and Regulations, within six (6) months of the Licence Holder's submission of its annual report to the Authority, the Authority and the Licence Holder, will undertake a joint review of the:

- (a) Approved Work Plan;
- (b) the Licensed Activities conducted under the Approved Work Plan; and
- (c) this Licence's conditions.

6. Specific Licence conditions

This clause sets out conditions specific to the Licence Holder and the project.

- (a) Within six (6) months of the date this Licence is issued, the Licence Holder must provide to the Authority's satisfaction, confirmation of its committed financial resources to:
 - (i) undertake the first two (2) years of its Approved Work Plan properly and lawfully;
 - (ii) respond to any incident; and
 - (iii) cover the costs of any potential liability arising from accidents, pollution, or serious harm.
- (b) In satisfying itself about the Licence Holder's committed financial resources and that the Licence Holder meets the Act's qualification criteria regarding the same, the Authority may require completion of any additional due diligence checks it considers appropriate.
- (c) The Licence Holder must ensure that it has appropriate and sufficient insurance for any expedition before the expedition's commencement and that the Licence Holder maintains its insurance throughout the expedition and afterwards as appropriate.
- (d) The Licence Holder must comply with all arrangements set out in its Application.
- (e) If there is any change or proposed change to the directors, management or control of the Licence Holder:
 - (i) the Licence Holder must notify, seek and obtain the Authority's approval in writing before any such change is made, insofar as it is practicable to do so;
 - (ii) if it is not practicable to notify, seek and obtain the Authority's approval in writing before any such change is made, the Licence Holder must notify the Authority as soon as practicable of the relevant change; and
 - (iii) the Authority may request any further information to determine whether the change affects the Licence Holder's compliance with the qualification criteria and/or evaluation criteria.
- (f) If there is any change or proposed change, direct or indirect, to any of the Licence Holder's financing arrangements set out in the Application:
 - (i) The Licence Holder must notify, seek and obtain the Authority's approval in writing before any such change is made, insofar as it is practicable to do so;

- (ii) if it is not practicable to notify, seek and obtain the Authority's approval in writing before any such change is made, the Licence Holder must notify the Authority as soon as practicable of the relevant change; and
- (iii) the Authority may request any further information to determine whether the proposed change affects the Licence Holder's compliance with the qualification criteria and/or evaluation criteria.
- (g) If there is any change or proposed change of any associate or affiliate who is carrying on Licensed Activities on behalf of the Licence Holder:
 - (i) the Licence Holder must notify, seek and obtain the Authority's approval in writing before any such change is made, insofar as it is practicable to do so;
 - (ii) if it is not practicable to notify, seek and obtain the Authority's approval in writing before any such change is made, the Licence Holder must notify the Authority as soon as practicable of the relevant change; and
 - (iii) the Authority may request any further information to determine whether the proposed change affects the Licence Holder's compliance with the qualification criteria and/or evaluation criteria.
- (h) If there is any change or proposed change to the directors, management or control of any associate or affiliate who is carrying on Licensed Activities on behalf of the Licence Holder:
 - (i) The Licence Holder must notify, seek and obtain the Authority's approval in writing before any such change is made, insofar as it is practicable to do so;
 - (ii) if it is not practicable to notify, seek and obtain the Authority's approval in writing before any such change is made, the Licence Holder must notify the Authority as soon as practicable of the relevant change; and
 - (iii) the Authority may request any further information to determine whether the proposed change affects the Licence Holder's compliance with the qualification criteria and/or evaluation criteria.
- (i) None of the above conditions in any way limit or negate the Licence Holder's requirement to satisfy all qualification criteria and evaluation criteria on a continuous basis throughout the term of this Licence and/or to comply with all requirements under the Act and Regulations.

7. Relinquishment conditions

- (a) The Licence Holder will relinquish blocks in the Licensed Area according to section 78 of the Act and the terms and schedule of relinquishment annexed to this Licence.
- (b) The schedule of relinquishment may be varied from time to time with the approval of the Authority. Any variation to the schedule of relinquishment must be annexed to this Licence.

8. Compliance and enforcement

- (a) This Licence and its terms and conditions are issued under and subject at all times to the Act and the Regulations, as amended from time to time.
- (b) Any breach of the Act, the Regulations and/or this Licence's terms and conditions may lead to enforcement action being taken by the Authority. This may include the issuing of written warnings or directions by the Authority under the Act, the variation, suspension or cancellation of this Licence under section 117 of the Act, the imposition of penalties, and/or criminal proceedings.

9. Force majeure

- (a) If the Licence Holder or the Authority is prevented from complying with this Licence, in whole or in part, by an event or circumstance of force majeure, it must give written notice to the other as soon as practicable after its occurrence.
- (b) Any notice issued further to paragraph (a) above must specify:
 - (i) the nature of the event or circumstance;
 - (ii) what is required to remedy the event or circumstance if remedy is possible;
 - (iii) the estimated time to cure or overcome the event or circumstance; and
 - (iv) the obligation(s) that cannot be performed in a properly or timely manner due to the event or circumstance.
- (c) If for any reason the party which receives a force majeure notice under paragraph (a) above disagrees with any aspect of the notice, the receiving party must notify the other party in writing within ten (10) days of receiving the notice.
- (d) The Licence Holder and Authority must attempt to resolve any dispute about the occurrence of a force majeure event or circumstance by mutual agreement before either party commences Court proceedings.
- (e) Apart from any payment of money due, the Licence Holder's performance of any obligation prevented by the force majeure event or circumstance is suspended during the continuance of any force majeure event or circumstance.
- (f) The term of this Licence will be automatically extended for the period of the force majeure.
- (g) If an obligation is suspended by reason of force majeure for more than one (1) year, the Licence Holder and the Authority will enter into good faith negotiations to vary the terms and conditions of this Licence to reflect the changed circumstances.

10. Governing language

This Licence is provided and executed in the English language only.

11. Governing law

The Cook Islands' laws govern this Licence. This Licence is to be construed in accordance with the laws of the Cook Islands in all respects.

12. Annexures to this Licence

- (a) The Annexures to this Licence may be varied from time to time with the Authority's approval.
- (b) The Annexures to this Licence are:
 - Annexure 1:coordinates and illustrative chart of the Licensed Area:Annexure 2:the approved work plan reflecting the current five (5)-
year programme of activities:Annexure 3:the approved environmental management programme:
 - Annexure 4: the approved incident response and management plan:
 - Annexure 5: the approved occupational health and safety plan:
 - Annexure 6: the approved local engagement, training and business development plan:
 - Annexure 7: the approved terms and schedule of relinquishment

IN WITNESS WHEREOF the undersigned, being duly authorised thereto by the respective parties, have signed this Licence in two (2) originals, at Rarotonga, Cook Islands, on 23 February 2022.

FOR AND ON BEHALF OF THE CROWN

FOR AND ON BEHALF OF MOANA MINERALS LIMITED

Honourable Mark Brown Prime Minister, Minister for Seabed Minerals

Brian Mason as the lawfully appointed attorney of Moana Minerals Ltd, for and on behalf of **Hans Smit** Chief Executive Office

Des Eggelton Director



AN OCEAN MINERALS COMPANY

Cook Islands Exploration License Application

Application Area

Description

As at January 5, 2022

NPPLN-00000-APPAR-01



13

Application Area Description

APPROVAL/S

Name & Title	Signature	Date
Hans Smit Chief Executive Officer	Hans Smit Hans Smit (Jan 5, 2022 11:08 EST)	Jan 5, 2022

AUTHOR/S

Name & Title	Signature	Date
Hans Smit Chief Executive Officer	Hans Smit Hans Smit (Jan 5, 2022 11:08 EST)	Jan 5, 2022

REVIEWER/S

Name & Title	Signature	Date
Laurie Meyer Chief Projects Officer	۲۰۰۲ ۲۰۰۲ ۲۰۰۲ ۲۰۰۲ ۲۰۰۲ ۲۰۰۲ ۲۰۰۲ ۲۰۰	Jan 5, 2022

CHANGE HISTORY

Date	Change Req No.	Revision	Description of change
6 Jan 2021	N/A	00	Issued
5 Jan 2022	N/A	01	Updated co-ordinates to reflect format required by SBMA

Application Area Description

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Application Area Description

1 INTRODUCTION

This document defines the application area by providing maps and co-ordinates of the area and associated blocks.

Application Area Description

2 APPLICATION AREA



Figure 1 - Application Area encompassing reserve areas 4 & 5

ID	LAT	LON	LAT degrees	LON degrees
1	-160.500	-17.000	-17° 00.000'	-160° 30.000'
2	-158.500	-16.000	-16° 00.000'	-158° 30.000'
3	-158.000	-17.000	-17° 00.000'	-158° 30.000'
4	-160.500	-16.000	-16° 00.000'	-160° 30.000'

Table	1 -	Application	Area	Coordinates
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Application Area Description

Table 2 - Application Area Block Coordinates

Coord1 Coord2 Block Name Latitude Latitude (DDM) Latitude Latitude (DDM) Latitude (DDM) (DDM) -16" 30 000' -16" 35 000'	Coord1 Coord2 Latitude Latitude (DDM) Latitude (DDM) Latitude (DDM) (DDM) _160° 30 000' _160° 35 000' _16° 35 000'	Doord1 Coord2 Longitude (DDM) Latitude (DDM) Latitude (DCM) _160° 30 000' _16° 35 000' _16° 30 000'	Coord2 Latitude (DDM) Latitude (DDM) 16° 25 000' 160° 25 000' 16° 30 000'	ord2 Longitude (DDM) Latitude (DD -160° 25 000' -16° 30 000	Latitude (DD -16° 30 000	W) CO	ord3 Longitude (DDM) -160° 25.000'	Co Latitude (DDM) -16° 30 000'	ord4 Longitude (D -160° 30 00
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016S161W-43 -16° 15.000' -160° 30.000' -16° 15.000' -160° 25.000'	-16° 15.000' -160° 30.000' -16° 15.000' -160° 25.000'	-160° 30.000' -16° 15.000' -160° 25.000'	-16° 15.000' -160° 25.000'	-160° 25.000'		-16° 20.000'	-160° 25.000'	-16° 20.000'	-160° 30.000'
016S161W-24 -16° 05.000' -160° 05.000' -16° 05.000' -160° 00.000'	-16° 05.000' -160° 05.000' -16° 05.000' -160° 00.000'	-160° 05.000' -16° 05.000' -160° 00.000'	-16° 05.000' -160° 00.000'	-160° 00.000'		-16° 10.000'	-160° 00.000'	-16° 10.000'	-160° 05.000'
016S161W-70 -16° 25.000' -160° 15.000' -16° 25.000' -160° 10.000'	-16° 25.000' -160° 15.000' -16° 25.000' -160° 10.000'	-160° 15.000' -16° 25.000' -160° 10.000'	-16° 25.000' -160° 10.000'	-160° 10.000'		-16° 30.000'	-160° 10.000'	-16° 30.000'	-160° 15.000'
016S161W-60 -16° 20.000' -160° 05.000' -16° 20.000' -160° 00.000'	-16° 20.000' -160° 05.000' -16° 20.000' -160° 00.000'	-160° 05.000' -16° 20.000' -160° 00.000'	-16° 20.000' -160° 00.000'	-160° 00.000'		-16° 25.000'	-160° 00.000'	-16° 25.000'	-160° 05.000'
016S161W-10 -16° 00.000' -160° 15.000' -16° 00.000' -160° 10.000'	-16° 00.000' -160° 15.000' -16° 00.000' -160° 10.000'	-160° 15.000' -16° 00.000' -160° 10.000'	-16° 00.000' -160° 10.000'	-160° 10.000'		-16° 05.000'	-160° 10.000'	-16° 05.000'	-160° 15.000'
016S161W-92 -16° 35.000' -160° 25.000' -16° 35.000' -160° 20.000'	-16° 35.000' -160° 25.000' -16° 35.000' -160° 20.000'	-160° 25.000' -16° 35.000' -160° 20.000'	-16° 35.000' -160° 20.000'	-160° 20.000'		-16° 40.000'	-160° 20.000'	-16° 40.000'	-160° 25.000'
016S161W-9 -16° 00.000' -160° 20.000' -16° 00.000' -160° 15.000'	-16° 00.000' -160° 20.000' -16° 00.000' -160° 15.000'	-160° 20.000' -16° 00.000' -160° 15.000'	-16° 00.000' -160° 15.000'	-160° 15.000'		-16° 05.000'	-160° 15.000'	-16° 05.000'	-160° 20.000'
0165161W-20 -16° 05.000' -160° 25.000' -16° 05.000' -160° 20.000'	-16° 05.000' -160° 25.000' -16° 05.000' -160° 20.000'	-160° 25.000' -16° 05.000' -160° 20.000'	-16° 05.000' -160° 20.000'	-160° 20.000'		-16° 10.000'	-160° 20.000'	-16° 10.000'	-160° 25.000'
016S161W-71 -16° 25.000' -160° 10.000' -16° 25.000' -160° 05.000'	-16° 25.000' -160° 10.000' -16° 25.000' -160° 05.000'	-160° 10.000' -16° 25.000' -160° 05.000'	-16° 25.000' -160° 05.000'	-160° 05.000'		-16° 30.000'	-160° 05.000'	-16° 30.000'	-160° 10.000'
016S161W-48 -16° 15.000' -160° 05.000' -16° 15.000' -160° 00.000'	-16° 15.000' -160° 05.000' -16° 15.000' -160° 00.000'	-160° 05.000' -16° 15.000' -160° 00.000'	-16° 15.000' -160° 00.000'	-160° 00.000'		-16° 20.000'	-160° 00.000'	-16° 20.000'	-160° 05.000'
016S161W-23 -16° 05.000' -160° 10.000' -16° 05.000' -160° 05.000'	-16° 05.000' -160° 10.000' -16° 05.000' -160° 05.000'	-160° 10.000' -16° 05.000' -160° 05.000'	-16° 05.000' -160° 05.000'	-160° 05.000'		-16° 10.000'	-160° 05.000'	-16° 10.000'	-160° 10.000'
016S161W-19 -16° 05.000' -160° 30.000' -16° 05.000' -160° 25.000'	-16° 05.000' -160° 30.000' -16° 05.000' -160° 25.000'	-160° 30.000' -16° 05.000' -160° 25.000'	-16° 05.000' -160° 25.000'	-160° 25.000'		-16° 10.000'	-160° 25.000'	-16° 10.000'	-160° 30.000'
016S161W-68 -16° 25.000' -160° 25.000' -16° 25.000' -160° 20.000'	-16° 25.000' -160° 25.000' -16° 25.000' -160° 20.000'	-160° 25.000' -16° 25.000' -160° 20.000'	-16° 25.000' -160° 20.000'	-160° 20.000'		-16° 30.000'	-160° 20.000'	-16° 30.000'	-160° 25.000'

Application Area Description

0165161W~81 -16° 30.000' -160° 20.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 0165161W-69 -16° 25.000' -160° 20.000' -160° 25.000' -160° 05.000' -160° 0165161W-59 -16° 20.000' -160° 10.000' -160° 25.000' -160° 05.000' -160° 0165161W-55 -16° 20.000' -160° 10.000' -160° 10.000' -160° 15.000' -160° 0165161W-55 -16° 30.000' -160° 15.000' -160° 10.000' -160° 10.000' -160° 0165161W-82 -16° 30.000' -160° 15.000' -160° 10.000' -160° 10.000' -160° 0165161W-83 -16° 30.000' -160° 15.000' -160° 10.000' -160° 10.000' -16° 0165161W-83 -16° 10.000' -160° 15.000' -16° 20.000' -16° 20.000' -16° 0165161W-83 -16° 20.000' -160° 15.000' -16° 20.000' -16° 10.000' -16° 0165161W-84 -16° 00.000' -16° 20.000' -16° 20.000' -16° 20.000' -16° 0165161W-75 -16° 20.000' -16°	-16° 35.000' -16° -16° 30.000' -160 -16° 25.000' -160 -16° 10.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 15.000' - 0° 15.000' - 0° 05.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 10.000' - 0° 10.000' - 0° 10.000' - 0° 10.000' - 0° 25.000' - 0° 20.000' -	16°35.000' 16°30.000' 16°25.000' 16°25.000' 16°35.000' 16°35.000' 16°35.000' 16°35.000' 16°25.000' 16°25.000' 16°25.000' 16°25.000' 16°25.000'	-160° 20.000' -160° 20.000' -160° 10.000' -160° 30.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 30.000'
I65161W-69-16° 25.000'-16° 25.000'-16° 15.000'-16°-16°I65161W-59-16° 20.000'-16° 10.000'-16° 05.000'-16°-16°-16°I65161W-55-16° 20.000'-16° 30.000'-16° 20.000'-16° 05.000'-16°-16°I65161W-51-16° 20.000'-16° 30.000'-16° 20.000'-16°-16°-16°I65161W-82-16° 30.000'-16° 20.000'-16° 10.000'-16°-16°-16°I65161W-82-16° 30.000'-16° 10.000'-16° 10.000'-16°-16°-16°I65161W-82-16° 30.000'-16° 10.000'-16° 10.000'-16°-16°-16°I65161W-82-16° 20.000'-16° 10.000'-16° 10.000'-16°-16°-16°I65161W-58-16° 20.000'-16° 20.000'-16° 20.000'-16° 10.000'-16°-16°I65161W-51-16° 20.000'-16° 20.000'-16° 20.000'-16° 20.000'-16°-16°I65161W-51-16° 10.000'-16° 20.000'-16° 20.000'-16° 20.000'-16°-16°I65161W-51-16° 00.000'-16° 30.000'-16° 20.000'-16° 20.000'-16°-16°I65161W-51-16° 10.000'-16° 20.000'-16° 10.000'-16° 20.000'-16°-16°I65161W-51-16° 00.000'-16° 20.000'-16° 20.000'-16° 20.000'-16°-16°I65161W-51-16° 00.000'-16° 20.000'-16° 20.000'-16° 20.000'-16°-16°I65161W-51-16° 00.00	-16° 30.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 10.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 35.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166 -16° 25.000' -166	0° 15.000' - 0° 05.000' - 0° 25.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 10.000' - 0° 10.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 25.000' - 0° 20.000' -	16° 25.000' 16° 25.000' 16° 25.000' 16° 10.000' 16° 35.000' 16° 25.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000'	-160° 20.000' -160° 10.000' -160° 30.000' -160° 20.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 30.000' -160° 25.000'
165161W-5916° 20.000'160° 10.000'16° 20.000'160° 05.000'160°165161W-5516° 20.000'160° 30.000'160° 25.000'160°160°165161W-2116° 20.000'160° 30.000'160° 15.000'160° 15.000'160°165161W-8216° 30.000'160° 15.000'16° 30.000'160° 10.000'16°165161W-8216° 30.000'160° 10.000'16° 30.000'16°16°165161W-8316° 10.000'160° 10.000'16° 30.000'16°16°165161W-3616° 10.000'160° 10.000'16° 10.000'16°165161W-5716° 10.000'160° 15.000'16° 20.000'16°165161W-5716° 20.000'16° 20.000'16° 20.000'16°165161W-716° 20.000'16° 20.000'16° 20.000'16°165161W-716° 10.000'16° 20.000'16° 25.000'16°165161W-716° 10.000'16° 15.000'16° 15.000'16° 25.000'165161W-716° 15.000'16° 15.000'16° 15.000'16° 25.000'165161W-4616° 15.000'16° 15.000'16° 25.000'16°165161W-5616° 20.000'16° 25.000'16° 25.000'16°165161W-5616° 20.000'16° 25.000'16° 25.000'16°165161W-5616° 20.000'16° 25.000'16° 20.000'16°165161W-5616° 20.000'16° 25.000'16° 20.000'16°165161W-5616° 20.000'16° 25.000'16° 20.000'16°16516	-16° 25,000' -160 16° 25,000' -160 -16° 10,000' -160 -16° 35,000' -160 16° 35,000' -160 -16° 35,000' -160 -16° 35,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 15,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160 -16° 25,000' -160	0° 05.000' - 0° 25.000' - 0° 15.000' - 0° 10.000' - 0° 10.000' - 0° 01.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 25.000' - 0° 20.000' -	16° 25.000' 16° 25.000' 16° 10.000' 16° 35.000' 16° 35.000' 16° 25.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000'	-160° 10.000' -160° 30.000' -160° 20.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 30.000' -160° 25.000'
Infestion Info	-16° 25.000' -160 -16° 10.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 25.000' - 0° 15.000' - 0° 10.000' - 0° 00.000' - 0° 10.000' - 0° 10.000' - 0° 10.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -	16° 25.000' 16° 10.000' 16° 35.000' 16° 35.000' 16° 25.000' 16° 25.000' 16° 05.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 25.000'	-160° 30.000' -160° 20.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 30.000' -160° 25.000'
$165161W-21$ $-16^{\circ} 05.000'$ $-160^{\circ} 20.000'$ $-16^{\circ} 05.000'$ $-160^{\circ} 15.000'$ -16° $165161W-82$ $-16^{\circ} 30.000'$ $-160^{\circ} 15.000'$ $-16^{\circ} 30.000'$ $-160^{\circ} 10.000'$ -16° $165161W-83$ $-16^{\circ} 30.000'$ $-160^{\circ} 10.000'$ $-160^{\circ} 05.000'$ $-16^{\circ} 05.000'$ -16° $165161W-83$ $-16^{\circ} 10.000'$ $-160^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $165161W-36$ $-16^{\circ} 10.000'$ $-160^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $165161W-58$ $-16^{\circ} 20.000'$ $-160^{\circ} 05.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $165161W-57$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $165161W-71$ $-16^{\circ} 00.000'$ $-16^{\circ} 30.000'$ $-16^{\circ} 00.000'$ $-16^{\circ} 25.000'$ $-16^{\circ} 05.000'$ $165161W-76$ $-16^{\circ} 15.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 05.000'$ $165161W-46$ $-16^{\circ} 15.000'$ $-16^{\circ} 05.000'$ $-16^{\circ} 25.000'$ $-16^{\circ} 25.000'$ $-16^{\circ} 25.000'$ $165161W-46$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $165161W-46$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $165161W-46$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ $-16^{\circ} 20.000'$ <td< th=""><th>-16° 10.000' -16° -16° 35.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160</th><th>0° 15.000' - 0° 10.000' - 0° 05.000' - 0° 01.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -</th><th>16° 10.000' 16° 35.000' 16° 35.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000'</th><th>-160° 20.000' -160° 15.000' -160° 15.000' -160° 05.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 30.000' -160° 25.000'</th></td<>	-16° 10.000' -16° -16° 35.000' -160 -16° 35.000' -160 -16° 35.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 15.000' - 0° 10.000' - 0° 05.000' - 0° 01.000' - 0° 15.000' - 0° 15.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -	16° 10.000' 16° 35.000' 16° 35.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000' 16° 25.000'	-160° 20.000' -160° 15.000' -160° 15.000' -160° 05.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 30.000' -160° 25.000'
016S161W-82 -16° 30.000' -160° 15.000' -160° 10.000' <th>-16° 35.000' -16° -16° 35.000' -16° -16° 35.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 05.000' -16° -16° 05.000' -16° -16° 15.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16°</th> <th>0° 10.000' - 0° 05.000' - 0° 05.000' - 0° 10.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -</th> <th>16° 35.000° 16° 35.000° 16° 25.000° 16° 25.000° 16° 05.000° 16° 15.000° 16° 25.000° 16° 25.000° 16° 25.000°</th> <th>-160° 15.000' -160° 10.000' -160° 15.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 15.000' -160° 25.000'</th>	-16° 35.000' -16° -16° 35.000' -16° -16° 35.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 05.000' -16° -16° 05.000' -16° -16° 15.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16°	0° 10.000' - 0° 05.000' - 0° 05.000' - 0° 10.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -	16° 35.000° 16° 35.000° 16° 25.000° 16° 25.000° 16° 05.000° 16° 15.000° 16° 25.000° 16° 25.000° 16° 25.000°	-160° 15.000' -160° 10.000' -160° 15.000' -160° 15.000' -160° 30.000' -160° 30.000' -160° 15.000' -160° 25.000'
0165161W-83 -16° 30.000' -160° 10.000' -16° 30.000' -160° 05.000' -160° 0165161W-36 -16° 10.000' -160° 05.000' -16° 10.000' -160° 00.000' -160° 0165161W-58 -16° 20.000' -160° 05.000' -16° 20.000' -160° 10.000' -160° 0165161W-57 -16° 20.000' -160° 15.000' -16° 20.000' -16° 20.000' -16° 0165161W-7 -16° 00.000' -160° 30.000' -16° 20.000' -16° 25.000' -16° 0165161W-7 -16° 10.000' -160° 30.000' -16° 10.000' -16° 25.000' -16° 0165161W-46 -16° 10.000' -160° 30.000' -16° 10.000' -16° 25.000' -16° 0165161W-46 -16° 15.000' -16° 15.000' -16° 15.000' -16° 25.000' -16° 0165161W-46 -16° 15.000' -16° 15.000' -16° 15.000' -16° 25.000' -16° 0165161W-56 -16° 20.000' -16° 25.000' -16° 20.000' -16° 20.000' -16°	-16° 35.000' -160 -16° 15.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 05.000' - 0° 00.000' - 0° 10.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -	16° 35.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 15.000' 16° 25.000' 16° 25.000' 16° 25.000'	-160° 10.000' -160° 05.000' -160° 15.000' -160° 20.000' -160° 30.000' -160° 30.000' -160° 25.000'
0165161W-36 -16° 10.000' -160° 05.000' -16° 10.000' -160° 00.000' -160° 0165161W-58 -16° 20.000' -160° 15.000' -160° 15.000' -160° 15.000' -160° 0165161W-57 -16° 20.000' -160° 20.000' -160° 15.000' -160° 15.000' -160° 0165161W-57 -16° 20.000' -160° 20.000' -160° 20.000' -160° 15.000' -16° 0165161W-7 -16° 00.000' -160° 30.000' -16° 00.000' -16° 25.000' -16° 0165161W-31 -16° 10.000' -160° 30.000' -16° 10.000' -16° 25.000' -16° 0165161W-46 -16° 15.000' -160° 30.000' -16° 15.000' -16° 25.000' -16° 0165161W-46 -16° 15.000' -16° 15.000' -16° 15.000' -16° 25.000' -16° 0165161W-56 -16° 20.000' -16° 15.000' -16° 25.000' -16° 20.000' -16°	-16° 15.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 05.000' -16° -16° 15.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16° -16° 25.000' -16°	0° 00.000' - 0° 10.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -	16° 15.000° 16° 25.000° 16° 05.000° 16° 05.000° 16° 20.000° 16° 20.000° 16° 20.000°	-160° 05.000' -160° 15.000' -160° 20.000' -160° 30.000' -160° 15.000' -160° 25.000'
016S161W-58 -16° 20.000' -160° 15.000' -160° 10.000' -160° 016S161W-57 -16° 20.000' -160° 20.000' -160° 15.000' -160° 016S161W-7 -16° 00.000' -160° 20.000' -160° 25.000' -160° 016S161W-7 -16° 00.000' -160° 30.000' -16° 00.000' -160° 25.000' -16° 016S161W-31 -16° 10.000' -160° 30.000' -16° 10.000' -16° 25.000' -16° 016S161W-46 -16° 15.000' -160° 30.000' -16° 15.000' -16° 25.000' -16° 016S161W-46 -16° 15.000' -160° 30.000' -16° 15.000' -16° 25.000' -16° 016S161W-46 -16° 15.000' -16° 25.000' -16° 25.000' -16° 25.000' -16° 016S161W-46 -16° 15.000' -16° 25.000' -16° 25.000' -16° 20.000' -16°	-16° 25.000' -160 -16° 25.000' -160 -16° 05.000' -160 -16° 15.000' -160 -16° 25.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 10.000' - 0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 20.000' -	16° 25.000' 16° 25.000' 16° 05.000' 16° 15.000' 16° 20.000' 16° 25.000'	-160° 15.000' -160° 20.000' -160° 30.000' -160° 15.000' -160° 25.000'
016S161W-57 -16° 20.000' -160° 20.000' -16° 0100' -160° 15.000' -16° 016S161W-7 -16° 00.000' -160° 30.000' -16° 00.000' -160° 25.000' -16° 016S161W-31 -16° 10.000' -160° 30.000' -16° 10.000' -160° 25.000' -16° 016S161W-36 -16° 10.000' -160° 30.000' -16° 10.000' -160° 25.000' -16° 016S161W-46 -16° 15.000' -160° 15.000' -16° 15.000' -16° 10.000' -16° 016S161W-56 -16° 20.000' -16° 25.000' -16° 25.000' -16° 20.000' -16°	-16° 25.000' -160 -16° 05.000' -160 -16° 15.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 15.000' - 0° 25.000' - 0° 25.000' - 0° 10.000' - 0° 20.000' -	16° 25.000' 16° 05.000' 16° 15.000' 16° 20.000' 16° 25.000'	-160° 20.000' -160° 30.000' -160° 30.000' -160° 15.000' -160° 25.000'
016S161W-7 -16° 00.000' -160° 30.000' -16° 00.000' -160° 25.000' -16° 016S161W-31 -16° 10.000' -160° 30.000' -16° 10.000' -160° 25.000' -16° 016S161W-46 -16° 15.000' -160° 15.000' -16° 15.000' -160° 10.000' -16° 016S161W-46 -16° 15.000' -160° 15.000' -160° 25.000' -16° -160° 10.000' -16° 016S161W-56 -16° 20.000' -160° 25.000' -16° 20.000' -16° 20.000' -16° -16° -16°	-16° 05.000' -160 -16° 15.000' -160 -16° 25.000' -160 -16° 25.000' -160	0° 25.000' - 0° 25.000' - 0° 10.000' - 0° 20.000' -	16° 05.000' 16° 15.000' 16° 20.000' 16° 25.000'	-160° 30.000' -160° 30.000' -160° 15.000' -160° 25.000'
016S161W-31 -16° 10.000' -160° 30.000' -16° 10.000' -160° 25.000' -16° 016S161W-46 -16° 15.000' -160° 15.000' -160° 10.000' -160° 10.000' -16° 016S161W-56 -16° 20.000' -160° 25.000' -16° 20.000' -16° -16°	-16° 15.000' -16C -16° 25.000' -16C -16° 25.000' -16C	0° 25.000' - 0° 10.000' - 0° 20.000' -	16° 15.000' 16° 20.000' 16° 25.000'	-160° 30.000' -160° 15.000' -160° 25.000'
016S161W-46 -16° 15.000' -16° 15.000' -16° 15.000' -16° 10.000' -16° -16° 10.000'	-16° 20.000' -160 -16° 25.000' -160	0° 10.000' - 0° 20.000' -	16° 20.000' 16° 25.000'	-160° 15.000' -160° 25.000'
016S161W-56 -16° 20.000' -160° 25.000' -16° 20.000' -160° 20.000' -16°	-16° 25.000' -160	0° 20.000' -	16° 25.000'	-160° 25.000'
			1000 00 01 1	1000 21 000
016S161W-44 -16° 15.000' -160° 25.000' -16° 15.000' -160° 20.000' -16°	-16° 20.000' -160	0° 20.000'	16° 20.000	-160° 25.000
016S161W-11 -16° 00.000' -160° 10.000' -16° 00.000' -160° 05.000' -16°	-16° 05.000' -160	0° 05.000'	16° 05.000'	-160° 10.000'
016S161W-93 -16° 35.000' -160° 20.000' -16° 35.000' -160° 15.000' -16°	-16° 40.000' -160	0° 15.000' -	16° 40.000'	-160° 20.000'
016S160W-2 -16° 00.000' -159° 55.000' -16° 00.000' -159° 50.000' -16°	-16° 05.000' -159	9° 50.000'	16° 05.000'	-159° 55.000'
016S160W-114 -16° 45.000' -159° 35.000' -16° 45.000' -159° 30.000' -16°	-16° 50.000' -159	9° 30.000'	16° 50.000'	-159° 35.000'
016S160W-96 -16° 35.000' -159° 05.000' -16° 35.000' -159° 00.000' -16°	-16° 40.000' -159	- ,000.00 °6	16° 40.000'	-159° 05.000'
016S160W-23 -16° 05.000' -159° 10.000' -16° 05.000' -159° 05.000' -16°	-16° 10.000' -155	9° 05.000' -	16° 10.000'	-159° 10.000'
016S160W-93 -16° 35.000' -159° 20.000' -16° 35.000' -159° 15.000' -16°	-16° 40.000' -159	9° 15.000' -	16° 40.000'	-159° 20.000'
016S159W-29 -16° 10.000' -158° 40.000' -16° 10.000' -158° 35.000' -16°	-16° 15.000' -158	8° 35.000' -	16° 15.000'	-158° 40.000'
016S159W-98 -16° 40.000' -158° 55.000' -16° 40.000' -158° 50.000' -16°	-16° 45.000' -158	3° 50.000'	16° 45.000'	-158° 55.000'
016S160W-134 -16° 55.000' -159° 55.000' -16° 55.000' -159° 50.000' -17°	-17° 00.000' -159	9° 50.000' -	17° 00.000'	-159° 55.000'
016S160W-97 -16° 40.000' -160° 00.000' -16° 40.000' -159° 55.000' -16°	-16° 45.000' -159	9° 55.000' -	16° 45.000'	-160° 00.000'
016S159W-74 -16° 30.000' -158° 55.000' -16° 30.000' -158° 50.000' -16°	-16° 35.000' -158	3° 50.000' -	16° 35.000'	-158° 55.000'
016S160W-43 -16° 15.000' -159° 30.000' -16° 15.000' -159° 25.000' -16°	-16° 20.000' -159	9° 25.000' -	16° 20.000'	-159° 30.000'
016S159W-77 -16° 30.000' -158° 40.000' -16° 30.000' -158° 35.000' -16°	-16° 35.000' -158	8° 35.000' -	16° 35.000'	-158° 40.000'

160W-10	1 -16° 40.000'	-159° 40.000' 160° 20 000'	-16° 40.000'	-159° 35.000' 160° 15 000'	-16° 45.000' 16° 45.000'	-159° 35.000' 160° 15 000'	-16° 45.000' 16° 45.000'	-159° 40.000' 160° 20.000'
26	-16° 10.000'	-158° 55.000'	-16° 10.000'	-158° 50.000'	-16° 15.000'	-158° 50.000'	-16° 15.000'	-158° 55.000'
56	-16° 20.000'	-159° 25.000'	-16° 20.000'	-159° 20.000'	-16° 25.000'	-159° 20.000'	-16° 25.000'	-159° 25.000'
V-12	2 -16° 50.000'	-159° 55.000'	-16° 50.000'	-159° 50.000'	-16° 55.000'	-159° 50.000'	-16° 55.000'	-159° 55.000'
V-54	-16° 20.000'	-159° 35.000'	-16° 20.000'	-159° 30.000'	-16° 25.000'	-159° 30.000'	-16° 25.000'	-159° 35.000'
N-72	-16° 25.000'	-159° 05.000'	-16° 25.000'	-159° 00.000'	-16° 30.000'	-159° 00.000'	-16° 30.000'	-159° 05.000'
N-52	-16° 20.000'	-158° 45.000'	-16° 20.000'	-158° 40.000'	-16° 25.000'	-158° 40.000'	-16° 25.000'	-158° 45.000'
W-12	3 -16° 50.000'	-159° 50.000'	-16° 50.000'	-159° 45.000'	-16° 55.000'	-159° 45.000'	-16° 55.000'	-159° 50.000'
W-12	9 -16° 50.000'	-160° 20.000'	-16° 50.000'	-160° 15.000'	-16° 55.000'	-160° 15.000'	-16° 55.000'	-160° 20.000'
JW-10	6 -16° 40.000'	-159° 15.000'	-16° 40.000'	-159° 10.000'	-16° 45.000'	-159° 10.000'	-16° 45.000'	-159° 15.000'
0W-61	-16° 25.000'	-160° 00.000'	-16° 25.000'	-159° 55.000'	-16° 30.000'	-159° 55.000'	-16° 30.000'	-160° 00.000'
0W-14	0 -16° 55.000'	-159° 25.000'	-16° 55.000'	-159° 20.000'	-17° 00.000'	-159° 20.000'	-17° 00.000'	-159° 25.000'
0W-89	-16° 35.000'	-159° 40.000'	-16° 35.000'	-159° 35.000'	-16° 40.000'	-159° 35.000'	-16° 40.000'	-159° 40.000'
59W-61	-16° 25.000'	-159° 00.000'	-16° 25.000'	-158° 55.000'	-16° 30.000'	-158° 55.000'	-16° 30.000'	-159° 00.000'
0W-62	-16° 25.000'	-159° 55.000'	-16° 25.000'	-159° 50.000'	-16° 30.000'	-159° 50.000'	-16° 30.000'	-159° 55.000'
9W-18	-16° 05.000'	-158° 35.000'	-16° 05.000'	-158° 30.000'	-16° 10.000'	-158° 30.000'	-16° 10.000'	-158° 35.000'
0W-11	8 -16° 45.000'	-159° 15.000'	-16° 45.000'	-159° 10.000'	-16° 50.000'	-159° 10.000'	-16° 50.000'	-159° 15.000'
JW-88	-16° 35.000'	-159° 45.000'	-16° 35.000'	-159° 40.000'	-16° 40.000'	-159° 40.000'	-16° 40.000'	-159° 45.000'
0W-41	-16° 15.000'	-159° 40.000'	-16° 15.000'	-159° 35.000'	-16° 20.000'	-159° 35.000'	-16° 20.000'	-159° 40.000'
0W-12	9 -16° 50.000'	-159° 20.000'	-16° 50.000'	-159° 15.000'	-16° 55.000'	-159° 15.000'	-16° 55.000'	-159° 20.000'
0W-8	-16° 00.000'	-159° 25.000'	-16° 00.000'	-159° 20.000'	-16° 05.000'	-159° 20.000'	-16° 05.000'	-159° 25.000'
1W-11	6 -16° 45.000'	-160° 25.000'	-16° 45.000'	-160° 20.000'	-16° 50.000'	-160° 20.000'	-16° 50.000'	-160° 25.000'
0W-12	1 -16° 50.000'	-160° 00.000'	-16° 50.000'	-159° 55.000'	-16° 55.000'	-159° 55.000'	-16° 55.000'	-160° 00.000'
0W-74	-16° 30.000'	-159° 55.000'	-16° 30.000'	-159° 50.000'	-16° 35.000'	-159° 50.000'	-16° 35.000'	-159° 55.000'
9W-10	0 -16° 40.000'	-158° 45.000'	-16° 40.000'	-158° 40.000'	-16° 45.000'	-158° 40.000'	-16° 45.000'	-158° 45.000'
LW-14	1 -16° 55.000'	-160° 20.000'	-16° 55.000'	-160° 15.000'	-17° 00.000'	-160° 15.000'	-17° 00.000'	-160° 20.000'
JW-64	-16° 25.000'	-159° 45.000'	-16° 25.000'	-159° 40.000'	-16° 30.000'	-159° 40.000'	-16° 30.000'	-159° 45.000'
JW-85	-16° 35.000'	-160° 00.000'	-16° 35.000'	-159° 55.000'	-16° 40.000'	-159° 55.000'	-16° 40.000'	-160° 00.000'
0W-94	-16° 35.000'	-159° 15.000'	-16° 35.000'	-159° 10.000'	-16° 40.000'	-159° 10.000'	-16° 40.000'	-159° 15.000'

° 25.000' -158° 55.000'	° 35.000' -159° 25.000'	° 55.000' -160° 25.000'	° 10.000' -159° 25.000'	° 50.000' -160° 05.000'	° 10.000' -159° 20.000'	° 10.000' -159° 15.000'	° 10.000' -158° 50.000'	° 30.000' -159° 40.000'	° 05.000' -158° 55.000'	° 25.000' -159° 15.000'	° 45.000' -160° 05.000'	° 45.000' -159° 10.000'	° 30.000' -159° 50.000'	° 30.000' -158° 55.000'	° 45.000' -159° 35.000'	° 25.000' -158° 35.000'	° 50.000' -158° 40.000'	° 35.000' -159° 10.000'	° 20.000' -158° 35.000'	° 30.000' -159° 30.000'	° 05.000' -159° 05.000'	° 00.000' -160° 15.000'	° 05.000' -158° 45.000'	° 20.000' -159° 20.000'	° 05.000' -159° 30.000'	° 05.000' -159° 45.000'	° 50.000' -160° 30.000'	20 000' -159° 10 000'	
-158° 50.000' -16'	-159° 20.000' -16'	-160° 20.000' -16'	-159° 20.000' -16'	-160° 00.000' -16'	-159° 15.000' -16'	-159° 10.000' -16'	-158° 45.000' -16'	-159° 35.000' -16'	-158° 50.000' -16'	-159° 10.000' -16'	-160° 00.000' -16'	-159° 05.000' -16'	-159° 45.000' -16'	-158° 50.000' -16'	-159° 30.000' -16'	-158° 30.000' -16'	-158° 35.000' -16'	-159° 05.000' -16'	-158° 30.000' -16'	-159° 25.000' -16'	-159° 00.000' -16'	-160° 10.000' -17'	-158° 40.000' -16'	-159° 15.000' -16'	-159° 25.000' -16'	-159° 40.000' -16'	-160° 25.000' -16'	-159° 05.000' -16'	
0.000' -16° 25.000'	0.000' -16° 35.000'	0.000' -16° 55.000'	0.000' -16° 10.000'	0.000' -16° 50.000'	.5.000' -16° 10.000'	.0.000' -16° 10.000'	-16° 10.000'	5.000' -16° 30.000'	0.000' -16° 05.000'	.0.000' -16° 25.000'	0.000' -16° 45.000')5.000' -16° 45.000'	5.000' -16° 30.000'	0.000' -16° 30.000'	:0.000' -16° 45.000'	0.000' -16° 25.000'	:5.000' -16° 50.000')5.000' -16° 35.000'	:0.000' -16° 20.000'	5.000' -16° 30.000'	0.000' -16° 05.000'	.0.000' -17° 00.000'	0.000' -16° 05.000'	.5.000' -16° 20.000'	5.000' -16° 05.000'	0.000' -16° 05.000'	5.000' -16° 50.000'	J5.000' -16° 40.000'	
.16° 20.000' -158° 5	.16° 30.000' -159° 2	16° 50.000' -160° 2	.16° 05.000' -159° 2	16° 45.000' -160° 0	.16° 05.000' -159° 1	16° 05.000' -159° 1	.16° 05.000' -158° 4	.16° 25.000' -159° 3	.16° 00.000' -158° 5	16° 20.000' -159° 1	16° 40.000' -160° 0	.16° 40.000' -159° 0	.16° 25.000' -159° 4	.16° 25.000' -158° 5	.16° 40.000' -159° 3	.16° 20.000' -158° 3	.16° 45.000' -158° 3	.16° 30.000' -159° 0	.16° 15.000' -158° 3	16° 25.000' -159° 2	16° 00.000' -159° 0	16° 55.000' -160° 1	16° 00.000' -158° 4	16° 15.000' -159° 1	.16° 00.000' -159° 2	.16° 00.000' -159° 4	16° 45.000' -160° 2	16° 35.000' -159° 0	
-158° 55.000'	-159° 25.000'	-160° 25.000'	-159° 25.000'	-160° 05.000'	-159° 20.000'	-159° 15.000'	-158° 50.000'	-159° 40.000'	-158° 55.000'	-159° 15.000'	-160° 05.000'	-159° 10.000'	-159° 50.000'	-158° 55.000'	-159° 35.000'	-158° 35.000'	-158° 40.000'	-159° 10.000'	-158° 35.000'	-159° 30.000'	-159° 05.000'	-160° 15.000'	-158° 45.000'	-159° 20.000'	-159° 30.000'	-159° 45.000'	-160° 30.000'	-159° 10.000'	
-16° 20.000'	-16° 30.000'	8 -16° 50.000'	-16° 05.000'	0 -16° 45.000'	-16° 05.000'	-16° 05.000'	-16° 05.000'	-16° 25.000'	-16° 00.000'	-16° 20.000'	8 -16° 40.000'	7 -16° 40.000'	-16° 25.000'	-16° 25.000'	2 -16° 40.000'	-16° 20.000'	3 -16° 45.000'	-16° 30.000'	-16° 15.000'	-16° 25.000'	-16° 00.000'	2 -16° 55.000'	-16° 00.000'	-16° 15.000'	-16° 00.000'	-16° 00.000'	5 -16° 45.000'	-16° 35.000'	
88 016S159W-50	89 016S160W-80	90 016S161W-128	91 016S160W-20	92 016S161W-12	93 0165160W-21	94 016S160W-22	95 016S159W-15	96 016S160W-65	97 016S159W-2	98 0165160W-58	99 016S161W-108	1 00 016S160W-10	1 01 016S160W-63	1 02 016S159W-62	1 03 016S160W-10.	1 04 016S159W-54	105 016S159W-11	1 06 016S160W-83	1 07 016S159W-42	1 08 016S160W-67	1 09 016S160W-12	110 016S161W-14	1 11 016S159W-4	1 12 016S160W-45	1 13 016S160W-7	1 14 016S160W-4	115 016S161W-11	1 16 016S160W-95	

-159° 45.000'	-160° 15.000'	-159° 35.000'	-159° 30.000'	-158° 40.000'	-158° 45.000'	-159° 05.000'	-159° 35.000'	-159° 50.000'	-158° 50.000'	-159° 25.000'	-159° 30.000'	-159° 10.000'	-159° 50.000'	-159° 50.000'	-159° 55.000'	-159° 50.000'	-159° 55.000'	-158° 55.000'	-159° 50.000'	-158° 45.000'	-159° 15.000'	-158° 40.000'	-158° 40.000'	-160° 00.000'	-159° 05.000'	-158° 45.000'	-159° 05.000'	-158° 35.000'	-159° 05.000'
-16° 20.000'	-16° 45.000'	-17° 00.000'	-16° 45.000'	-17° 00.000'	-16° 10.000'	-16° 20.000'	-16° 10.000'	-16° 10.000'	-16° 50.000'	-16° 20.000'	-16° 10.000'	-16° 55.000'	-16° 25.000'	-16° 35.000'	-16° 20.000'	-16° 20.000'	-16° 15.000'	-16° 10.000'	-16° 45.000'	-16° 20.000'	-16° 55.000'	-16° 25.000'	-16° 05.000'	-16° 50.000'	-16° 35.000'	-16° 55.000'	-17° 00.000'	-16° 35.000'	-16° 25.000'
-159° 40.000'	-160° 10.000'	-159° 30.000'	-159° 25.000'	-158° 35.000'	-158° 40.000'	-159° 00.000'	-159° 30.000'	-159° 45.000'	-158° 45.000'	-159° 20.000'	-159° 25.000'	-159° 05.000'	-159° 45.000'	-159° 45.000'	-159° 50.000'	-159° 45.000'	-159° 50.000'	-158° 50.000'	-159° 45.000'	-158° 40.000'	-159° 10.000'	-158° 35.000'	-158° 35.000'	-159° 55.000'	-159° 00.000'	-158° 40.000'	-159° 00.000'	-158° 30.000'	-159° 00.000'
-16° 20.000'	-16° 45.000'	-17° 00.000'	-16° 45.000'	-17° 00.000'	-16° 10.000'	-16° 20.000'	-16° 10.000'	-16° 10.000'	-16° 50.000'	-16° 20.000'	-16° 10.000'	-16° 55.000'	-16° 25.000'	-16° 35.000'	-16° 20.000'	-16° 20.000'	-16° 15.000'	-16° 10.000'	-16° 45.000'	-16° 20.000'	-16° 55.000'	-16° 25.000'	-16° 05.000'	-16° 50.000'	-16° 35.000'	-16° 55.000'	-17° 00.000'	-16° 35.000'	-16° 25.000'
-159° 40.000'	-160° 10.000'	-159° 30.000'	-159° 25.000'	-158° 35.000'	-158° 40.000'	-159° 00.000'	-159° 30.000'	-159° 45.000'	-158° 45.000'	-159° 20.000'	-159° 25.000'	-159° 05.000'	-159° 45.000'	-159° 45.000'	-159° 50.000'	-159° 45.000'	-159° 50.000'	-158° 50.000'	-159° 45.000'	-158° 40.000'	-159° 10.000'	-158° 35.000'	-158° 35.000'	-159° 55.000'	-159° 00.000'	-158° 40.000'	-159° 00.000'	-158° 30.000'	-159° 00.000'
-16° 15.000'	-16° 40.000'	-16° 55.000'	-16° 40.000'	-16° 55.000'	-16° 05.000'	-16° 15.000'	-16° 05.000'	-16° 05.000'	-16° 45.000'	-16° 15.000'	-16° 05.000'	-16° 50.000'	-16° 20.000'	-16° 30.000'	-16° 15.000'	-16° 15.000'	-16° 10.000'	-16° 05.000'	-16° 40.000'	-16° 15.000'	-16° 50.000'	-16° 20.000'	-16° 00.000'	-16° 45.000'	-16° 30.000'	-16° 50.000'	-16° 55.000'	-16° 30.000'	-16° 20.000'
-159° 45.000'	-160° 15.000'	-159° 35.000'	-159° 30.000'	-158° 40.000'	-158° 45.000'	-159° 05.000'	-159° 35.000'	-159° 50.000'	-158° 50.000'	-159° 25.000'	-159° 30.000'	-159° 10.000'	-159° 50.000'	-159° 50.000'	-159° 55.000'	-159° 50.000'	-159° 55.000'	-158° 55.000'	-159° 50.000'	-158° 45.000'	-159° 15.000'	-158° 40.000'	-158° 40.000'	-160° 00.000'	-159° 05.000'	-158° 45.000'	-159° 05.000'	-158° 35.000'	-159° 05.000'
-16° 15.000'	-16° 40.000'	-16° 55.000'	-16° 40.000'	-16° 55.000'	-16° 05.000'	-16° 15.000'	-16° 05.000'	-16° 05.000'	-16° 45.000'	-16° 15.000'	-16° 05.000'	-16° 50.000'	-16° 20.000'	-16° 30.000'	-16° 15.000'	-16° 15.000'	-16° 10.000'	-16° 05.000'	-16° 40.000'	-16° 15.000'	-16° 50.000'	-16° 20.000'	-16° 00.000'	-16° 45.000'	-16° 30.000'	-16° 50.000'	-16° 55.000'	-16° 30.000'	-16° 20.000'
016S160W-40	016S161W-106	016S160W-138	016S160W-103	016S159W-137	016S159W-16	016S160W-48	016S160W-18	016S160W-15	016S159W-111	016S160W-44	016S160W-19	016S160W-131	016S160W-51	016S160W-75	016S160W-38	016S160W-39	016S160W-26	016S159W-14	016S160W-99	016S159W-40	016S160W-130	016S159W-53	016S159W-5	016S160W-109	016S160W-84	016S159W-124	016S160W-144	016S159W-78	016S160W-60
118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147

00' -160° 25.000'	00' -159° 15.000'	00' -159° 10.000'	00' -159° 30.000'	00' -158° 50.000'	00' -159° 15.000'	00' -159° 40.000'	00' -159° 15.000'	00' -159° 20.000'	00' -159° 20.000'	00' -159° 25.000'	00' -159° 45.000'	00' -159° 15.000'	00' -159° 00.000'	00' -158° 50.000'	00' -160° 10.000'	00' -158° 35.000'	00' -159° 05.000'	00' -158° 45.000'	00' -159° 55.000'	00' -158° 55.000'	00' -159° 30.000'	00' -158° 35.000'	00' -158° 50.000'	00' -159° 50.000'	00' -159° 50.000'	00' -158° 35.000'	00' -159° 10.000'	00' -158° 50.000'	
00' -17° 00.0	00' -16° 15.0	00' -17° 00.0	00' -16° 35.0	00' -17° 00.0	00' -17° 00.0	00' -16° 35.0	00' -16° 05.0	00' -17° 00.0	00' -16° 35.0	00' -16° 30.0	00' -16° 35.0	00' -16° 30.0	00' -16° 55.0	00' -16° 45.0	00' -16° 40.0	00' -16° 45.0	00' -16° 10.0	00' -16° 15.0	00' -16° 40.0	00' -17° 00.0	00' -16° 25.0	00' -16° 40.0	00' -16° 20.0	00' -16° 05.0	00' -16° 40.0	00' -16° 15.0	00' -16° 15.0	00' -16° 25.0	
, -160° 20.00	ו ^י -159° 10.00	1 ^{-159°} 05.00	ו ^י -159° 25.00	, -158° 45.00	, -159° 10.00	, -159° 35.00	ו ^י -159° 10.00	, -159° 15.00	, -159° 15.00	1 ^{-159°} 20.00	ו ^י -159° 40.00	ו ^י -159° 10.00	ו' -158° 55.0(, -158° 45.00	1 ^{-160°} 05.00	, -158° 30.00	, -159° 00.00	, -158° 40.00	, -159° 50.00	, -158° 50.00	ו' -159° 25.00	, -158° 30.00	ו' -158° 45.00	ו ^י -159° 45.00	ו' -159° 45.00	, -158° 30.00	ו' -159° 05.00)' -158° 45.0(1 1 1 0 0 1 0
-17° 00.000	-16° 15.000	-17° 00.000	-16° 35.000	-17° 00.000	-17° 00.000	-16° 35.000	-16° 05.000	-17° 00.000	-16° 35.000	-16° 30.000	-16° 35.000	-16° 30.000	-16° 55.000	-16° 45.000	-16° 40.000	-16° 45.000	-16° 10.000	-16° 15.000	-16° 40.000	-17° 00.000	-16° 25.000	' -16° 40.000	-16° 20.000	' -16° 05.000	-16° 40.000	' -16° 15.000	' -16° 15.000	' -16° 25.000	
-160° 20.000	-159° 10.000	-159° 05.000	-159° 25.000	-158° 45.000	-159° 10.000	-159° 35.000	-159° 10.000	-159° 15.000	-159° 15.000	-159° 20.000	-159° 40.000	-159° 10.000	-158° 55.000	-158° 45.000	-160° 05.000	-158° 30.000	-159° 00.000	-158° 40.000	-159° 50.000	-158° 50.000	-159° 25.000	-158° 30.000	-158° 45.000	-159° 45.000	-159° 45.000	-158° 30.000	-159° 05.000	-158° 45.000	
-16° 55.000'	-16° 10.000'	-16° 55.000'	-16° 30.000'	-16° 55.000'	-16° 55.000'	-16° 30.000'	-16° 00.000'	-16° 55.000'	-16° 30.000'	-16° 25.000'	-16° 30.000'	-16° 25.000'	-16° 50.000'	-16° 40.000'	-16° 35.000'	-16° 40.000'	-16° 05.000'	-16° 10.000'	-16° 35.000'	-16° 55.000'	-16° 20.000'	-16° 35.000'	-16° 15.000'	-16° 00.000'	-16° 35.000'	-16° 10.000'	-16° 10.000'	-16° 20.000'	
-160° 25.000'	-159° 15.000'	-159° 10.000'	-159° 30.000'	-158° 50.000'	-159° 15.000'	-159° 40.000'	-159° 15.000'	-159° 20.000'	-159° 20.000'	-159° 25.000'	-159° 45.000'	-159° 15.000'	-159° 00.000'	-158° 50.000'	-160° 10.000'	-158° 35.000'	-159° 05.000'	-158° 45.000'	-159° 55.000'	-158° 55.000'	-159° 30.000'	-158° 35.000'	-158° 50.000'	-159° 50.000'	-159° 50.000'	-158° 35.000'	-159° 10.000'	-158° 50.000'	
-16° 55.000'	-16° 10.000'	-16° 55.000'	-16° 30.000'	-16° 55.000'	-16° 55.000'	-16° 30.000'	-16° 00.000'	-16° 55.000'	-16° 30.000'	-16° 25.000'	-16° 30.000'	-16° 25.000'	-16° 50.000'	-16° 40.000'	-16° 35.000'	-16° 40.000'	-16° 05.000'	-16° 10.000'	-16° 35.000'	-16° 55.000'	-16° 20.000'	-16° 35.000'	-16° 15.000'	-16° 00.000'	-16° 35.000'	-16° 10.000'	-16° 10.000'	-16° 20.000'	
016S161W-140	016S160W-34	016S160W-143	016S160W-79	016S159W-135	016S160W-142	016S160W-77	016S160W-10	016S160W-141	016S160W-81	016S160W-68	016S160W-76	016S160W-70	016S159W-121	016S159W-99	016S161W-95	016S159W-102	016S160W-24	016S159W-28	016S160W-86	016S159W-134	016S160W-55	016S159W-90	016S159W-39	016S160W-3	016S160W-87	016S159W-30	016S160W-35	016S159W-51	01 COLED
148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177

-159° 15.000'	-159° 40.000'	-160° 00.000'	-160° 10.000'	-159° 45.000'	-159° 05.000'	-159° 40.000'	-159° 25.000'	-159° 30.000'	-159° 25.000'	-159° 00.000'	-159° 05.000'	-158° 55.000'	-160° 00.000'	-159° 40.000'	-159° 50.000'	-158° 40.000'	-159° 35.000'	-158° 50.000'	-158° 35.000'	-158° 45.000'	-158° 40.000'	-158° 45.000'	-159° 20.000'	-160° 15.000'	-158° 50.000'	-158° 35.000'	-159° 20.000'	-159° 00.000'	
-16° 20.000'	-16° 10.000'	-16° 20.000'	-16° 45.000'	-16° 25.000'	-16° 55.000'	-16° 05.000'	-16° 45.000'	-16° 55.000'	-16° 15.000'	-16° 05.000'	-16° 50.000'	-16° 20.000'	-16° 15.000'	-16° 55.000'	-16° 50.000'	-16° 40.000'	-16° 15.000'	-16° 55.000'	-16° 05.000'	-16° 40.000'	-16° 55.000'	-16° 35.000'	-16° 15.000'	-16° 50.000'	-16° 40.000'	-16° 55.000'	-16° 45.000'	-16° 50.000'	
-159° 10.000'	-159° 35.000'	-159° 55.000'	-160° 05.000'	-159° 40.000'	-159° 00.000'	-159° 35.000'	-159° 20.000'	-159° 25.000'	-159° 20.000'	-158° 55.000'	-159° 00.000'	-158° 50.000'	-159° 55.000'	-159° 35.000'	-159° 45.000'	-158° 35.000'	-159° 30.000'	-158° 45.000'	-158° 30.000'	-158° 40.000'	-158° 35.000'	-158° 40.000'	-159° 15.000'	-160° 10.000'	-158° 45.000'	-158° 30.000'	-159° 15.000'	-158° 55.000'	
-16° 20.000'	-16° 10.000'	-16° 20.000'	-16° 45.000'	-16° 25.000'	-16° 55.000'	-16° 05.000'	-16° 45.000'	-16° 55.000'	-16° 15.000'	-16° 05.000'	-16° 50.000'	-16° 20.000'	-16° 15.000'	-16° 55.000'	-16° 50.000'	-16° 40.000'	-16° 15.000'	-16° 55.000'	-16° 05.000'	-16° 40.000'	-16° 55.000'	-16° 35.000'	-16° 15.000'	-16° 50.000'	-16° 40.000'	-16° 55.000'	-16° 45.000'	-16° 50.000'	
-159° 10.000'	-159° 35.000'	-159° 55.000'	-160° 05.000'	-159° 40.000'	-159° 00.000'	-159° 35.000'	-159° 20.000'	-159° 25.000'	-159° 20.000'	-158° 55.000'	-159° 00.000'	-158° 50.000'	-159° 55.000'	-159° 35.000'	-159° 45.000'	-158° 35.000'	-159° 30.000'	-158° 45.000'	-158° 30.000'	-158° 40.000'	-158° 35.000'	-158° 40.000'	-159° 15.000'	-160° 10.000'	-158° 45.000'	-158° 30.000'	-159° 15.000'	-158° 55.000'	
-16° 15.000'	-16° 05.000'	-16° 15.000'	-16° 40.000'	-16° 20.000'	-16° 50.000'	-16° 00.000'	-16° 40.000'	-16° 50.000'	-16° 10.000'	-16° 00.000'	-16° 45.000'	-16° 15.000'	-16° 10.000'	-16° 50.000'	-16° 45.000'	-16° 35.000'	-16° 10.000'	-16° 50.000'	-16° 00.000'	-16° 35.000'	-16° 50.000'	-16° 30.000'	-16° 10.000'	-16° 45.000'	-16° 35.000'	-16° 50.000'	-16° 40.000'	-16° 45.000'	
-159° 15.000'	-159° 40.000'	-160° 00.000'	-160° 10.000'	-159° 45.000'	-159° 05.000'	-159° 40.000'	-159° 25.000'	-159° 30.000'	-159° 25.000'	-159° 00.000'	-159° 05.000'	-158° 55.000'	-160° 00.000'	-159° 40.000'	-159° 50.000'	-158° 40.000'	-159° 35.000'	-158° 50.000'	-158° 35.000'	-158° 45.000'	-158° 40.000'	-158° 45.000'	-159° 20.000'	-160° 15.000'	-158° 50.000'	-158° 35.000'	-159° 20.000'	-159° 00.000'	
-16° 15.000'	-16° 05.000'	-16° 15.000'	-16° 40.000'	-16° 20.000'	-16° 50.000'	-16° 00.000'	-16° 40.000'	-16° 50.000'	-16° 10.000'	-16° 00.000'	-16° 45.000'	-16° 15.000'	-16° 10.000'	-16° 50.000'	-16° 45.000'	-16° 35.000'	-16° 10.000'	-16° 50.000'	-16° 00.000'	-16° 35.000'	-16° 50.000'	-16° 30.000'	-16° 10.000'	-16° 45.000'	-16° 35.000'	-16° 50.000'	-16° 40.000'	-16° 45.000'	
016S160W-46	016S160W-17	016S160W-37	016S161W-107	016S160W-52	016S160W-132	016S160W-5	016S160W-104	016S160W-127	016S160W-32	016S159W-1	016S160W-120	016S159W-38	016S160W-25	016S160W-125	016S160W-111	016S159W-89	016S160W-30	016S159W-123	016S159W-6	016S159W-88	016S159W-125	016S159W-76	016S160W-33	016S161W-118	016S159W-87	016S159W-126	016S160W-105	016S159W-109	
178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	

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AN OCEAN MINERALS GROUP COMPANY

MOANA

MINERALS

Cook Islands Exploration License Application

Exploration Work Program Summary

As at January 20, 2022

NPPLN-00001-EXPLN-01



Exploration License Application

APPROVAL/S

Name & Title	Signature	Date
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REVIEWER/S

Name & Title	Signature	Date
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CHANGE HISTORY

Date	Change Req No.	Revision	Description of change
11 Jan 2022	N/A	00	Issued
20 Jan 2022		01	Added Proposed Expenditures & Cash Flow information

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1 INTRODUCTION

Ocean Minerals group of companies (OM) is comprised of Cayman registered parent company Ocean Minerals, LLC (OML) and wholly owned subsidiary companies including US registered Moana Minerals Inc., OML Rare Earth, LLC and Cook Islands registered Moana Minerals Limited. For practical purposes, key management activities are performed by Moana Minerals Inc. personnel under intercompany management agreements. Moana Minerals Ltd will employ operational staff, and most operational activities will be conducted through this subsidiary including services from contractors and consultants whenever practical. This approach meets the requirements for local content and spending. For purposes of the application, when OM is referenced, it could imply either OML, Moana Minerals Inc. or Moana Minerals Ltd, or any combination thereof.

Moana Minerals Limited is the party applying for an Exploration License for polymetallic nodules within the Cook Islands Exclusive Economic Zone (CIEEZ) encompassing our existing OML reserved Areas 4 and 5 (Figure 1). At the time of application, OM is calling this Application Area "Moana 1".



Figure 1 - Location of OM proposed license Application Area within the CIEEZ

The OM Application Area has previously been the subject of investigation by Japanese scientific research organizations who identified the existence of significant polymetallic nodules within the CIEEZ. The occurrence of polymetallic nodules in the deep ocean basins has been well known since the late 1800s. During these cruises, nodules were collected, and the results of their analyses served to define areas of potential economic interest to be surveyed in more detail by later cruises. The most comprehensive

programs were undertaken by the Japanese Government, Japan International Cooperation Agency (JICA) at the request of the Committee for Co-ordination of Joint Prospecting for Mineral Resources in the South Pacific Offshore Areas and South Pacific Applied Geoscience Commission (CCOP/SOPAC). OM considers the previous sampling to be suitable for geologic research, but insufficient for detailed economic evaluation of the nodules resource.

On behalf of OM, RSC Mining & Mineral Exploration Ltd. has undertaken a mineral resource estimate using historic sampling data over an area of the CIEEZ which includes the Application Area. RSC has subsequently provided an Inferred Mineral Resource estimate of 338 x 10⁶ t of polymetallic nodules at an average nodule abundance of 30 kg/m², within the Application Area (at a cut-off grade of 15 kg/m²).

OM considers the Application Area to have suitable nodule abundance, seafloor topography and other factors that merit additional detailed exploration as a precursor to developing a deepsea nodule mining operation. The primary objective of the proposed Exploration Work Program is to determine the economic viability of sustainably sourcing cobalt (as a primary product, and other minerals, as identified later, as secondary products) from the Cook Islands nodule resource. Key questions to be answered relate to:

- Understanding the environmental conditions including, but not limited to, seafloor and water column to determine how best to carry out commercial mining while minimizing impacts and protecting the environment
- The extractability (processing) of cobalt and other critical metals from the nodules
- Characteristics of the physical environment and the nodules themselves that influence mineability and metallurgical processing

Our proposed program focuses on preparing us to confidently proceed with applying for a mining license within the 5-year term of the Exploration Licensing period, as well as completing an associated Environmental and Social Impact Assessment and securing the necessary Environmental Permits.

This Exploration Work Program document outlines our current knowledge of Moana 1, the gaps that we propose to fill through our Exploration Work Program, the work we plan to execute to develop our environmental baseline and impact analysis, our approach to executing the Work Program, and our team credentials.

OM has compiled in our Exploration Work Plan a complete set of supplemental information in which we have attempted to address all requirements as identified in the following Cook Islands Seabed Minerals regulations, acts, policies and guidelines:

- 1. Seabed Minerals Act of 2019, as amended by Amendment of 2020
- 2. Seabed Minerals Exploration Regulations of 2020
- 3. Cook Islands National Seabed Minerals Policy of 2020
- 4. Guideline for Applications for the Grant of Exploration Licenses, October 2020
- 5. Marae Moana Act

2 DEFINITIONS, ABBREVIATIONS & ACRONYMS

Field	Description or Definition
CI	Cook Islands
CIEEZ	Cook Islands Exclusive Economic Zone
ISA	International Seabed Authority
JORC	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves
Moana	Moana Minerals Limited
ОМ	Ocean Minerals Group of companies
OML	Ocean Minerals LLC

3 APPLICATION AREA

Moana is applying for an exploration license for polymetallic nodules in an area within the CIEEZ which aligns with OML's existing Reserved areas 4 and 5 (see **Error! Reference source not found.**) – the Application Area. Moana is naming this area as "Moana 1". The Application Area contains 288 blocks with the corner coordinates of the total application area shown in Figure 2.



Figure 2 - Location of OM Application Area in the CIEEZ.

Moana selected the Application Area based on the information summarized in the OML mineral resource report and covers the identified prospective areas in and around OML's reserved areas. The OML resource model is based on historical data, ranked based on quality of the sampling, along with past regional resource studies. The results of the OML resource study have guided the choice in Application Area.

ID	Block ID	LON	LAT	LON degrees	LAT degrees
1	Moana 1	-159.500	-17.000	159° 30' 00.00" W	17° 00' 00.00" S
2	Moana 1	-158.500	-16.000	158° 30' 00.00" W	16° 00' 00.00" S
3	Moana 1	-158.000	-17.000	158° 30' 00.00" W	17° 00' 00.00" S
4	Moana 1	-159.500	-16.000	159° 30' 00.00" W	16° 00' 00.00" S

Table 1 - MO	ANA Application	n Area	coordinates
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4 PROPOSED WORK PLAN

Moana finds itself in an unusual situation already reporting, in accordance with the JORC standard, a resource within the area for which Moana is applying for an exploration permit. As Moana already has a resource defined, our work program can focus primarily on data collection related to establishing a robust environmental baseline with resource work limited to the improvement of reported confidence levels.

Moana has developed an exploration work program, using the environmental baseline needs, engineering data requirements, resource report data and our team's experience as a foundation, that permits Moana to cautiously and systematically move the company toward achieving our primary objectives. The key objectives are:

- Development of an ecosystem model to provide a framework for Ecosystem-Based Management
- Environmental studies to understand the baseline environment
- Characterizing the nodule resource and understanding the associated geology, chemical and physical properties
- Contributing to an understanding of the Cook Islands nodule resource and best practice sustainable resource utilization.
- Upgrading the classification of the mineral resource (inferred \rightarrow indicated/measured)
- Confirming that revenue can be generated through the sale of extracted metals
- Identifying and delineating preservation areas and potential mining sites
- Development and validation of mining and metallurgical processing systems
- Completing an Environmental and Social Impact Assessment
- Acquiring the required environmental permits and permissions needed to commence commercial operations
- Applying for, and securing of, a mining license

Moana's proposed exploration work plan is projected to be 4 to 5 years in total duration, with the objective of pivoting from exploration to application for an environmental permit and concludes with the submission of a mining license application under the laws of the Cook Islands. Our program is broken into three key streams comprised of plans or projects:

- The Exploration Work Plan that includes:
 - Collection of environmental baseline data and technical impact assessment studies, completion of an ESIA, leading to Environmental Permitting
 - Resource sampling and upgrade of the resource report to reflect resources at indicated and measured confidence levels
 - Securing of samples and data in support of ongoing engineering efforts related to Mining system and processing system development
 - o Community outreach and contributing to CI development in this field
 - Mining license application

- Additional fund raising
- Mining System Development Project, using the Scoping, Pre-Feasibility and Definitive Feasibility iterative development cycle to drive work programs to ensure success and mitigate project risk.
- Process System Development Project, extraction, metallurgical processing and refining system development, using the Scoping, Pre-Feasibility and Definitive Feasibility iterative development cycle to drive work programs to ensure success and to mitigate project risk.

The work program and its requirements are primarily dictated by the requirements of the Environmental Management Program and an Environmental Scoping Study, which together identify the required information and sequencing. The planned campaigns and offshore operations work programs are augmented with tasks that address resource and engineering project needs and sampling.

The resource upgrade project work scope developed by Moana defines the required sample collection spacing and quantity, the protocols needed to ensure data integrity, and the identity of additional data needed (assays, chemical analysis, etc.) by the resource geologists. These data in turn permit the resource geologists to better define and understand the areal extent of the resource, nodule distribution and abundance, nodule mineral content, and continuity of the deposit and thereby permit reporting an improvement in the classification of the mineral resource in the application area.

Our engineering project and associated work scope focuses on, in collaboration with our partners, development of optimal mining and metallurgical processing solutions required to produce salable metals from harvested Cook Island nodules. This work scope runs concurrently with the environmental and resource programs. Our approach is to team with best in class, experienced engineering and operations companies who are experts in their respective fields and have the reputations and standards for safe and sustainable operations. Our philosophy is to track closely the development advances by the leading companies in the field of deep seabed mining equipment and engage with them to integrate their proven component technologies into Moana's mining system.

As part of our ongoing program to continually improve and increase project confidence levels, the data collected during the first two years of our proposed work program together with results derived from studying and analyzing the samples and collected data will be combined with the outcome of the process plant pilot testing program to update the Preliminary Economic Assessment report. In turn this updated Preliminary Economic Assessment will initiate our Pre-Feasibility Study that once reviewed and published will result in the commencement of the Feasibility Study process. Each of these is a project milestone representing significant increase in understanding of the environment, confidence in our system design, reduction in project risk, an improvement in the accuracy of project economics, an increase in project valuation, and a step closer to applying for a mining license.

OM's companies are all privately held and not bound by public reporting on mineral resource reporting codes (e.g., JORC); however, we believe it is best practice to follow these internationally recognized reporting standards as it ensures a complete and thorough accepted framework for reporting the findings of our work program related to our defined resource and our engineered solutions.

The overall Exploration Work Program, is laid out as follows:

- Environmental Work Program philosophy, key underlying policies, objectives, data collection requirements, and methodologies in order to complete an environmental baseline, perform an ESIA, and apply for environmental permit for exploitation/mining.
- Resource Work Plan strategy and requirements for upgrading resource classification from

inferred to indicated and measured and increasing the amount of resource reported.

- Engineering Work Plan data requirements, collection methods, risk reduction activities, establishing test and demonstration requirements.
- Offshore Operational Plan ties together an operations program to address all of the requirements identified in Sections 6.1 through 6.3. and lays out a multi-year plan in order to meet the objectives and requirements. Addresses resources, methods, equipment, vessels, expertise.

4.1 Social Impacts

The social component of ESIA studies will be in accordance with Moana's Integrated Safety, Health and Environmental Policy and will proactively address interactions between the project and resource use (e.g., fisheries, tourism, shipping), assessment of the socio-economic impacts or sustainability value add (positive and negative) and community-level impacts and ensuring good working relationships with local authorities and communities. Moana's objective is to leverage opportunities for training, education, and outreach in Cook Islands throughout the program.

This component, in addition to the ESIA in general, will involve a process of stakeholder identification and staged consultation. The groups that are likely to be part of the stakeholder study include fisheries authorities, tourism authorities, local community bodies and local level governments or traditional authorities, non-government organizations, church groups, environmental groups, and Cook Islands Government agencies.

Moana will seek opportunities to partner with academic and environmental institutions in the Cook Islands, ensuring our environmental work is undertaken with scientific integrity, transparency, and independence.

4.2 Environmental Work Program

There are three guiding principles of the Environmental Work Program which stem from OM's Environmental Policy:

1. Ecologically Sustainable Development (ESD):

This policy establishes a commitment for OM to integrate environmental, social, cultural, and economic considerations into decision-making processes. ESD is recognized across jurisdictions and links to specific CI policies and therefore enables specific connection and alignment between the OM environmental program and CI and general Pacific nations sustainable development goals.

2. Ecosystem-based Management (EBM):

The EBM policy establishes a commitment for OM to integrate the interdependencies and connectivity of the marine ecosystem in question (the open ocean and abyssal seafloor) into ESIA studies, rather than narrowly focus on single issues or species. Ecosystem-based approaches consider the importance of ecosystem structure and functions which contribute to healthy ecosystem services. In the deep-sea, ecosystem-based approaches require consideration of the spatial and temporal scales that are relevant to management and must address residual uncertainties. Importantly, ecosystem-based approaches identify the key indicators of ecosystem health that can be used in monitoring programs and can inform responsive and effective adaptive management strategies. Ecosystem-based management also requires consideration of the human dimension with respect to provisioning

and cultural services provided by the ecosystem. OM recognizes that social-ecological systems are coupled, and that societal choice is linked to environmental outcomes.

3. Evidence-based Decision Making:

This policy establishes a commitment for OM to engage in and promote scientific evidence in decisionmaking. Internally, this prevents unsubstantiated claims or motivations diverting effort or investment away from core processes. Externally, this drives a requirement for study scoping, stakeholder interactions, dealings with opponents etc. to be based in evidence. Evidence-based decision making is enshrined in regional and international standards and it is believed that this approach will assist Seabed Minerals Authority, National Environmental Service, and other agencies in the CI to drive the decision-making process towards a best practice that advances from the current state-of-the-art, leveraging mainly from the decades of research in the CCZ. From an internal OM perspective, this approach helps to frame critical stakeholder interactions and reduces the risk of diverting effort away from core tasks.

Moana's Environmental Work Program will be based on an Ecosystem-Based Management (EBM) framework as detailed in the *NPPLN-31000-ENVMN-00 Environmental Management Plan*, acknowledging the multiple environmental and social dimensions of the project and the environmental interdependencies of ecological function, communities and status. EBM will be operationalised by applying an ecosystem model. This will ensure that baseline studies are focused on the information requirements of a robust baseline and ESIA, that data feeds back into the model to inform adaptative management where required and importantly, that studies are connected to tractable indicators that can be adopted in later monitoring phases.

The environmental work program outlines a staged plan of work, guided by the principles outlined above, to achieve a set of deliverables. These deliverables will comply with regulations and progressively inform Moana, the Seabed Minerals Authority, National Environment Service, and other stakeholders to better understand the Cook Islands deep-sea environment and consequently manage contemplated nodule mining activities. The environmental work program will engage the best available scientific knowledge and leading scientists. In so doing, our objective is to leverage opportunities for training, education, and outreach in the Cook Islands throughout the program.

Environmental work program deliverables include:

- Information that will contribute to a broader understanding of the deep-sea environment of the Cook Islands.
- Environmental data on an exploration license area and regional scale.
- Information that will contribute to the ongoing development of a deep-sea mineral exploration industry Best Practice in Cook Islands.
- Key environmental input to decision-making during the exploration phase.
- Advancement of environmental studies in parallel with geological resource studies, recognizing that the two are closely connected.
- Environmental information required to achieve consent for Tier 2 activities. Tier 2 activities are defined as having some but not significant impacts on the environment. Most exploration activities and research technology have a relatively low impact on the marine environment.

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- Baseline data for an Environmental Impact Assessment for any Tier 3 activities of the exploration program and later permitting obligations. Tier 3 activities have the potential to cause significant environmental impact.
- Environmental data, reports, and stakeholder engagement.

4.2.1 Approach

Moana will adopt a staged exploration program that will generate information at the regional scale, the scale of the exploration license area, and at progressively higher resolution in focused sub-areas of the Application Area. While this Work Plan relates to the Exploration Phase of the project, Moana's intention is for all environmental work to supply the needs of an Environmental and Social Impact Assessment (ESIA). In this way, the longer-term objectives of project commercialization and permitting direct the scope of the environmental studies and ensure that the environmental information requirements are embedded in the resource studies from the beginning of exploration.

The majority of exploration activities are classed as Tier 2 activities by the Environment Act (2003), being unlikely to cause serious harm and therefore do not require a specific exploration-level Environment Impact Assessment. Throughout the Exploration Work Plan, the need may arise for Tier 3 activities which would trigger a specific exploration-level Environmental Impact Assessment. Should Tier 3 activities and Environmental Impact Assessment be required, these will be completed in parallel to, and integrated with, the broader ESIA framework. The key junctures and information requirements of the Work Plan are described below.

4.2.1.1 Stakeholder Engagement

Deep-sea minerals exploration in Cook Islands will involve a range of stakeholders. Some of these are under the influence of well-funded global Non-Governmental Organisations and the Clarion Clipperton Zone experience suggests that there is likely to be vocal opposition expressed throughout the exploration program. The Clarion Clipperton Zone experience also suggests that there are a range of contractor strategies that can be employed to deal with negative press, research findings, industry promotion etc. Planning is required to ensure that emerging stakeholder issues are identified, assessed and dealt with appropriately and that messaging and strategy at the highest levels of OM stays a consistent course, ethical business practices are followed, and in-country investments are protected.

A stakeholder group will be invited to workshops at key junctures of the ESIA Scoping Study in order to inform and seek feedback on ESIA logic and study design. This process will seek specific input for the ecosystem model with respect to knowledge held in-country. Aside from on-going engagement and interaction with the CI community, additional formalized workshops will be held at important milestones, such as at the completion of exploration campaigns, to ensure there is transparency, the stakeholders are aligned with the project objectives, and any adaptation requirements are identified early. Throughout this process, there will also be a focus on identifying collaborative research and training opportunities.

4.2.2 Environmental Work Plan Activities

The plan of activities for a 5-year exploration license is summarized in Table 2 and is described below for each year. The Work Plan is designed around the sequencing of the information requirements and the concept of mobilizing "Campaigns" (voyages), with multiple "Legs" (crew-changes). Each leg

represents a group of studies that complement each other in terms of the scientific disciplines and the logistical/equipment requirements.

4.3 Offshore Operational Plan

The proposed plan of work as summarized is designed to improve the current technical and economic assessment of the project in a stepwise manner, starting with those issues perceived to be most critical to the ultimate commercialization potential. The plan has been developed by the Moana team which is able to leverage significant experience with legacy nodule exploration, mining, and metallurgical processing experience from the 1970's, as well as more up to date experience in mineral extraction, current seabed mining equipment operations, and deep-water oil and gas operations.

After internal reviews of the information on hand and completion of a gap analysis, a technical readiness assessment and a review of the requirements for securing of mining and environmental permits and permissions, Moana has established the following priorities for the initial two-year exploration program. They are:

- Collect broad area (full Application Area) bathymetric and geotechnical data essential for planning of anticipated exploration cruises, compilation of EIS/EIA, and engineering design work programs.
- Collect bulk samples of nodules for use in metallurgical tests to conduct scale testing and validate OM's selected extraction and refining process.
- Continue the collection of baseline environmental data, including benthic and physical oceanographic data.
- Validate and optimize the modified Free Fall Grab for ongoing use as resource reporting tool.
- Collect engineering, bathymetric, and geotechnical data to validate design assumptions and update concept designs for the mining system, to be used in an updated cost estimate and risk assessment as input to updating reports.
- Update the published Preliminary Economic Assessment at a scoping level; and
- Commence a Sustainability Review on impact and potential benefits of the project to the Cook Islands and commence capacity development of Cook Islanders.

The bathymetry data is needed to perform detailed campaign planning and scheduling of the remaining campaigns, ensuring collection of all the data needed to complete the full exploration work program. Specifically, selection of sites for the long-term environmental array as selection of seafloor sample locations cannot be optimally selected without this information.

The bulk sampling and engineering data collection are required to conduct metallurgical tests to assess the ultimate technical and commercial viability of the scalability and effectiveness of the metallurgical processing methods. This data and metallurgical test results provide input into the mining project economic models, thus forming the basis for updating the Preliminary Economic Assessment. With this information at hand, the decision on further exploration and investments can be made.

The continuation of collecting of environmental baseline data, started during our 2019 research campaign, is critical and will continue immediately to contribute to our plan of applying for and acquiring a Mining License and Environmental Permit by the end of the 5-year exploration license period.

Moana's program differs from traditional exploration programs in that Moana intends to extensively utilise

local resources available in the Cook Islands. This approach does create challenges in that local assets and personnel do not always meet all our technical criteria; however, through working together, planning, engineering, and training these challenges can be overcome. This strategy was demonstrated during execution of our 2019 research campaign with favorable results. Consequently, our exploration program is designed around more frequent campaigns, each consisting of multiple legs, allowing the swap out of resources and personnel based on the specific needs of the desired work program. The equipment spreads chosen for the work programs are mobile to ensure the mobilization to and from the desired local vessel remains achievable and flexible.

The following sections discuss the general approach to the work planned during the first two years and specifically Expedition #1. If awarded an exploration license, detailed procedures and schedules for the expedition shall be developed and final equipment selections made, with charter and operational details for a vessel established and principally agreed during detailed planning of the campaign.

Phase	Environmental Activities	Key Task/Objective	Reports / Results
	YEAR 1		
Project start-up	Licensing and permits		
	Establish ecosystem model basis		
	ESIA Scoping Study and Stakeholder Workshop		
	Study design and service provider contracting	Contracting, licenses and permits	
	Environmental work package commissioning and desktop studies	Year 2 Plan of Work	
	Project logistics and Campaign#1 planning	ESIA Scoping Study	
Reporting and consultation		Service provider contracting	Sampling Work Plan
Campaign#1	Tier 2 desktop environmental risk assessment		
Leg 1 Multibeam survey	Vessel-based multibeam bathymetry and backscatter		
Leg 2 Seafloor sampling	FFG nodule resource sampling		Bulk sample collection for metallurgical and engineering tests
	Boxcore sampling – nodule classification, geochemistry and biology		
	Regional and contract area water sampling and CTD casts		
	Drifting hydrophone program		

Table 2 - Work Program Activities

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Phase	Environmental Activities	Key Task/Objective	Reports / Results			
	Observation program					
	YEAR 2					
Desktop	Habitat mapping and spatial planning	Seabed bathymetry and backscatter	Metallurgical pilot test program			
	Data integration, reporting and consultation	Habitat domains and spatial planning	Updated mineral resource			
	Campaign#2 planning	Regulator and stakeholder consultation	Post sampling report			
Campaign#2	Voyage work plan and desktop environmental risk assessment					
Leg 1 Oceanographic moorings	Oceanographic moorings installation	Instrumentation deployed to record time-series data for current speed and direction, water column structure, underwater noise, cetacean vocalisations, particle flux				
	Regional and contract area water sampling and CTD casts	Rosette water samples and CTD profiles to charactersie water column structure and physicochemistry				
	Drifting hydrophone program	Drifting arrays to record cetacean vocalisation				
	Observation program					
Leg 2 Seafloor	Seabed imaging - nodule resource, habitat and megafauna		Engineering soil parameters			
imaging and sampling	nodule resource sampling					
	Drifting hydrophone program					
	Observation program					
	Boxcore sampling - geochemistry and biology					

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Phase	Environmental Activities	Key Task/Objective	Reports / Results
Leg 3 Seafloor	Multicore sampling - biogeochemistry and biology		
sampling	Benthic lander sampling - biogeochemistry		
	Drifting hydrophone program		
	Observation program		
Desktop	Data integration, reporting and consultation	Preliminary plume model	Geological and mineralization model
	Spatial planning	Year 3 Plan of Work	Indicated resource
	Campaign#3 planning	Regulator and stakeholder consultation	
			Update PEA
	YEAR 3		·
Project- specifications and design	Finalise project design specifications and needs for Tier 3 activities (Testing)		
Campaign#3	Voyage work plan and desktop environmental risk assessment		
Leg 1	Oceanographic moorings servicing		
Oceanographic moorings	Regional and contract area water sampling and CTD casts		
	Drifting hydrophone program		
	Observation program		
Leg 2 Pelagic sampling	Pelagic sampling - biological sampling and acoustic sensing	FFG nodule resource sampling	
	Regional and contract area water sampling and CTD casts		
	Drifting hydrophone program		
	Observation program		
Desktop	Campaign#4 planning	Scope of required Tier 3 EIA if required	
	Data integration, reporting and consultation	Regulator and stakeholder consultation	Workplans for engineering test work
	Updated provisional plume model		

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Phase	Environmental Activities	Key Task/Objective	Reports / Results
Campaign #4	Voyage work plan and desktop environmental risk assessment		
	Drifting hydrophone program		
	Observation program		
Leg 2 Seafloor	Boxcore sampling - geochemistry and biology		
sampling & Tier 3 EIA	Multicore sampling - biogeochemistry and biology		
	Benthic lander sampling - biogeochemistry and biology	Commencement of Tier 3 Activity EIA if required	
	Drifting hydrophone program	Continuation of Environmental Baseline	
	Observation program	Continuation of integrated ESIA	Update geological and mineralization model
Desktop	Campaign#5 planning	Year 4 Plan of Work	Update resource
	Data integration, reporting and consultation	Regulator and stakeholder consultation	Engineering test work
			Prefeasibility Study
	YEAR 4		
Campaign #5	Voyage work plan and desktop environmental risk assessment		
Leg 1 Oceanographic	Oceanographic moorings servicing and		
moorings	3 EIA		
moorings	Regional and contract area water sampling and CTD casts		
moorings	Regional and contract area water sampling and CTD casts Drifting hydrophone program	Tier 3 Activity EIA if required	
moorings	Regional and contract area water sampling and CTD casts Drifting hydrophone program Observation program	Tier 3 Activity EIA if required Integration of Tier 3 Activity results to ESIA	
moorings Leg 2 Pelagic sampling	Regional and contract area water sampling and CTD casts Drifting hydrophone program Observation program Pelagic sampling - biological sampling and acoustic sensing	Tier 3 Activity EIA if required Integration of Tier 3 Activity results to ESIA	
moorings Leg 2 Pelagic sampling	New focus installations if required for her 3 EIA Regional and contract area water sampling and CTD casts Drifting hydrophone program Observation program Pelagic sampling - biological sampling and acoustic sensing Regional and contract area water sampling and CTD casts	Tier 3 Activity EIA if required Integration of Tier 3 Activity results to ESIA	
moorings Leg 2 Pelagic sampling	New focus installations if required for her 3 EIARegional and contract area water sampling and CTD castsDrifting hydrophone programObservation programPelagic sampling - biological sampling and acoustic sensingRegional and contract area water sampling and CTD castsDrifting hydrophone program	Tier 3 Activity EIA if required Integration of Tier 3 Activity results to ESIA	

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Phase	Environmental Activities	Key Task/Objective	Reports / Results
Leg 3 Any required Tier 3 activities	Tier 3 EIA program if required	Continuation of Environmental Baseline	
Leg 3 Any required Tier 3 monitoring	Tier 3 EIA program if required	Continuation of integrated ESIA	
Desktop	Tier 3 EIA if required	Year 5 Plan of Work	
	Data integration, reporting and consultation	Regulator and stakeholder consultation	Feasibility Study
	Final plume model		
	YEAR 5		
Resource Evaluation	Compliant resource evaluation report		Resource Estimate Report, including Models
Feasibility and Business	Feasibility study and business evaluation report		
Evaluation			Mining Project Execution Plan
			Economic Study
Exploitation ESIA	Progressive development and finalization	Submit and review ESIA Report	Mine Plan

4.3.1 Vessels

OM is considering multiple vessels for use as platforms from which to conduct our exploration activities. It is highly desirable to find a way to use a local Cook Islands vessel, based in Avarua as we did to execute our research campaign. For that reason, equipment selection and design has been considered to meet this objective. The designs of the water column and seafloor sampling equipment, dredge basket, seafloor camera spread, and FFGs have also been reviewed or adapted to meet this objective.

5 **RISK/BENEFIT ASSESSMENT**

Marine operational maritime risks are preliminarily identified in document **NPPLN-41200-INRSP-00 Incident Response Management Plan**. Some preliminary high-level risks related to Expedition #1, some other high-level risks and even some benefits that directly impact the Cook Islands are identified in this section.

These risks have been reviewed and a first pass mitigation strategy established. The risks have not been rated and ranked; however, these risks together with any additional risks identified during the detailed planning phases of our campaigns will be managed in accordance with the Risk Management Plan.

At this early stage we believe we can, through effective identification and definition of requirements, and by designing for the necessary infrastructure, mitigate, manage or eliminate the identified risks.

The significant risks and benefits identified include:

1. <u>Risk – Impact of chartering the local vessels</u>

The vessel charter for Expedition #1 could be as long as 30 days during which time the vessel under charter would not be available for other uses. OM is cognizant of the role the local vessels play in supplying local communicates and therefore OM is considering methods whereby the local vessels could be made available to conduct supply cruises during the period between initial installation of the equipment spread and commencing testing and the exploration cruise. Details around this plan will be reviewed during charter negotiations. To accommodate this plan, strategies being considered are the type of equipment being deployed and the method of installation.

2. <u>Risk – Loss of the local vessel</u>

The loss of the local vessels chartered by OM would impact the ocean as well as the local population. To mitigate the impact to the ocean, OM will work with the vessel owners to ensure there is adequate insurance in place to allow for the required remedial actions needed to ensure minimal impact to the environment.

3. Risk – Misinformation about our program and intentions

To ensure there is no misunderstanding of OM's intentions and activities, OM will be engaging with stakeholders and the community to ensure our plans and intentions are clearly communicated and understood by all parties. To ensure this process is ongoing, OM, once approvals are received, will employ a resident Cook Islander in the capacity of Community Engagement Coordinator and Environmental Liaison Officer to provide local access to OM and to communicate and explain OM's activities and intent to stakeholders and the general public.

4. <u>Benefit – Hiring of local resources</u>

OM is reviewing the availability and suitability of local resources for use in our program. Specifically, areas under consideration include the charter of the local vessels, use of local fabrication facilities and hiring of Cook Islanders in many of the roles identified for executing our work plan. The key benefits are the infusion of revenue into the community, the improvement of skills through training and ongoing employment of resident Cook Islanders.

5. Benefit – Expanded data for marine scientific research

Continued addition of environmental, seafloor and nodule data to the Cook Islands' database of

information on the seabed and ocean from within broad range of the CIEEZ. This data includes bathymetry, sub-bottom profiling and backscatter data of the seafloor, water column data including currents, temperature, conductivity and pressure. This data provides long term baseline information for use and to the benefit of Marine Scientific Research of the Cook Islands.

Moana strongly believes the benefits of exploration outweigh any risks and look forward to the opportunity to work with the stakeholders within the Cook Islands to expand our knowledge and understanding of the deep seabed and surrounding environment within the CIEEZ on a path to possible future sustainable development of the CI nodule resource.

6 PROPOSED EXPENDITURES & CASH FLOW

Table 3 presents the projected preliminary annual costs for each of the major tasks to be carried out in support of the proposed program of activities with reasonable confidence for the initial two years and high-level cost estimates for remaining 3 years of the exploration plan. These costs include preliminary estimated costs to be incurred directly by OM for activities that directly benefit the Application Area.

Expenditures are given for continued environmental baselining and monitoring, completion of ESIA, resource upgrade and expansion, process and engineering advancement and design, technology derisking, trials and test programs, and economic evaluation. This is the current estimate, and it is the intention of OM to carry out this program in a timely fashion as depicted in Table 3. However, as this plan is preliminary, changes to the pace and timing of activities and expenditure may be revised due to vessel schedules, new information acquired, technical learnings, the state of the metals market, Covid-19 restrictions and other factors. Per the Regulations, we will work with the Authority to make appropriate changes to the program of activities and the expenditure forecasted herein as may be necessary and prudent. For the avoidance of doubt, OM's obligation to incur any expenditure will not be considered to have accrued until the year in which it is scheduled to be incurred.

Work Plan Budget	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL WORK PLAN
						-
US Office	863,600	2,914,400	2,914,400	2,914,450	2,448,150	12,055,000
Cook Islands	101,000	280,550	384,000	432,000	432,000	1,629,550
General Travel	88,000	258,000	258,000	258,000	207,000	1,069,000
	-	-	-	-	-	-
Total Overhead Expenses	1,052,600	3,452,950	3,556,400	3,604,450	3,087,150	14,753,550
						-
Dermitting & Licensing	410.000	100.000	100.000	200.000	250.000	0
Permitting & Licensing	410,000	100,000	100,000	200,000	250,000	1,060,000
Prospecting Permit (REE)	210,000	-	-	-	-	210,000
Exploration License	200,000	100,000	100,000	100,000	-	500,000
	-	-	-	100,000	250,000	350,000
Campaigns	5,644,000	7,763,500	5,580,500	2,359,750	36,000	21,383,750
Equipment Storage, Maintenance & Staging Facility		21,000	12,000	12,000	12,000	57,000
Training/Outfitting of Local CI Maintenance Crew		24,000	24,000	24,000	24,000	96,000
Campaign #1	5,634,000	-	-	-	-	5,634,000
Campaign #2	10,000	7,678,500	-	-	-	7,688,500
Campaign #3	-	40,000	3,140,000	-	-	3,180,000
Campaign #4	-	-	2,394,500	10,000	-	2,404,500
Campaign #5	-	-	10,000	2,313,750	-	2,323,750
Environmental (Sample Processing,)	180,000	490,000	1,280,000	2,645,000	550,000	5,145,000
Resource Upgrade	-	100,000	200,000	-	-	300,000
Geological Characterization	-	-	300,000	-	-	300,000
Metocean Data	20,000	-	-	-	-	20,000
Processing System	455,000	1,195,000	-	-	-	1,650,000
Mining System	-	-	350,000	-	-	350,000
Reporting	-	150,000	850,000	-	-	1,000,000
Contingency	105,880	274,398	331,820	322,473	194,358	1,228,928
Operating Expenses	6,814,880	10,072,898	8,992,320	5,527,223	1,030,358	32,437,678
Total Expenses and Capital Spend (US\$)	USD 7,867,480.00	USD 13,525,847.50	USD 12,548,720.00	USD 9,131,672.50	USD 4,117,507.50	USD 47,191,227.50
Total Expenses and Capital Spend (NZ\$) 1.37	NZD 10,778,447.60	NZD 18,530,411.08	NZD 17,191,746.40	NZD 12,510,391.33	NZD 5,640,985.28	NZD 64,651,981.68

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Table 4 estimates expenditures as a percentage of total for key objective categories of the exploration work plan – namely, programs around environmental management, resource estimates, and engineering.

Spending Stream	Total Spend (NZD)	Percentage of Total
Overhead/Operational	20,212,363	31%
Environmental	33,526,707	52%
Resource	3,051,675	5%
Engineering	3,767,500	6%
Other	4,093,736	6%

Table 4 - Expenditures as a % of Total

Work program Expected Expenditure (in New Zealand Dollars) based on Exploration License award in April 2021.

AN OCEAN MINERALS GROUP COMPANY

MOANA

MINERALS

Cook Islands Exploration License Application

Environmental Management Program

As at January 5, 2022

NPPLN-31000-ENVMN-01



Integrated Environmental Management Plan

APPROVAL/S

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1 OBJECTIVES OF OCEAN MINERALS' ENVIRONMENTAL MANAGEMENT PROGRAM

The Ocean Minerals Group of companies (OM) is comprised of US registered parent company Ocean Minerals, LLC (OML) and wholly owned subsidiary companies including US registered OML Rare Earth, LLC and Cook Islands registered Moana Minerals Limited (Moana). For practical purposes, all funding, management, and operational activities are performed by OM personnel under intercompany agreements. Parties to contracts with contractors and consultants will be at subsidiary level whenever practical, and as such meet the requirements for local content and spending. For purposes of the application, when OM is referenced, it could imply either OML or Moana Minerals, or both.

Moana Minerals' specific Work Plan is described in document **NPPLN-00000-EXWRK-00 Exploration Work Program** and the key elements of the environmental aspects of the work plan are summarized herein. The plan will draw on the lessons that the team has learned through decades of experience in the deep-sea mining sector, our exposure to activities in the CCZ and our appreciation for the factors that are unique and specific to the Cook Islands.

OM recognizes the importance of good corporate stewardship to the successful implementation of seabed minerals exploration and mining. The appreciation of the cultural connections that Cook Islanders have with the ocean is a key aspect of the social dimension of the EMP and related Local Engagement, Training and Business Development Plan. This EMP recognizes the traditional and 'modern religious' aspects of the cultural environment and the direct link between these aspects and the Marae Moana Act (2017), a modern legislative instrument that is underpinned by indigenous approaches of ' $r\bar{a}'ui'$ – a traditional form of natural resource management – and that was instituted with strong bipartisan support and in collaboration with the House of Ariki.

OM's strategy to establish the environmental studies within an over-arching Environmental and Social Impact Assessment (ESIA) framework that includes a robust engagement and consultation plan reflects our understanding of the importance of social and cultural dimensions to environmental management.

The general objectives of the exploration Environmental Management Program (EMP) are to:

- Operationalize OM's Environmental Policy and international best environmental practice.
- Fulfil OM's regulatory obligations.
- Avoid Serious Harm in exploration.
- Adopt a Precautionary Approach.
- Provide a structure for administration, environmental monitoring and reporting of the environmental work plan and a basis for adaptive management.
- Harmonize geological resource exploration with environmental baseline data collection.
- Embed environmental studies within an Ecosystem-Based Management framework.

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- Embed environmental studies in the exploration program within an Environmental and Social Impact Assessment (ESIA) framework so that OM can pivot from exploration to environmental permitting of exploitation.
- Initiate environmental studies that are on the critical path to exploitation permitting and financing, particularly those that require long temporal baselines.
- Target studies to generate information required for the environmental management of deep-sea mining, while also connecting with broader knowledge generation in the Cook Islands and marine scientific research opportunities.
- Provide a platform for best available scientific knowledge for use in evidence-based decision making.
- Provide a platform for capacity building, education and stakeholder consultation.
- Provide transparency in communicating environmental data and information to Cook Islands and international stakeholders.
- Be part of an emerging Best Practice in Cook Islands seabed minerals exploration and collaborate with the SBMA and other agencies to meet Sustainable Development Plans and Seabed Minerals Policy.

2 DEFINITIONS, ABBREVIATIONS AND ACRONYMS

Field	Description or Definition
μm	Micron
AABW	Antarctic Bottom Water
AUV	Autonomous Underwater Vehicle
CBD	Commission on BioDiversity
CCZ	Clarion Clipperton Zone
CEO	Chief Executive Officer
CI	Cook Islands
CIEEZ	Cook Islands Economic Exclusion Zone
EBSA	Ecological and Biological Sensitive Area
EEZ	Economic Exclusion Zone
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
EU	European Union
EWP	Exploration Work Plan
FAD	Fisheries Aggregating Device
FFG	Free Fall Grab
GHG	Greenhouse Gas
IRMP	Incident Response Management Plan
ISA	International Seabed Authority
ISA	International Seabed Authority
km	Kilometre
LAT	Average Low water Mark
m	Meter(s)
MARPOL	The International Convention for the Prevention of Pollution from Ships
Moana	Moana Minerals Limited
NES	National Environmental Service
NGO	Non-Governmental Organization

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nM	Nautical Mile		
ОМ	Ocean Minerals Group comprised of Ocean Minerals LLC, and Moana Minerals Limited		
OML	Ocean Minerals LLC		
POC	particulate organic carbon		
ROV	Remote Operated Vehicle		
SBMA	Seabed Minerals Authority		
SEC	South Equatorial Current		
SMS	Submerged Massive Sulphide		
SOP	Standard Operating Procedure		
SOPAC	South Pacific Applied Geoscience Commission		
SPB	South Penrhyn Basin		
UNESCO	United Nations Educational, Scientific and Cultural Organization		

3 POLICIES, LEGISLATION, GUIDELINES AND TREATIES

3.1 OM Environmental Policy

3.1.1 Overview

OM is committed to causing no serious environmental harm in any of our operations and mitigating direct and indirect environmental impacts across our business. OM will apply international best practice in environmental sustainability and strive for excellent performance in environmental management.

3.1.2 Scope

This policy applies to all OM employees and contractors in all of our land-based and offshore operations.

3.1.3 Principles

OM will:

- Comply with the environmental laws and regulations of the jurisdictions in which we operate.
- Operate within an Ecosystem-Based Management framework that centralizes our environmental knowledge base, identifies project environmental risks, prioritizes environmental studies, and operationalizes this policy in Environmental and Social Impact Assessments.
- Respect traditional knowledge and customary practices of environmental management and incorporate these cultural environmental aspects into our environmental management framework.
- Apply the Precautionary Principle where appropriate in our operations.
- Recognize the significant potential for deep-sea mining to contribute to economic development in our areas of operation and the responsibility to adhere to global and jurisdictional Sustainable Development Goals and Policies.
- Develop and nurture a culture of environmental management across the company and implement programs of employee awareness, energy and emissions reduction and sustainable supply chains.
- Foster a culture of corporate environmental stewardship and collaboration among regulators, stakeholders and research partners and install an adaptive management approach to continually improve environmental performance.
- Apply best available scientific and technological approaches to environmental management.

3.1.4 Breaches

OM recognizes that breaches of this policy at the level of the individual employee to business units has the potential to cause economic, social, and ecological impacts. All suspected breaches will be investigated, and appropriate disciplinary and remedial action taken.

3.1.5 Policy Interaction

This policy links with:

- Environmental, Community, Occupational Health and Safety Policy
- Risk Management Plan
- Quality and Best Practice as defined in the Environmental Data and Sample Quality Assurance processes of the Exploration Program (see Section 5.1).

3.2 Cook Islands Legislation, Policies and Guidelines

The key legislation, policies, guidelines, and programs in place for the Cook Islands are listed in Table 1.

Table 1 - Cook Islands legislati	on, policies, guidelines, and programs
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Instrument	Description	Responsible Department/Agency
Legislation		
Seabed Minerals Bill (2019), Seabed Minerals Amendment Act (2020), Seabed Minerals (Exploration) Regulations (2020), Environment (Seabed Minerals Activities) Regulations (2020)	abed Minerals Bill 19), Seabed Minerals endment Act (2020), abed Minerals (ploration) gulations (2020), vironment (Seabed nerals Activities) gulations (2020)Sets out the governance requirements for the licensing of exploration and exploitation activities. Upholds the requirements of the Environment Act (2003) and establishes compliance requirements.	
Cook Islands Environment Act (2003)	Core legislation under which an ESIA will be completed and which controls the permitting of activities that have the potential to cause significant environmental harm.	The Cook Islands National Environment Service
Marae Moana Act (2017)	Requires that the Cook Islands EEZ area be managed for the primary purpose of protecting and conserving the ecological, biodiversity and heritage values of the Cook Islands marine environment. Founded on the traditional principals of ' $r\bar{a}$ ' u ' – a form of traditional spatial	Marae Moana Council, Marae Moana Technical Advisory Group, and other agencies

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	management applied in ancestral society. Allows for seabed mining.	
Marine Resources Act (2005)	Establishes the entire Cook Islands EEZ as a whale sanctuary and a shark sanctuary. This declaration provisions for the protection of whale and shark species against commercial exploitation and the management of tourism, fisheries and scientific research and other activities that have the potential to intentionally or inadvertently interact with these species.	Ministry of Marine Resources
Cook Islands Natural Heritage Trust Act (1999)	Establishes a Cook Islands Natural Heritage Trust with the necessary resources and powers to investigate, identify, research, study, classify, record, issue, preserve and arrange publications, exhibitions, displays and generally educate the public on the science of, and traditional practices and knowledge relating to, the flora and fauna of the Cook Islands.	
Prevention of Marine Pollution Act (1998)	An act to provide for the prevention of marine pollution, the dumping and transportation of other waste in Cook Islands Waters by vessels and to give effect to various international conventions on marine pollution and protection of the marine environment.	Ministry of Transport
Maritime Transport Act (2008)	Provide for the maritime safety of the Cook Islands and Cook Islands vessels and protect the marine environment.	Ministry of Transport
Maritime Zones Act (2018)	Declares the territorial sea (LAT to 12 nM), contiguous zone (LAT to 24 nM), exclusive economic zone (LAT to 200 nM), and continental shelf of the Cook Islands as the maritime zones of the Cook Islands. Declares, and expresses the rights of the Cook Islands and other States in relation to, the maritime zones of the Cook Islands consistently with international law. Repeals with Continental Shelf Act (1964) and the Territorial Sea and	All

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	Exclusive Economic Zone Act (1977).		
Traditional Knowledge Act (2013)	Gives legal recognition to and protection of the rights in the traditional knowledge of the traditional communities of the Cook Islands (e.g. traditional canoe carving, traditional conservation practice, fishing practice, etc.)	Ministry of Cultural Development	
Policy			
National Seabed Minerals Policy (2014)	Sets out the Government's sustainable management and regulation of seabed minerals.	Seabed Minerals Authority	
Te Tarai Vaka (Cook Islands Environmental and Social Safeguards Policy)	Sets out the Government's objectives for environmental and social safeguards for the Cook Islands.	Central Policy and Planning Office of the Office of the Prime Minister, Ministry of Finance and Economic Management	
Guidelines			
Te Tarai Vaka (Cook Islands Environmental and Social Safeguards Guideline)	Guidance for environmental and social safeguards for the development seabed mining in Cook Islands.	Central Policy and Planning Office of the Office of the Prime Minister, Ministry of Finance and Economic Management	
Te Kaveinga Nui (Cook Islands National Sustainable Development Plan 2016- 2020)	Sets out Cook Islands sustainable development goals.	Central Policy and Planning Office of the Office of the Prime Minister, Ministry of Finance and Economic Management	

The Cook Islands Marae Moana Act (2017) establishes the entire EEZ as an area to be managed for the primary purpose of protecting and conserving the ecological, biodiversity and heritage values of the Cook Islands marine environment. Marae Moana is somewhat unique in that it considers the whole EEZ as a connected ecosystem that is 'protected', while also identifying areas within the EEZ where industry can be allowed. As such, Marae Moana is considered an overarching ocean management framework, within which deep-sea mining is identified as an allowed, spatially defined activity. The Marae Moana Act (2017) also establishes formal marine protected areas of 50 nM around each land mass, where commercial activities are prohibited. OM's Application Area is outside the 50 nM protected areas. Marae Moana is underpinned by indigenous approaches of 'rā'ui' – a traditional form of natural resource management that prevented access to certain areas or during certain times – which is reflected in modern marine spatial planning approaches.

Marae Moana has strong bilateral government support and strong support from the community. The Act is administered by the Marae Moana Council that is chaired by the Prime Minister and comprises the opposition lead, a religious leader, a representative of the finance ministry and community leaders. The Act was established in consultation with the House of Ariki: the 'house' of chiefs. The Seabed Minerals Amendment Act (2020) upholds the requirements of the Marae Moana Act (2017) and in practice, a deep-sea mining application received by the Seabed Minerals Authority would be assessed against the nine Marae Moana principles of ecologically sustainable use (Table 2).

Table 2 - Principles of the Marae Moana Act (2017) against which seabed mining applications will be assessed, and how the Exploration Work Plan will address these principles.

Principle	Description	How Moana Minerals exploration program accords
1. Principle of protection, conservation, and restoration	The areas within the marae moana should be protected, and their biodiversity conserved, for their cultural and natural heritage value; and shared by all Cook Islanders:	The release of exploration blocks by the SBMA is within the context of marae moana. The impacts of exploration activities will be similar to other large scale research programs and will fall below internationally accepted thresholds of serious harm. The pre-campaign work plan documentation will include desktop risk assessments of the activities and any exploration activities that pose a risk of serious harm will be subject to an EIA pursuant to the requirements of the Environment Act (2003). The exploration research will shed light on the biodiversity values in the EEZ and the ESIA process will emphasize the cultural heritage aspects. The exploration research will shed light on the habitats and ecological function of midwater and benthic environments that will inform the identification of BPAs/PRZs. Potential ESBAs (e.g. seamounts) that fall within contract areas will also be explored which will feed into spatial planning.
2. Principle of sustainable use to maximise benefits	The marine resources should be used to maximise benefits, while meeting key environmental objectives to benefit current and future generations of Cook Islander	The release of exploration blocks by the SBMA is within the context of marae moana, which ultimately seeks to create opportunities to increase quality of life for Cook Islanders. The exploration research program will generate knowledge not only on the environmental conditions, but also the mineral resource and financial viability of deep-sea mining such that sustainable use can be assessed now and into the future. If it eventuates that deep-sea mining is not deemed to be acceptable by Cook Islanders at this time, the exploration program will still yield the required information to understand the extent of the marine resource and the technical, legal,

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		environmental and social dimensions of sustainable development for future consideration. The impacts of exploration activities will be similar to other large scale research programs and will fall below internationally accepted thresholds of serious harm.
3. Precautionary principle	The precautionary principle of the Rio Declaration should be applied where there are threats of serious or irreversible damage, and that a lack of full scientific certainty should not be used as a reason for postponing cost- effective measures to prevent environmental degradation in accordance with the Cook Islands' capabilities in the implementation of the marae moana	The precautionary principle underpins all consideration of deep-sea mining seeks to maximise benefits and minimise impacts. The Moana Minerals' team exposure to the ISA regulatory regime in the CCZ brings an awareness of the practical implementation of the precautionary principle. By implementing an ecosystem-based management framework in the exploration program Moana Minerals seeks to generate data that increases certainty and provide objectives tools with which to assess risk. Parameterised ecosystem models using a spectrum of conceptual, fuzzy cognition, Bayesian inference through to fully quantified sub-models can be used to test scenarios and assess ecosystem responses. The aspiration is that this in turn can be used to analyse where potential thresholds exist, identify safe operating spaces, and test various development concepts.
4. Principle of community participation	All stakeholders should participate in the planning and implementation processes, which means that information exchange, consultation, respect for differing points of view, recognition of culture and traditions, equitable access to opportunities for present and future generations, easily understood and openly justified processes, and the shared ownership of responsibility should be promoted and encouraged in the decision-making processes of the marae moana	Moana Minerals has engaged in an ESIA process, recognising the critical importance of social impact assessment in Cook Islands. Specialists in this area have been engaged to develop a Stakeholder Engagement Plan (SEP). The IAP2 Spectrum of Public Participation (2018) is a global best practice model being applied (see response to question above about NGO engagement). The scoping study includes a thorough review of the social and cultural dimensions of the project. Recognising the importance of community participation, one the first activities that Moana Minerals will engage in upon award is the presentation and workshopping of an ESIA Scoping Study which is currently being prepared which details the environmental and social studies. To date, Moana Minerals has provided feedback on a range of SBMA outputs. During our 2019 sampling voyage, Moana Minerals consulted widely with community, participated in a range of engagements and produced outputs for television and print media.

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5. Principle of transparency and accountability	The processes for assessing, planning, allocating, managing, and evaluating management of ocean resources should provide transparent and clear lines of accountability	Moana Minerals demonstrated transparency though the 2019 voyage by openly sharing samples and data. SBMA personnel, NES personnel, independent observers and senior members of community participated in offshore activities. In the exploration program we are implementing Data Management standards that align with the ISA DeepData systems which transparently share environmental data and seek to foster inter- contractor collaboration. The data management systems have functionality to provide online portals and reporting consoles to provide real-time tracking of activities. Accountability will be serviced through a strict licensing process and through Moana Minerals' corporate policies.
6. Principle of integrated management	The integration of decision making across all relevant stakeholders (Government, non- government, and external partners) should be pursued in decisions affecting the operation of this Act	The SBMA, NES and Marae Moana Council are three key agencies with links to technical advisory panels, independent reviewers and public consultation obligations. This nexus of regulatory authorities will be a core aspect of integrated management. Moana Minerals, through our ecosystem-based management approach and Stakeholder Engagement Plan will provide data and information at the required intervals to foster integrated decision making. Our transparency environmental data and implementation of our data management process, in addition to sharing things like ideas on standardised habitat classifications, will foster integration across contractors.
7. Principle of investigation and research	A culture of investigation and research as a basis of discussion and decision-making should be fostered, and that ocean planning and management decisions should be based on the best available scientific and other information, recognising that current information regarding ocean resources may be limited	The exploration program of work is indeed a major research program that will involve multiple disciplines across international teams. Scientific publishing in addition to reports and educational material will be generated. Moana Minerals strongly supports evidence-based decision making. A major driver of the ESIA scoping study is to identify the specific studies that are required to inform management decisions, and not just develop an exhaustive list of scientific research projects.

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8. Principle of ecosystem- based management	There should be an ecosystem-based approach to the management of natural resources that aims to sustain the health, resilience, and diversity of ecosystems of species, while allowing for sustainable use by humans of the goods and services they provide	An ecosystem-based approach is a centrepiece of Moana Minerals' exploration program. Moana Minerals has engaged in an ESIA scoping study which has built an ecosystem modelling framework that resolved to ecological responses and ecosystem services. The model connects studies and data requirements through that model to ensure that ecological functions and ecosystem services are protected and that the required data are being generated.
9. Principle of sustainable financing	Adequate funding for activities implemented for the marae moana should be pursued to achieve desired outcomes	Moana Minerals has raised, and continues to raise further funds, to support the execution of our exploration work plan that was built to ensure adherence to the morae moana principles. Moana Minerals has not, and will not, allow investors or lenders to restrict the use of monies obtained in a manner that might limit its commitment to ensure the principles of the Marae Moana Act are adhered to.

3.3 International Regulations and Guidelines

International regulations and guidelines are listed in Table 3. While these are not directly required for operation in the Cook Islands EEZ, it has been made explicit by the Cook Islands Seabed Mineral Authority that equivalency is sought where appropriate with regulations, guidelines, and experiences from the Area (the ocean areas outside of any EEZ where mineral resources are under the jurisdiction of the International Seabed Authority). These regulatory instruments and guidelines form a growing body of international best practice in the deep-sea mining industry and because they have been developed through collaboration with scientists and a diversity of interests, are likely to inform the expectations of stakeholders in Cook Islands.

Table 3 -	International	regulations	and guide	elines.
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Instrument	Description	Responsible Department/Agency
Regulations and Recommendations		
Consolidated Regulations and Recommendations on Prospecting and Exploration (2015)	Compilation of guidelines and regulations related to prospecting and exploration in The Area	International Seabed Authority
Recommendations for the guidance of contractors for the assessment of the possible environmental	2020 recommendations for EIA during exploration	International Seabed Authority

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impacts arising from exploration for marine minerals in the Area		
Draft Regulations on Exploitation of Mineral Resources in the Area (ISA 2019)	Draft 2019 for exploitation regulations in The Area	International Seabed Authority
MARPOL	Global shipping environmental controls	International Maritime Organization
Guidelines		
Pacific-ACP States Regional Environmental Management Framework for Deep Sea Minerals Exploration and Exploitation	EU-funded project with SOPAC to harmonize approaches to deep sea mining in Pacific states, including assistance with the establishment of state legislation. Establishes regional scale framework and recommendations for environmental management.	EU-Pacific Community (SPC)
Pacific-ACP States Regional Scientific Research Guidelines for Deep Sea Minerals	EU-funded project with SOPAC to harmonize approaches to deep sea mining in Pacific states, including assistance with the establishment of state legislation. Recommends approaches to engaging in scientific research.	EU-NIWA-Pacific Community (SPC)
Pacific-ACP States Regional Financial Framework for Deep Sea Minerals Exploration and Exploitation	EU-funded project with SOPAC to harmonize approaches to deep sea mining in Pacific states, including assistance with the establishment of state legislation. Establishes regional scale financial framework.	EU-Pacific Community (SPC)
Various think pieces and guidelines published as ISA technical studies	Documents and workshop presentations that collectively informs the growing 'best practice' basis in The Area	International Seabed Authority

3.4 Conventions and Treaties

Cook Islands is signatory to the treaties listed in Table 4. These agreements generally set out the Government's aspirations and duties for environmental protection and sustainable development and they recognize the importance of cooperation among Pacific Island states, particularly in relation to transboundary issues.

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Treaty	Description
Convention on Biological Diversity (1992)	Aims to conserve biological diversity and species in natural surroundings, and to rehabilitate degraded ecosystems. Activities which may adversely affect biodiversity require:
Adopted at the 1992 United Nations 'Conference on Environment and Development' in Rio de Janeiro, Brazil	 Article 7. Identity and monitor impacts. Article 8. Establish a system of protected areas (including within the marine environment). Article 14(a). Conduct environmental impact assessments. Article 14(c). Promote consultation. The CBD adopts an ecosystem approach as its primary framework for action, defining the 'ecosystem' as a dynamic complex of plant, animal and micro-organism communities and their non-living environment, interacting as a functional unit.
Convention on Biological Diversity (1992) - Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS)	Provides a legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The '2020 Aichi Targets' includes a target that by 2020, parties are to implement at least 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, that are ecologically representative and connected.
1992 United Nations 'Conference on Environment and Development' – Agenda 21	 A non-binding voluntarily implemented action plan for sustainable development. It outlines key policies for achieving sustainable development that meets the needs of the poor and recognizes the limits of development to meet global needs. Specific chapters applicable to environmental management of deepsea minerals development include: Chapter 8. Integrating environment and development in decisionmaking. Chapter 15. Conservation of biological diversity. Chapter 17. Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas and coastal areas, and the protection, rational use and development of their living resources.
Nouméa Convention (1982) The Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (Nouméa Convention), adopted in 1982.	 Promotes two main objectives: to prevent, reduce and control pollution from any source; and to ensure sound environmental management and development of natural resources. Article 8 'Pollution from Seabed Activities' of the Nouméa Convention states, 'The Parties shall take all appropriate measures to prevent, reduce and control pollution in the Convention Area, resulting directly or indirectly from exploration and exploitation of the seabed and its subsoil'. Article 17 'Scientific and Technical Co-Operation':

Table 4 - Cook Islands signatory international treaties.

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	 the Parties shall co-operate, either directly or with the assistance of competent global, regional, and sub-regional organizations, in scientific research, environmental monitoring, and the exchange of data and other scientific and technical information related to the purposes of the Convention; and in addition, the Parties shall, for the purposes of this Convention, develop and co-ordinate research and monitoring programs relating to the Convention Area and co- operate, as far as practicable, in the establishment and implementation of regional, sub-regional and international research programs.
	The Noumea Convention is complemented by two Protocols: the Dumping Protocol and the Pollution Emergencies Protocol, which are applicable to Parties' EEZ and to areas of the high seas beyond national jurisdiction that are completely enclosed by this EEZ. In particular, Parties must prevent, reduce and control pollution caused by discharges from vessels, resulting directly or indirectly from exploration and exploitation of the seabed and its subsoil. It contains an EIA requirement, which must include opportunity for public comment and consultation with other States who may be affected.
The International Marine Minerals Society Code for Environmental Management of Marine Mining Voluntary code for environmental management of	 Environmental principles for marine mining: to observe the laws and policies and respect the aspirations of sovereign States and their regional sub-divisions, and of international law, as appropriate to underwater mineral developments. to apply best practical and fit-for-purpose procedures for environmental and resource protection, considering future activities and developments within the area that might be affected.
marine mineral activities (exploration and exploitation)	 to consider environmental implications and observe the precautionary approach. to consult with stakeholders and facilitate community partnerships on environmental matters throughout the project's life cycle. to maintain an environmental quality review program and deliver
	 on commitments. to report publicly on environmental performance and implementation of the code. 2. A set of operating guidelines for application at a specific mining site. Guidelines to set an environmental management program for an exploration or extraction site, that can be used by all stakeholders; including government agencies, intergovernmental and non-
Convention on the Conservation of	Platform for the conservation and sustainable use of migratory animals and their habitats.
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Migratory Species of Wild Animals (CMS) (Bonn Convention) (1979)		
Memorandum of understanding for the Conservation of Cetaceans and their habitats in the Pacific Islands region (2006)	 Agreements to take steps to conserve all cetaceans. Action plan to address: a) Threat reduction b) Habitat protection, including migratory corridors c) Research and monitoring d) Education and public awareness e) Information exchange f) Capacity building g) Responses to stranding and entanglements h) Sustainable and responsible cetacean-based tourism i) International cooperation 	
Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, 2005	Actions and strategies in 19 priority areas of the Barbados Program of Action for the Sustainable Development of Small Island Developing States (BPOA), which address the economic, environmental, and social developmental vulnerabilities facing islands. Priority areas include climate change and sea-level rise, resources, energy resource, biodiversity resources, science and technology, human resource development, etc. The Programme identifies culture as a key pillar of sustainable development.	
United Nations 'Conference on Environment and Development' in Rio de Janeiro, Brazil (1992)	 Recognizes the importance of preserving the environment to the success of long-term economic progress. The following principles particularly address issues in regard to the management, protection and preservation of the environment. Principle 2. States are responsible to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond limits of the national jurisdiction. Principle 3. The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations. Principle 4. Environmental protection shall constitute an integral part of the development process. Principle 7. States shall cooperate to strengthen capacity-building for sustainable development by improving scientific understanding. Principle 10. Environmental issues are best handled with participation of all concerned citizens. 	

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•	Principle 11. States shall enact effective environmental legislation.
•	Principle 14. States should cooperate to discourage or prevent relocation or transfer of substances that cause severe environmental degradation.
•	Principle 15. The precautionary approach shall be widely applied.
•	Principle 16. Internalization of environmental costs so the polluter bears the costs of the pollution.
•	Principle 17. Environmental impact assessments shall be undertaken for activities that are likely to have a significant adverse impact on the environment.
•	 Principle 19. Prior and timely notification of adverse transboundary environmental effects.

4 CHARACTERIZATION OF THE MARINE ENVIRONMENT

4.1 Benthic Environment

There is little existing information on deep-sea benthic environments in Cook Islands. The geomorphology of the seafloor is discerned from broad scale bathymetry (Gebco, 2021) and sections of multibeam bathymetry from historical exploration voyages (from OM data holdings). OM's Application Area in the South Penrhyn Basin (SPB) is at 5,200 m water depth and this part of the SPB in general is characterized by the presence of nodules and surficial oxic brown to dark red-brown ferromanganiferous clays (Cronan et al., 2010). This sediment composition is fundamentally different to that in the CCZ, where siliceous sediments are dominant in high nodule areas.

Abyssal hills occur in the SPB and the tectonic interpretation of Viso et al. (2005) indicates that there are two orientations: approximately east–west trending and north–south trending abyssal hills, separated by the Tongareva triple junction. The abyssal hills are reported to be 100–500 m high and 1–10 km side to side and 10–100 km long (Viso et al., 2005). The southwestern Pacific region in general is characterized by an abundance of seamounts and knolls (Yesson et al., 2011), although in the SPB large areas without these structures are apparent (Figure 1).

Mining will target the relatively flat terrain of the abyssal plain. Seamounts and knolls, which can harbor diverse and sensitive biology communities (Althaus et al., 2009; Clark et al., 2014), are not sites of high nodule abundance and are currently unable to be traversed by nodule collectors, precluding them from mining. In the Application Area, benthic communities can be generally considered as comprising:

- 1. Sessile nodule-attached epifauna: organisms attached to hard nodule surfaces.
- 2. Sessile sediment epifauna: organisms attached to the sediment surface.
- 3. Mobile epifauna that range across both nodule and sediment habitats.
- 4. Sediment infauna: organisms living within under the sediment surface, withing the interstices of the sediment bed.
- 5. Hyperbenthic organisms: residing in the semi-liquid layer and water column close to seabed (benthic boundary layer).

Within these groups of organisms, size ranges vary. In the terminology applied by the ISA, benthic organisms are classed as microfauna (bacteria and eukaryotic organisms < $32 \mu m$ in body size), meiofauna (eukaryotes $32-250 \mu m$ body size), macrofauna (> $250 \mu m$ to 2 cm body size) or megafauna (>2 cm, visible in seabed imagery). The abundance of organisms and species diversity for most groups (particularly macrofauna and megafauna) generally decreases with depth (Rex and Etter, 2010). This is due largely to the physical and chemical conditions at these depths and low rates of benthic nutrient supply. The collective biomass of benthic bacteria, meiofauna, macrofauna and megafauna in the Cook Islands abyssal basin, is modelled to be among the lowest on the planet (Wei et al., 2010) (Figure 2).

The entire SPB falls within a single, large abyssal biogeographic zone known as the Tropical Eastern Abyss (Dunstan et al. 2020) reflecting the broad geographic distributions of most abyssal benthic fauna. In general, the abundance of organisms and species diversity for most groups (particularly macrofauna and megafauna) decreases with depth (Rex and Etter, 2010). Studies in the CCZ have shown that the abundance of organisms decreases along the size spectrum from bacteria to megafauna (Wei et al., 2010), due in most part to water chemistry at these depths (below the carbonate compensation depth and low in silicates) and low rates of benthic production and nutrient supply. In the SPB, nodules are likely to provide a hard substrate for the attachment of sessile invertebrates as has been observed in other nodule provinces (e.g., Bluhm 1994; Simon-Lledo et al. 2020). Foraminiferans, bryozoans, sponges, and black corals are among some of the nodule-attached fauna identified from CCZ nodules (Veillette et al., 2007). While nodule-attached fauna of some kind is expected in the SPB nodule province, this is yet to be confirmed.

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Figure 1 - Seamounts and knolls in the Cook Islands EEZ in relation to OML Reserved areas/Moana Minerals Application Area (Source: Yesson et al., 2011).



Figure 2 – Distribution of predicted benthic biomass (Source: Wei et al. 2010)

On sediments in the CCZ nodule province, giant protists (Xenophyophora) are the dominant sessile epifaunal (living on the sediment surface) organisms in the macro- to megafauna size range (Kamenskaya et al. 2013, 2015). Sediment infauna (living on the sediment interstices or in burrows) in the CCZ nodule province, and indeed many other abyssal sites, tends to be dominated by species in the meiofauna size range. In the macrofauna size range, sediment infauna in the CCZ nodule province is typically dominated by polychaete worms, crustaceans (isopods, amphipods and tanaids) and molluscs (bivalves and gastropods) (e.g. Stoyanova, 2014). Sediment macrofauna communities from the Indian Ocean nodule province show similarities to those in the Pacific province (Ingole et al., 2001). Furthermore, Glover et al. (2002) showed ubiquitous distributions of 30–40 polychaetes (90% of the total polychaete assemblage) among sites that were 3,000–4,000 km apart. Therefore, benthic macrofauna of SPB is expected to have broad similarities with other nodule provinces and the small number of biological samples that have been reported from the SPB indeed show these similarities (McCormack, 2016).

Mobile epifauna in the CCZ and other abyssal zones tends to be dominated by echinoderms (mainly holothurians, seastars and urchins) and these organisms are among the most abundant in seafloor imagery and as a result can be identified with some confidence (e.g., Tilot, 2006). Burrows, dwelling traces, and waste casts of various types (collectively known as lebbenspuren) are also among the most conspicuous and frequently observed structures in seafloor imagery. These features contribute to the quantification of bioturbation and to infer populations of mobile epifauna (e.g. echinoderms) and large burrowing species (e.g. various large worm species) (Lauerman and Kaufmann, 1998; Dundas, 2009).

Sinking of particles from the surface layers of the ocean (particulate organic carbon (POC) flux) is the main source of productivity to the abyssal sea floor. Benthic communities in the CCZ and other Pacific abyssal sites are typically dominated by deposit-feeders that specialize in foraging on surface-derived production and populations may respond to short-term enhancements in supply related to, for example, surface phytoplankton blooms or benthic 'storms'. Therefore,

productivity at the ocean surface and processes of nutrient uptake, recycling and repacking in the water column is key to controlling biomass of benthic organisms. There are indications that POC flux in the SPB is lower than that of the CCZ (Smith et al., 2008; Hannides and Smith, 2003) which may partly explain the low infaunal species richness and abundance recorded in the SPB compared to the CCZ (McCormack, 2016).

Decades of work in the CCZ and other abyssal zones reveal two factors relevant to the establishment of an environmental baseline and assessment of potential impacts:

- 1) taxonomic descriptions are incomplete, and it is highly likely that any new sampling in any part of the abyssal zone will uncover species that are new to science;
- 2) biological distributions are patchy and highly variable at multiple spatiotemporal scales.

Therefore, environmental baseline studies and impact assessment of seabed mining must take a multiple-lines-of-evidence approach, using multiple indicators (e.g. direct sampling and seabed imaging) and take advantage of new technological solutions where appropriate (e.g. genetic methods) and deal with residual uncertainty in a transparent and consultative manner under a precautionary framework such as exists in the Cook Islands regulations.

In the Cook Islands, Okamoto et al. (2003) collected 575 images and identified a variety of megafauna including unidentified sponges, sea pens, crinoids, sea anemones and at least three types of sea cucumbers. Of 733 individual biota seen, sponges were most frequently observed at 593 individuals, followed by 70 sea cucumbers, and 44 starfish. No specific biota to substrate relationships were identified. Nekton fauna observed included shrimps, many fish (200 mm long) and jelly forms of swimming fauna were noted. The survey also showed the presence of bioturbation on the seabed. Macrofaunal biota belonging to nine groups and a few unknown organisms were confirmed by Okamoto et al. (2003) at all stations in samples sieved to 300 µm. The most common fauna were foraminifera, ostracoda and isopoda, which occurred at three stations. Other fauna included nematodes, bivalves, polychaetes, harpacticoids and amphipods. The total number of animals per sample ranged from 31 to 85. Samples were examined by 10 mm depth intervals to 50 mm and macrofauna were most abundant in the upper 10 mm of sediment.

The extensive work carried out within the CCZ has shown that traditional taxonomy is complex and labor intensive, even though considerable work on taxonomic methods and standardization has been undertaken (see for example Mullineaux 1987, Thiel et al. 1993, Veillette et al. 2007, Kamenskaya et al. 2013; 2015, Martinez Arbizu 2015, Vanreusel et al. 2016, Amom et al. 2016, De Smet et al. 2017, Stoyanova 2014, Pape et al. 2017, Miljutina et al. 2010, Raschka et al. 2014, Radziejewska, 2014). The patchy distributions and generally low abundance of fauna represents a major sampling challenge and reviews have indicated that after some 40 years of sampling, the knowledge of total biodiversity of meiofauna, for example, is still unknown. In recent times, genetic tools and ecosystem-based assessments have proven to be useful in bolstering and in some areas replacing traditional taxonomic style studies.

Benthic communities are structured spatially, primarily due to the variable tolerance of benthic species to environmental conditions, preferences for substrate and habitat, and distribution of food resources. There is evidence from the CCZ to suggest that terrain (depth), nodule density

and benthic POC flux are the main factors structuring benthic communities. Simon-Lledó et al. (2020) reported megafauna density was highest in the TOML areas of the CCZ where nodule cover was highest, due to the increased habitat available for obligate nodule-attached fauna. Simon-Lledó et al. (2019) reported megafauna community differences with bathymetric gradients.

4.2 Pelagic Environment

4.2.1 Oceanography

The water column overlaying the SPB is a subcomponent of a large pool of Western South Pacific oceanic water. Biochemically, the oceanic waters of Cook Islands are part of the large South Pacific Subtropical Gyre Province that spans Easter Island to Samoa (Longhurst 2007). The Cook Islands EEZ is characterized by relatively low surface primary production (Verlaan et al. 2004, one of the key indicators of oceanic biological productivity (Menkes et al. 2015). Surface chlorophyll-a concentrations in the Cook Islands EEZ are generally lower than those observed in the CCZ (Figure 3). Subsurface chlorophyll maxima, not measurable by satellite imagery, typically occur in tropical waters at 50 to 100 m depth (Longhurst 2007, Furnas and Mitchell 1996, Menkes et al. 2015). Sinking particles from the surface layers of the ocean (particulate organic carbon (POC) flux) is the main source of productivity to the abyssal sea floor. Therefore, low productivity at the ocean surface is expected to be a limiting factor on benthic faunal biomass.

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Figure 3 - Seasonal surface chlorophyll-a concentration in Cook Islands EEZ (purple polygon) relative to other ocean regions, cool colors = low concentration, warm colors = high concentration. (Source: NASA Earth Observation, MODIS satellite, 2017)

At abyssal depths in the SPB, the dominant water mass is known as Antarctic Bottom Water (AABW), a cold (~1°C), dense water mass some 1,000 m thick that migrates slowly north towards the equator from Antarctica (Tsuchiya 1991, Hartin et al. 2011). Available temperature data indicates relatively uniform structure at abyssal depths (Figure 4). The chemical oceanography in the abyssal zone in the SPB is expected to be temporally stable. Any temporal variation is likely to be expressed mainly in surface layers and driven by large-scale processes such as seasonal variation, climatic events such as cyclones and El-Niño.



Figure 4 - World Ocean Database 2018 stations covering Cook Islands (top left) and temperature profile (top right) through a north-south section, oxygen profile stations in the vicinity of Application Area.

Cook Islands is situated within the South Pacific subtropical gyre (Ridgway and Dunn 2007) and the dominant large-scale surface current system influencing the region is the westerly flowing South Equatorial Current (SEC) (Keppler et al. 2018). The SEC drives net westward flows from 0 m to approximately 1,000 m depth (Ganachaud et al. 2014). Eddies, island wake features and responses to south easterly trade winds and climatic events such as tropical cyclones influence surface currents (Keppler et al. 2018). However, the Cook Islands in general and Moana's reserved areas lay to the east and south of the zonal jets of the SEC that occur west of ~170°E (Webb 2000, Ganachaud et al. 2014).

Below the influence of the SEC, the dominant water masses are the cold Antarctic Intermediate Mode Water (~1,000 m to 3,500 m depth) and Antarctic Bottom Water (~3,500 m to the seabed) (Sokolov and Rintoul 2000, Bostock et al. 2013). Antarctic Bottom Water flows north through the Aitutaki Passage to influence the South Penrhyn Basin and flows around the northern margin of the Manihiki Plateau, to the north of the Cook Islands EEZ (Yamazaki, 1992). Water temperature near the seabed is approximately 1 °C (Reid 1997).

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Figure 5 - Schematic of dominant surface and bottom ocean currents in the CIEEZ (after Kenex, 2014).

4.2.2 Biological Communities

The oceanic waters of the Cook Islands are considered part of a large biogeographic zone known as the Southern Central Pacific Region (Sutton et al. 2017), reflecting the fact that surface and subsurface water masses are ubiquitous throughout the region and many of the species inhabiting the oceanic environment have broad geographic distributions. In a later data-driven and delphic bioregionalization, the Cook Islands region was ascribed to an Eastern Subtropical Gyre region (Dunstan et al. 2020) characterized by oligotrophic characteristics that are less favorable for micronekton development. Foodwebs in these regions are characterized by low nitrogen fixation (Deutsch et al., 2001; Shiozaki et al., 2014) and new primary production is fueled by nitrate leading to generally short food chains where large phytoplankton such as diatoms are directly grazed by macrozooplankton (Le Borgne et al., 2011).

In the expansive habitat of the pelagic zone in the open ocean, biomass is dominated by smallbodied invertebrates and fishes, known as micronekton, that are broadly distributed and occur in generally low abundance (Ceccarelli et al. 2013, Menkes et al. 2015). The global phenomenon of diel vertical migration, the mass movement of micronekton from deep (~1,000 m) to shallow strata (0-200 m) at night, and their return during the day, is the most ecologically significant processes in the pelagic zone. This behavioral phenomenon brings deep-dwelling micronekton within foraging range of pelagic predators in the South Pacific Ocean where they constitute a large proportion of the diet of tunas and other apex predators (Young et al. 2010; 2015).

Large-bodied predators such as tunas, billfishes and dolphinfish are spatiotemporally variable in their distribution and are of most interest to commercial fisheries. The entire Cook Islands exclusive economic zone (CIEEZ) is a declared shark sanctuary, established under the Marine Resources Act (2005), prohibiting the commercial exploitation of sharks. The Application Area does not include habitats for inshore and deep slope fishes, and no such habitats exist within 200 km of the Project. Oceanic fish species expected to occur in the OM Application Area include a number of tuna species (albacore (Thunnus alalunga), yellowfin T. albacares), big-eye (T. obsesus), skipjack (Katsuwonus pelamis), dog-toothed (Gymnosarda unicolor)). Tuna species can be surface or pelagic and migratory. Non-tuna species are expected to include billfish (blue marlin (Makaira nigricans), black marlin (Makaira indica), striped marlin (Tetrapturus audax), broadbill swordfish (Xiphias gladius), sailfish (Istiophorus platypterus). Other pelagic species such as wahoo [Pa'ara] (Acanthocybium solandri); dolphinfish [Ma'i ma'i] Coryphaena hippurus) and rainbow runner [Roroa] (*Elagatis bipinnulatus*) are likely to occur in the area. Oceanic species feed largely on epipelagic fishes, squids and crustaceans. A number of different species of flying fish (all of the family Exocoetidae) are common. In the oceanic waters of Cook Islands are 16 species of flying fish, which occur near Samoa. Flying fish are schooling, pelagic fishes found near the ocean's surface where they feed on small fishes and plankton.

Cetaceans (whales and dolphins), sharks and seabirds also occur in the pelagic zone. In 2001, Cook Islands EEZ was declared a Whale Sanctuary (Cook Islands, 2001), which provides a mechanism for managing activities that interact with whales such as fisheries, scientific research and tourism. A total of 13 cetacean species have been identified within the Cook Islands EEZ with a further 11 species thought to likely occur in the region (Figure 6). Humpback whales (*Megaptera novaeangliae*) are seasonally prevalent in the southern Cook Islands every year between early July and late October (Hauser et al., 2010, cited in McCormack, 2016). Humpback

whales are less frequently observed north of Palmerston Island and in the central area of the SPB. Humpback whales visiting Cook Islands are reported to be either transiting through the region (Hauser et al., 2010, cited in McCormack, 2016) or utilizing the area for calving (Hauser and Clapham, undated). Previously, cetacean surveys in the SPB have been spatially limited, with dedicated surveys in the Cook Islands largely restricted to coastal regions with a strong focus on humpback whales and largely restricted to nearshore waters around Rarotonga.

Common name	Scientific name	Notes
Humpback whale	Megaptera novaeangliae	Likely breeds and calves in the region
Sei whale	Balaenoptera borealis	
Blue whale	Balaenoptera musculus	Likely B. m. brevicauda
Dwarf minke whale	Balaenoptera bonaerensis/acurorostrata sp.	Likely dwarf minke
Bryde's Whale	Balaenoptera edeni	
Sperm whale	Physeter macrocephalus	
Killer whale	Orcinus orca	
Fin whale	Balaenoptera physalus	
False killer whale	Pseudorca crassidens	
Short-finned pilot whale	Globicephala macrorhynchus	
Pygmy killer whale	Feresa attenuata	
Risso's dolphin	Grampus griseus	
Rough toothed dolphin	Steno bredanesis	
Melon headed whale	Peponocephala electra	
Bottlenose dolphin	Tursiops truncatus	
Pantropical spotted dolphin	Stenella attenuata	
Peale's dolphin	Lagenorhynvhus australis	
Common dolphin	Delphinus delphis	
Spinner dolphin	Stenella longirostris	Likely dwarf form
Striped dolphin	Stenella coeruleoalba	
Fraser's dolphin	Lagenodelphis hosei	
Cuvier's beaked whale	Ziphius cavirostris	
Blainville's beaked whale	Mesoplodon densirostris	
Pygmy sperm whale	Kogia breviceps	
Dwarf sperm whale	Kogia simus	
Source: Hauser & Clapham (2012).		

Table 5 - Summary of marine mammal known to be present in the CIEEZ

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The CIEEZ supports a diverse marine seabird fauna. McCormack (2005) provides a summary of key elements of the seabird community. Suwarrow atoll in the Northern Group support regionally significant colonies of sooty terns (100,000 pairs), lesser frigatebirds (5,000 pairs), red-footed boobies (1,000 pairs), and red-tailed tropicbirds (500 pairs) along with other species. Takūtea, in the Southern Group has a large colony of red-tailed tropicbirds (1,500 pairs), and the only Southern Group colonies of great frigatebirds (100 pairs), red-footed boobies (100 pairs).

Three marine turtles are found in Cook Islands and may occur in the Application Area. These are the hawksbill turtle (*Eretmochelys imbricata*) and the green turtle ['Onu] (*Chelonia mydas*) (Kulbicki et al. 2011) and the loggerhead turtle (*Caretta caretta*). The green and loggerhead turtles are endangered and the hawksbill critically endangered¹. Turtles are recorded as nesting on Manihiki, Pukapuka, Penryhn and Palmerston.

4.3 Cultural Environment

Cook Islands Maori are Polynesian, and several tribes trace their ancestry back to Samoa and Raiatea (French Polynesia). By tradition there are also connections between the Rarotongans and the New Zealand Maori. Cook Islanders and all South Pacific peoples have a strong spiritual and cultural connection to the ocean. This cultural connection has several dimensions that can be broadly categorized as 'traditional' and 'modern religious' aspects. The traditional dimension is expressed in The Ocean Declaration of Maupiti (2009), of which Cook Islands is a signatory and which states that for many Pacific communities:

- There are sacred and intrinsic links with land, sky, and ocean. This constitutes for many a fundamental and spiritual basis of existence.
- The ocean is a holistic reality of the life cycles of the earth.
- The ocean is their identity, way of living, values, knowledge, and practices that have sustained them for millennia.

Marae Moana is underpinned by indigenous approaches of 'rā'ui' – a traditional form of natural resource management that prevented access to certain areas or during certain times – which is reflected in modern marine spatial management and ecosystem-based management.

The modern religious dimension is expressed in Christian religious beliefs that may be underpinned by the traditional basis that the ocean has 'mana' (spiritual authority). Modern religious beliefs have been expressed in the consultation processes of deep-sea mining exploration. The belief that a Christian God has blessed Cook Islands by providing nodule resources that, in lieu of other primary industry potential, can be exploited for the betterment of Cook Islanders has been expressed and illustrates the importance of religion in modern life.

Therefore, although subsistence and artisanal activities may be limited to the coastal environment, there are expected to be cultural considerations of deep-sea mining that will be investigated through the ESIA.

¹ <u>https://www.maraemoana.gov.ck/index.php/biodiversity</u>

4.4 Ecosystem Services

4.4.1 Supporting and Regulating Services

4.4.1.1 Circulation, Nutrient Cycling and Climate Regulation

Below 1000 m, the vast volumes of cold deep-sea water masses are isolated from the atmosphere, circulating around the globe and creating a buffer for the carbon and nitrogen cycles and regulating climate. The process of ocean circulation is a supporting and regulating service due to the link between water mass structure and movement and nutrient cycling and climate regulation and CO_2 exchange (Thurber et al. 2014).

The sinking of particulate organic matter, generated in the productive sunlit upper layers of the ocean, and the progressive degradation of labile compounds, and transport of materials to the seafloor (a process known as the biological pump) is the primary source of energy to the abyssal seafloor in the open ocean. Processes such as upwelling and diel vertical migration of zooplankton and micronekton can also re-suspend nutrients back into the surface and sub-surface layers. At abyssal depths and in areas where surface primary production is relatively low, the quantity of carbon and quality of nutrition is generally low which limits the benthic biomass able to be sustained. The deep-sea water column and seabed therefore provide both supporting services (e.g. supporting the production of biomass) and regulating services (e.g. sequestering carbon and cycling nutrients).

4.4.1.2 Primary and Secondary Production

Primary production is limited to the upper sunlit layers of the open ocean, but is vast and drives many of the trophic interactions that are connected to human values (e.g. foodwebs supporting fisheries and megafauna). Primary production can reach the seafloor in the form of "falls" of pelagic organisms (e.g. whale falls) or debris (e.g. terrestrial plant material). These spatially constrained inputs of primary production can create isolated secondary production on the seafloor in the form of chemosynthetic production and biomass growth in heterotrophic organisms. In recent years, there has been a new appreciation of the amount of primary chemosynthetic production generated in the unlit layers of the open ocean water column by microbes feeding of the vast pool of dissolved inorganic carbon. Other compounds may also be used in this process of chemosynthetic production, which are provided by the progressive degradation and repackaging of sinking particulate organic matter.

Organic carbon degradation and assimilation in the formation of biomass is one of the major supporting services of consideration for fisheries. The respiration of most organisms involved in secondary production is stored in the deep-sea, and thus the deep sea provides an important regulating service. Recent evidence shows the major role that seabirds can have in ingesting and transporting production from the upper layers of the ocean to terrestrial environments (Otero et al., 2018). The existence of large seabird colonies in Cook Islands is expected to be reflected in a significant contribution of these predators to open ocean ecosystem processes. Furthermore, there has been recent appreciation of the importance of production enhancement and nutrient mixing via the feeding of large-bodied predators such as whales, dolphins and tunas (Roman and McCarthy 2010).

4.4.1.3 Waste Absorption and Detoxification

The deep-sea is recognized as a place where waste products can be stored and sometimes detoxified through natural processes. The deep-sea ecosystem is considered among the most remote from human interaction and waste products including disused chemical weapons and discharge from mining processing plants (e.g. deep-sea tailings deposition) are intentionally placed on the deep seafloor. Transport and absorption of waste from effluent sources closer to continental shelves and areas of human habitation is recognized as a regulating ecosystem service. Bioremediation by seafloor microbial communities has been reported for hydrocarbon spills and releases. This service can represent negative impacts in the form of pollution, contamination and bioaccumulation. To our knowledge, no such deep-sea dumping of waste has occurred in the CIEEZ.

4.4.2 Provisioning Services

4.4.2.1 Mining

The deep-sea provides the conditions for the existence of concentrated minerals and obviously the presence of polymetallic nodules in the CIEEZ represents a major potential provisioning service. The processes involved in exploring and commercializing deep-sea mining, scientific research and consideration of the impacts and societal benefits of deep-sea mining is a global undertaking. Technological solutions to extraction, development of regulations and consideration of environmental impacts have accelerated in response to increasing demand.

Other mineral resources that occur in the deep-sea include mineralized sediments, seafloor massive sulphide (SMS) deposits and cobalt crusts (SPC 2016b). Potential mineralized sediments have been identified in CIEEZ, although no SMS or cobalt crusts have been identified as yet.

4.4.2.2 Offshore Fisheries

The offshore tuna fishery is the most important commercial fishery in the CIEEZ, and it is a subcomponent of the large West and Central Pacific tuna fishery. Offshore fishing at the Cook Islands is made up of longline fishing for tuna and tuna-like species, purse seine fishing (operating under the US Multilateral Treaty and bilateral agreements) and Cook Island registered trawlers that operate in the southern Indian Ocean under the South Indian Ocean Fisheries Agreement (SIOFA) (fao.org). The Cook Islands entered into an agreement with Korea and Kiribati flagged companies in 2016.

Yellowfin, albacore skipjack and bigeye tuna are harvested, and other species include mahi mahi, wahoo, and billfishes (Anon 2000). Local vessels, along with those from Japan, Korea and Taiwan target tuna mainly by long line, for the export sashimi market and canneries, particularly those in American Samoa and Fiji. Foreign vessels are restricted to fishing outside the 12-mile territorial sea around each island to avoid conflict with the artisanal fishing (Anon 2000).

Commercial fishing intensity within the Cook Islands EEZ is relatively low compared to other areas in the South Pacific region (Figure 6).

In the vicinity of OM's application area, commercial fishing activity appears to be negligible. Future studies aim to access vessel monitoring data to quantify the spatial extent and intensity of ocean commercial fishing.

Since 2012, there has been a ban on the commercial fishing of shark within the CIEEZ. A quota management system was implemented on 1 January 2017 for albacore (total allowable catch of 9,750 t, bigeye tuna 3,500 t) fished from Cook Islands waters.

It is thought possible but uncommon that vessels engaged in exploration will interact with Cook Islands commercial fishing vessels. However, this statement may be amended as stakeholder engagement progresses. EIA studies will aim to access vessel monitoring data to quantify the spatial extent and intensity of ocean commercial fishing.

The longline fleet is made up of ten vessels operating within the Western and Central Pacific Fisheries Commission Convention area (WCPFC-CA). Of these, three domestic vessels were licensed to fish within national jurisdiction only. Eight vessels were authorized to fish both within the CIEEZ and on the High Seas, but rarely fished beyond national jurisdiction. The majority of the longline fishing activity targeting South Pacific albacore tuna (*Thunnus alalunga*), was concentrated in the northern CIEEZ, in areas north of 15°S.

During 2017, 45 foreign flagged vessels (from two Chinese companies operating out of Pago Pago, Suva, Papeete and Kosrae (Federated States of Micronesia)) were authorized to operate in the CIEEZ. These vessels were not permitted to fish within the 12 nM limit of all islands and within 24 NM of Rarotonga). Three Rarotonga based longliners catch albacore tuna and a range of species to cater mainly for the local market, with some exports to Japan. These vessels are around 20 m in length and operate within 100 nM of Rarotonga (MMR 2017).

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Figure 6 - Commercial fishing intensity in Cook Islands EEZ (data range = 6 months to 30 May 2018). Red square = Approximate location of the Moana project region of interest (Source: Global Fishing Watch, globalfishingwatch.org/map)

There is a strong seasonal trend evident in Cook Islands fisheries. In general, first and fourth quarter catch rates and total catch are low, with this period referred to as the off-season. Second and third quarter catches are the peak of the fishing season. The longline fishery is typically delineated around 15°S however longline fishing effort and catch continues to extend further south than in previous years. In 2017, 45% of key tuna species were caught below 15°S latitude. Bigeye tuna is mostly taken in the northernmost part of the CIEEZ, north of Penrhyn, closer to the equatorial belt. Albacore were taken south of 15°S, towards Aitutaki and south of Mangaia.

Albacore dominate the overall 2017 catch totalling about 3,552 t and accounting for 65% of the total species catch composition. Yellowfin tuna comprised 18% of the longline catch (971 t) and bigeye tuna 5% (277 t). Other species make up the remaining 12% of catch, including blue marlin (123 t), skipjack tuna (79 t), wahoo (107 t), swordfish (54 t), mahi (59 t) and others (MMR 2017) (Figure 7).

Purse seine fishing occurs within the CIEEZ. The purse seine fishery is a surface fishery targeting schooling skipjack tuna (*Katsuwonus pelamis*) in the tropical waters of the Western and Central Pacific Ocean. The purse seine fishery operates in the northernmost waters of the CIEEZ and catches are unloaded at canneries in Pago Pago, American Samoa (MMR 2017).

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Figure 7 - Long line fishery, species composition of the other species in the 2017 catch (Source: from MMR 2018)

The purse seine fishery is controlled by fishing effort using the Vessel Day Scheme (VDS), which monitors the days fished inside the CIEEZ. 2017 was the third year the Cook Islands agreed bilateral arrangements to license purse seine vessels in addition to vessels under the US Multilateral Treaty with Pacific Islands States (US Treaty). In 2017, an additional 15 vessels from Korea, Kiribati and Spain were licensed to fish in the CIEEZ. Cook Islands has a declared Purse Seine limit of 1,250 vessel days available annually, of which 350 days are reserved for US vessels under the US Treaty. US vessels fished 456 days in the CIEEZ in 2017. All purse seine vessels are prohibited to fish within 24 NM of each island and 48 NM of Rarotonga. Three Rarotonga based longliners catch tuna and other species for the local market and operate within 100 NM of Rarotonga (MMR 2017).

A Sustainable Fisheries Partnership Agreement with the European Union was signed in October 2016 and came into force in May 2017. Two Spanish purse seine vessels were also authorized to fish under the EU Sustainable Fisheries Partnership Agreement (SFPA), with a capped total of 7,000 t from a national tonnage limit of 30,000 t. In 2017 the Spanish vessels fishing under the SPFA caught 650 t and were present in the CIEEZ for 13 days.

Of the total purse seine catch, 90% was skipjack tuna, 8% was yellowfin, and 2% of bigeye tuna. Of the total catch in 2017, 95% was taken from fishing aggregating devices (FAD) associated sets and 5% from free school sets. Since 2012, an average of 79% of the total purse seine catch has been from associated sets, with 21% from un-associated sets, indicating the reliance on FAD sets for the viability of the fishery in Cook Islands waters. There is a strong seasonal trend in the purse seine fishery, with the fourth and first quarter of the year the peak season of the fishery. This is opposite to the longline fishery which operates largely through the winter months. The purse seine fishery is subject to a three-month FAD closure from July to September, which prohibits the setting of nets on FADs (MMR 2017). The composition of bycatch in the purse seine fishery available from observer data coverage on 2017 purse seine sets indicates that silky sharks

comprise the largest component of bycatch, followed by blue marlin and rainbow runners, mahi, dolphin fish and dorado (MMR 2017).

The spatial distribution of purse seine catches is exclusive to the northernmost parts of the EEZ, north of 13°S. This is north of the Application Area.

4.4.2.3 Coastal Zone Fisheries

Pelagic and reef-associated fish species in the coastal zone are important to subsistence, artisanal and small-scale commercial fisheries in Cook Islands (Cook Islands Ministry of Marine Resources). The majority of this fishing takes place in the coastal zone (Gillett 2016) and not in the oceanic environment over the South Penrhyn Basin. The Cook Islands artisanal fishery occurs from all inhabited islands, primarily targeting tuna and pelagic species.

In 2017 there were 265 active artisanal vessels reporting on the artisanal database. Of these, 96% were small powered boats with outboard motors, 3% were recreational sport charter vessels (tourist operators), and 1% were unpowered canoes.

Common fishing methods include hook-and-line, vertical longline, gill net and other netting methods, spearfishing, fish trapping and manual gleaning (Anon undated). Artisanal fishers with powered vessels often troll around the coast of the islands, while unpowered canoes tend to fish at fishing aggregating devices (FADs) using handlining methods.

Artisanal catch data was recorded from the islands of Aitutaki, Atiu, Mangaia, Manihiki, Mitiaro, Mauke, Pukapuka, Rakahanga, and Rarotonga. Artisanal catch estimates totalled 255 t in 2017. The majority of the reported catch comes from Aitutaki and Rarotonga.

Catch from the artisanal fishery is consumed locally and sold through local markets. The nearshore fishery is variable and different species are known to be seasonally abundant (Anon 2000).

Pelagic and reef-associated fish species in the coastal zone are important to subsistence, artisanal and small-scale commercial fisheries in Cook Islands (Cook Islands Ministry of Marine Resources). The majority of this fishery takes place in the coastal zone (Gillett 2016) and not in the oceanic environment over the SPB. Common fishing methods include hook-and-line, vertical longline, gill net and other netting methods, spearfishing, fish trapping and manual gleaning (Anon undated). Fishing for pelagic species is concentrated around Fish Aggregating Devices (FADs) deployed for the purpose of attracting fishes. Catch from the artisanal fishery is consumed locally and sold through local markets. The nearshore fishery is variable and different species are known to be seasonally abundant (Anon 2000).

4.4.2.4 Aquaculture

A variety of marine aquaculture projects have been developed and undertaken but none is associated with deep offshore waters within the CIEEZ.

Developments in the mariculture of round pearls using the black-lip pearl shell, *Pinctada margaritifera* have led to the development of a black pearl industry in Cook Islands. Pearls are commercially cultured in Manihiki and Penrhyn lagoons in the north of the country, some 600 km from OM's Application Area, and have become one of the country's largest exports. There are 210 pearl farms in total occupying an area of some 10 km² in Manihiki Lagoon and 1 km² in

Penrhyn Lagoon (Anon 2000). The fishery is based on two species, the small pearl oyster (*Pinctada maculata*, which produces a golden pearl) and the black-lipped pearl oyster (*Pinctada margaritifera*, which produces the more valuable black pearl). Pearl exports are valued between NZ\$5–10 million and the Cook Islands Ministry of Marine Resources is encouraging the spread of pearl farming to other islands.

Efforts are also being made to commercially develop milkfish (*Chanos chanos*) culture and capture fisheries based on trochus shell (*Trochus niloticus*).

4.4.2.5 Energy Production

The deep ocean provides sources of oil and gas reserves. Energy generation from harnessing temperature differentials of hydrothermal venting and the natural temperature stratification in the ocean (ocean thermal energy conversion, OTEC), wave energy and tidal energy are among some of the renewable energy sources provided by the ocean. Exploitation of these renewable sources is limited but is coming under increasing scrutiny and interest in much the same way that deep-sea mining interest has increased: driven by increased demand and technological advances in solving some of the early commercialization problems. To our knowledge, there is no active exploitation of subsea energy in CIEEZ, however it is recognized that scientific research for OMs exploration program has potential foundational significance for a variety of other marine research that could follow.

4.4.2.6 Bioprospecting

The deep-sea is considered a potential source for novel natural products that have pharmaceutical properties. It is generally considered that compounds of potential value to biomedicine and cosmetic industries exist. It is interesting to note that the 2008 Nobel prize for chemistry was awarded to researchers who isolated a bioluminescent protein from a jellyfish which is used to investigate nerve cells and cancer. To our knowledge, there is no active bioprospecting in CIEEZ, however it is recognized that scientific research for OM's exploration program has potential foundational significance for a variety of other marine research that could follow.

4.4.2.7 Communications

The deep-sea provides a provisionary service by hosting telecommunications infrastructure in the form of subsea cables. In the Cook Islands, the Manatua cable comes to shore at Rarotonga and Aitutaki and connects to the global internet via Samoa and Tahiti (Figure 8). To our knowledge there is no subsea communications infrastructure intersecting OM's application area.

High speed internet afforded by the Manatua cable will benefit the project by allowing efficient data sharing and will obviously be a benefit to the broader Cook Islands community.

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Figure 8 - The Manatua submarine cable system. (Source: Manatua Consortium Media Release, February 2020).

4.4.2.8 Military

The deep-sea environment hosts military activities. The extent of military use of the deep-sea environment in CIEEZ is unknown but is expected to be generally lower than Pacific continental shelf and continental slope locations, and lower than that of deep-sea locations that are closer to major military bases (e.g. Hawaii). It is conceivable that there are interrelationships between seabed minerals explorations, particularly seabed mapping, and military use (e.g. identification of navigable deep-sea routes). However, it is recognized that the spatial scale of seabed minerals exploration in CIEEZ and the vessel and technological resources used in exploration are likely to be minor in comparison to the areas of operation and resources of the various militaries operating in the ocean.

4.4.2.9 Shipping

On a global scale, shipping and total vessel traffic in the Cook Islands EEZ is generally low (

Figure 9) but commercial shipping is critically important to the delivery of products to Cook Islands (individually and collectively) and the economy in general. The Port of Rarotonga has limited size and infrastructure and is not an all-weather port, which places a restriction on the size class of ships able to be received. Inter-island shipping is also important in Cook Islands. OM's exploration project will interact with shipping operations, mainly within the Port of Rarotonga where berthing space and wharf infrastructure and resources may be limited. Interactions with

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transiting vessels at the OM application area is expected to be minimal but vessels may come into radar or visual range. Normal ship transiting practice of Automatic Identification System (AIS), radar, radio communications and visual lookout will be used to identify passing ships and avoid negative interactions.

In the future, mining operations are likely to require personnel and supply shipping, representing an opportunity for expanding existing inter-island shipping operations.



Figure 9 - Comparative global cargo ship (a) and total vessel density (b). Approximate location of Cook Islands EEZ is shown by red square. (Source: Wu et al. 2017).

4.4.3 Cultural Services

4.4.3.1 Cook Islands Traditional Beliefs, Knowledge and Values

The exploration program will be nested within an Environmental and Social Impact Assessment (ESIA) framework. The social dimension is added in recognition of the fact that avoiding negative social impacts and maximizing positive social and socioeconomic impacts will be key to exploration and future commercialization of the project.

The open ocean is integral to the origin stories, traditional knowledge, and cultural values of Cook Islanders. These values are upheld in the Marae Moana Act (2017) and are witnessed throughout everyday life. From traditional to modern beliefs, the ocean plays a key role in the identity of Cook Islanders and the EMP recognizes that this factor will be paramount in the social acceptability of deep-sea mining in Cook Islands and that excellent environmental performance will be one of the most important criteria in gaining that acceptability.

4.4.3.2 Global Human Culture

References to the deep-sea and an awareness of the 'wildness' of the open ocean holds an important place in human culture and imagination. Beyond the fact of being a habitat for wildlife that we admire and wish to preserve, the existence of the oceanic deep-sea environment is meshed into ancient and modern civilization in form of mythologies, stories and literature, art, music, aesthetics, entertainment, tourism, and technological development. As such, while OM's exploration activities will take place in the CIEEZ, and will recognize the cultural values of Cook Islanders, it is also recognized that global cultural values will be influential.

4.4.3.3 Marine-based Tourism

There are currently 12 game fishing charter vessels in the Cook Islands. These are high powered outboard and inboard motorboats and are approximately 8–12 m in length. Trolling is the main fishing method used to target billfish, tuna, and other pelagic game fish species.

Tourism, and the supporting activities of restaurants and accommodation, is the Cook Island's biggest export, contributing approximately 50% to GDP (Cook Islands Ministry of Finance and Economic Management). Tourists from New Zealand form the majority of tourists and activities are centered on Rarotonga and other islands where the natural values of the marine environment are primary attraction. Diving, snorkeling, charter fishing, whale watching, and other water sports and marine-based activities are key to tourism.

There is no information that indicates that the Application Area activities will occur in vicinity of tourism related activities. This information will be updated through stakeholder engagement.

4.4.3.4 Marine Scientific Research and Education

The Cook Islands has limited dedicated marine research facilities. The National Environment Service and The Cook Islands Natural Heritage Trust are the two main science providers and other agencies include the Aitutaki Marine Research Centre and the Centre for Cetacean Research and Conservation, Rarotonga. In addition, a number of NGOs engaged in marine research and conservation operate in the country (see Section 3.4.5.1).

The University of the South Pacific has a campus in Cook Islands and offers Bachelor of Science courses and undergraduate courses in Ocean Resources Management. New Zealand-based academic institutes may also operate research programs in Cook Islands.

4.4.3.5 Archaeology

Cook Islands terrestrial archaeological sites relating to Polynesian maritime migration, culture and colonization are significant (Weisler et al. 2016). Underwater artefacts may be expected to occur, particularly around islands where most human interaction was cantered. The presence of Polynesian or other archaeological sites, such as World War II wrecks, at the mining site will be the subject of further study throughout the exploration and ESIA program. Detailed multibeam echo sounding over the mining site will be a primary data input to this assessment. Cook Islands generally was not a significant WWII theatre and there does not appear to be known congregations of wrecks such as those known from nearby states such as Solomon Islands²

4.5 Stakeholder Environment

4.5.1 Cook Islands Society

OM commits to proactive and open engagement with the Cook Islands community throughout our Exploration Work Plan (EWP) and Environmental Management Program (EMP).

OM's objective is to engage the community within the Cook Islands as a whole, to not only support the idea of seabed mineral exploration, but to also advocate on behalf of and participate in that mineral exploration. It is recognized that Cook Islanders' traditional subsistence and artisanal activities may be limited to the coastal environment, but there are cultural considerations of deepsea mining that will be investigated through the ESIA and incorporated in OM's planning.

4.5.2 Cook Islands Government Agencies

4.5.2.1 Seabed Minerals Authority

The Seabed Minerals Bill (2019) and the Seabed Minerals Amendment Act (2020) establishes a Cook Islands Seabed Minerals Authority as a statutory agency of the Government of the Cook Islands. The Environment (Seabed Minerals Activities) Regulations (2020) set out the requirements for environmental permitting of exploration activities. The Act provides for the appointment of a Seabed Minerals Commissioner and Officers to oversee the functions of the Seabed Minerals Bill as required, reporting to an appointed responsible Minister. Seabed Minerals Amendments Act (2020) sets out the administrative framework, duties and responsibilities of the proponent and the Seabed Minerals Authority and penalties for non-compliance. Interface between the Government and the community is via the Cook Islands Seabed Minerals Advisory Board, comprised of a chairperson (appointed by the responsible

² http://www.seaaustralia.com/wwii_shipwrecks.htm; https://www.pacificwrecks.com/provinces/cook.html

Minister), the Seabed Minerals Commissioner, five members representing the island communities of the Cook Islands, and additional members as required.

4.5.2.2 National Environment Service

The Cook Islands National Environment Service is the agency responsible for permitting, monitoring and enforcing environmental laws under the Environment Act (2003). The National Environment Service also plays an important role in research and stakeholder engagement in the area of sustainable development of seabed mining in Cook Islands.

The Seabed Minerals Amendment Act (2020) upholds the requirement to comply with the Environment Act (2003), the core legislation controlling the permitting of activities that have the potential to cause *significant environmental impacts*.

4.5.2.3 Marae Moana Council

The Marae Moana Act is administered by the Marae Moana Council that is chaired by the Prime Minister and comprises the opposition lead, a religious leader, a representative of the finance ministry and community leaders. The Act was established in consultation with the House of Ariki (see Section 4.5.1.4).

4.5.2.4 House of Ariki

The House of Ariki is a parliamentary body in the Cook Islands. It is composed of Cook Islands high chiefs (ariki), appointed by the Queen's Representative. There are up to twenty-four members, representing different islands of the Cooks.

4.5.2.5 Ministry of Marine Resources

The Ministry of Marine Resources is responsible for the conservation, management and development of marine resources. Established in 1984, the Ministry's objective is to ensure the sustainable use of living and non-living marine resources for the benefit of the people of the Cook Islands.

4.5.2.6 Ministry of Transport

The Cook Islands Ministry of Transport is a government entity with policy and primary oversight of the maritime administration; it is responsible for both domestic and international shipping services, including port and coastal state activities.

4.5.3 Marine-based Tourism

As described in Section 4.4.3.3, marine-based tourism is an important cultural service in the Cook Islands and contributes to the economy. There is no information that indicates that the Application Area activities will occur in the vicinity of tourism related activities. This information will be updated through stakeholder engagement and EIA studies.

Tourism operators often have significant knowledge of the marine environment and can be among the thought-leaders in small communities. Experience from elsewhere would suggest that marine-based tourism may be sensitive to any negative impressions expressed in the media or perceptions of clientele as to the quality of experience. As one example, game fishing charters tend to attract knowledgeable, senior figures in the community and the interactions at fishing/yacht clubs in some South Pacific locations can be opinion-forming.

4.5.4 Marine Commercial Fisheries

The tuna fishery is the most important commercial fishery in the Cook Islands EEZ. Commercial fishing intensity within the Cook Islands EEZ is relatively low compared to other areas in the South Pacific region. In the vicinity of OM's Application Area, commercial fishing activity appears to be negligible. EIA studies will aim to access vessel monitoring data to quantify the spatial extent and intensity of ocean commercial fishing.

Experience from elsewhere would suggest that commercial and artisanal fishers may be sensitive to any negative impressions expressed in the media or perceptions of seafood quality.

4.5.5 International Agencies

4.5.5.1 Non-Governmental Organizations (NGOs)

Deep-sea mining attracts considerable attention from NGOs, some of which are already actively engaged in considerations of nodule mining in CCZ (e.g., PEW Charitable Trusts, Seas At Risk, Deep Sea Conservation Coalition, Fair Oceans, Global Ocean Trust). NGOs differ in their levels of opposition to deep-sea mining, and therefore their levels of engagement with industry and regulators.

Our experience at workshops run by the International Seabed Authority, projects in the CCZ and observations of NGO activity indicates that vocal opposition to deep-sea mining from NGOs will be a challenge for the project. Indeed, at the 2021 International Union for Conservation of Nature (IUCN) World Conservation Congress, there was substantial support for a motion to protect deep-ocean ecosystems and biodiversity through a moratorium on seabed mining which received global media coverage.

OM intends to closely monitor activities, have a strong internal policy and plan for NGO engagement and maintain a focus on robust evidence-based decision making.

4.5.5.2 Academic Research Institutes

The strong research component of environmental studies in previous deep-sea mining exploration projects has fostered a sporadic but generally strong academic science involvement. Exploration companies operating in the CCZ often link with academic research consortia who come to the collaboration with vessels and research packages that address the various ISA environmental requirements. Scientific papers in peer reviewed journals generated by this activity range from policy to environmental discoveries.

For Cook Islands and other Pacific Island nations, where capacity building is a desirable outcome, engagement with regional universities and institutes may be desirable. We note the presence of a University of the South Pacific campus in Cook Islands and the potential for interaction with undergraduate courses and post-graduate research. SPC (2016a) outlined some guidelines for research in deep-sea minerals exploration and identified the contribution that minerals exploration

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can make to knowledge generation for Pacific Island nations. SPC (2016a) also acknowledges the importance of trans-boundary issues and collaboration. There are links between academic research, precaution, and public opinion and OM recognizes that academic research is an important stakeholder in deep-sea mining project development and that objective scientific data is required for evidence-based decision making.

5 ENVIRONMENTAL MANAGEMENT SYSTEMS

5.1 Administration

The exploration EMP will be executed as part of an integrated information management system that will serve as the administration basis for the exploration project. It will provide the basis for reporting, auditing and review. The information management system will detail the company policy, permit requirements, monitoring processes, performance indicators, training requirements, required interactions with external parties etc. The information management system will facilitate routine environmental performance reporting and will outline the processes for training, incident management and corrective actions.

OM will apply the same concepts of quality assurance to the environmental program that are required for mineral resource assessment. An environmental database will be a central aspect of achieving this quality assurance (see Section 5.2 below). As the environmental activities of the exploration phase will be completed within an ESIA framework, early engagement with ESIA consultants and key research providers will be an additional layer of administration and independent quality assurance.

Execution of the EMP will be the responsibility of the Environmental Manager who reports directly to the CEO.

5.2 Data Management and Collaboration

OM recognizes that environmental data management is key to success of the exploration program and effective collaboration. An environmental database will be used for the exploration project that is also in use for exploration projects in the CCZ s and a major Marine Knowledge Framework project in Australia (CoastKit). The database complies with the ISAs requirements for sample tracking and data export. The database is comprised of:

- Citations and sources of evidence.
- An ecosystem model structure so that study design can be linked to information requirements.
- Ecological classification tools to depict spatial distributions of habitats and biological communities and ecological labelling tools to unify data within ecological contexts.
- Tools to facilitate offshore sample and data registration directly into database forms, with chain of custody processes.
- Online portals to provide regulators, stakeholders and collaborators with direct visualizations of sampling activity, analytical results etc.
- Query tools to provide data exports and standard reports to regulators, stakeholders and collaborators.

OM recognizes that collaboration among Cook Islands and international agencies will be important to achieve social acceptance of seabed mining in Cook Islands. It is intended that the environmental database and its ecosystem modelling tools will form a basis for direct

collaboration, communication and evidence-based decision making in the ESIA process. It is also recognized that there are opportunities to contribute an emerging best practice and assist Cook Islands agencies such as SBMA and NES with development of similar database tools to assist with internal management of multi-contractor data in a similar way that ISAs DeepData database operates in CCZ. Effective standardization and management of multi-contractor data will be important for Cook Islands agencies to integrate information at the regional scale.

Through the conduct of exploration cruises, OM will encourage the involvement of independent observers as already done for the 2019 scientific research voyage.

5.3 Sample Handling

The exploration program will generate numerous environmental and geological resource samples. Proper sample registration and transmittal to accredited laboratories is essential to quality assured geological resource evaluation. Barcoded sample labels will be used as a basis for chain-of-custody and linking laboratory data to sites. OM recognizes the logistical challenge of moving large volumes of highly valuable samples to multiple international laboratories. OM successfully met this challenge during the 2019 scientific research voyage and the lessons learned during this survey will be valuable for the exploration program.

Representative samples will be shared with SBMA and opportunities for other sample sharing with researchers, educators and stakeholders will be sought.

5.4 Existing Protected Areas and Ecologically or Biologically Significant Areas

The Marine Resources Act 2005 establishes the entire Cook Islands EEZ as a whale sanctuary and a shark sanctuary. This declaration provisions for the protection of whale and shark species against commercial exploitation and the management of tourism, fisheries and scientific research and other activities that have the potential to intentionally, or inadvertently, interact with these species.

The Marae Moana Act 2017 act establishes a Marine Protected Area 50 nautical miles around each of the islands in the country, one stated objective of which is to provide –

"...a seabed minerals activity buffer zone to provide for the protection of pelagic, benthic, coral reef, coastal and lagoon habitats of the marae moana by prohibiting all seabed minerals activities, while allowing other ecologically sustainable uses."

All of OM's exploration areas as part of the Application Area fall outside areas covered by the Marae Moana Act 2017.

Cook Islands is signatory to the Convention on Biological Diversity (CBD), which lists a number of recognized or slated Ecologically or Biologically Significant Areas (EBSAs). These areas do not represent legislated protection areas but rather internationally recognized sites of high biodiversity value or ecosystem function/resilience value. Five EBSAs are recognized by the CBD in Cook Islands. Of these, two are associated with the islands and coastal waters around Suwarrow and Rarotonga. One EBSA is associated with the Ua puakaoa seamounts in the western of the CIEEZ and there is one EBSA associated with the Manihiki Plateau in the north.

The OM Application Area is separated from these sites by 100s to 1000s of kilometres. Another Cook Islands EBSA overlaps with the central SPB nodule province and Moana's exploration activities, that being an area known as the Western South Pacific High Aragonite Saturation State Zone. This EBSA is erected by CDB to cover a large oceanographic feature area (not a seabed feature) characterized by water column physicochemical properties that render it potentially resilient to future climate change impacts. This EBSA overlaps with the central SPB nodule province and OM's areas Application Area. The overlap with OM's Application Area represents approximately 2% of the total area of the EBSA (see Figure 10). Exploration activities do not represent a risk to aragonite concentrations throughout the water column at the scale of this EBSA.



Figure 10 - OM application area comprised of OML Reserved Areas 4 and 5 in context of existing Marae Moana Act 2017 protected areas and Convention on Biological Diversity ESBAs.

5.5 Spatial Planning

The establishment of Preservation Reference Zones (PRZs) and Biodiversity Preservation Areas (BPAs) is a central piece of OMs environmental program and a key spatial planning tool to achieve conservation objectives at the contract scale and the regional scale. PRZs seek principally to provide a control area to investigate potential impacts of mining. BPAs may achieve similar goals, but also have a broader aim of protecting representative communities. OM recognises that while the company only has rights to spatially manage areas within contract areas, the establishment of BPAs should integrate with regional environmental management in a multi-contractor setting.

PRZs should be:

- 1. Representative of the biotopes that will be mined.
- 2. Large enough to protect ecosystem function.
- 3. Positioned so as to be outside of the area of influence of potential plumes.
- 4. Designed using modern protected area design practices to promote connectivity, encapsulate proximal non-minable habitats where possible, and consider biogeographic variability at the scale of the EEZ to achieve the principles of the Marae Moana Act (2017).

BPAs have many of the same features but could include habitats are not representative of the area that will be mined, or areas of known or suspected high biodiversity value (e.g. seamounts).

These preservation area design tenants require data from the baseline environmental program, particularly data on seafloor terrain and nodule abundance, ocean currents, sediment biogeochemistry and biological communities at multiple spatial scales.

OM shall interact with agencies including the Marae Moana Council throughout the exploration programme to communicate spatial planning outcomes and input to further discussions. At this time, OM identifies that maintaining optionality in the design of PRZs to keep ecosystem linkages and connectivity may be advantageous (e.g. including say a seamount in a mosaic of representative abyssal flats habitat in a PRZ). Furthermore, OM recognises the multi-contractor opportunities to consider representativeness of habitats at the regional scale and how the exploration and relinquishment requirements may feed into BPAs.

We envisage the following phased approach to spatial planning:

- Phase 1 (Year 1 2): Seafloor multibeam acoustic mapping to establish terrain and abiotic habitat distribution to identify potential PRZs and BPAs and design of sampling programs accordingly.
- Phase 2 (Year 2 3): Analysis of seafloor imaging, physicochemical and biological sampling, 12 months of ocean current monitoring and provisional plume model to confirm suitability of potential PRZ(s). Consultation with regulators and stakeholders to communicate proposed PRZ design. Adaptive management of the environmental sampling design where required.
- Phase 3 (Year 3 5): Analysis of additional spatial and temporal environmental data and final plume modelling to confirm PRZ suitability in relation to the 4 core design tenants. ESIA progressing in parallel to capture broader environmental and social impact assessment considerations and ongoing consultation with regulators and stakeholders to confirm final PRZ design. ESIA to generate final evidence-based PRZ design and monitoring program.

6 EXPLORATION ENVIRONMENTAL RISK ASSESSMENT

6.1 Introduction

The Environment (Seabed Minerals Activities) Regulations 2020 (Schedule 1 and 2) describe the tiers of activity that require consent and those that require permitting. The following Risk Assessment addresses the known Tier 2 activities that will be carried out in the exploration program. By definition, these activities pose relatively low risk of significant impacts and therefore do not require a specific Environmental Impact Assessment (EIA). As described in the Work Plan, the need for OM's exploration program to conduct Tier 3 activities that do require a permit and EIA will be known at the end of Year 2.

Environmental sampling activities, sampling devices and instruments that will be used during the exploration program are typical of deep-sea scientific research activities around the world and the detailed environmental programme is described in the Exploration Work Plan. The activities will interact with the sea surface, atmosphere, water column and seafloor. Interaction with the seafloor will cause negligible disturbances at the scale of the contract area and abyssal environment. The area disturbed will be considerably less than 10,000 m² and will be defined as Tier 2 activities that have low environmental risk by definition. The Tier 2 exploration activities and the receiving environments are listed in Table 6.

Activity type	Activity	Receiving Environment
Vessel operations	Mobilization and demobilization	Nearshore - atmosphere
		Nearshore – water column
		Onshore – social
	Operation	Nearshore – water column
		Offshore – water column
Multibeam echosounding	Sampling	Offshore – water column
		Offshore – seafloor
Oceanographic moorings	Mooring deployment and operation	Offshore – water column
		Offshore – seafloor
Water sampling and CTD profiles	Sampling	Offshore – water column
Drifting hydrophones	Sampling	Offshore – water column
Nodule and sediment sampling	Freefall grab sampling	Offshore – seafloor
		Offshore – water column

Table 6 - Tier 2 activities and receiving environments

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	Boxcore sampling	Offshore – seafloor
		Offshore – water column
	Multicore sampling	Offshore – seafloor
		Offshore – water column
	Epibenthic dredge	Offshore – seafloor
		Offshore – water column
Seabed imaging	Towed camera, AUV, ROV	Offshore – seafloor
		Offshore – water column
Pelagic sampling	Net trawls and sampling	Offshore – water column
	Water sampling	Offshore – water column
	Bioacoustics	Offshore – water column
Benthic lander sampling	Lander experiments	Offshore – seafloor
	Lander trapping	Offshore – seafloor
	Lander imaging	Offshore – seafloor
Project execution	All activities	Onshore - social

6.2 Potential Environmental Risks

The potential risks of the exploration program are identified in Table 7. The assessment of the significance of these risks is informed by the understanding of the environment and experience of the project team with the observations made during the 2019 scientific research voyage, similar exploration programs in the CCZ and other activities in deep-sea and continental shelf environments.

The environmental risks of the majority of Tier 2 activities are negligible to low and involve interactions with the seafloor or water column habitats that are small in scale and/or intensity when contextualized within the spatial scales of the open ocean and abyssal environments of the EEZ.

Potential risks associated with logistical aspects of mobilization and demobilization from the Port of Rarotonga are ranked as Moderately significant. This is in recognition of the logistical challenges encountered during the 2019 scientific research voyage and an appreciation for the increased complexity of movements and international supply for the Exploration Work Program.

Other Moderate and High significance aspects of the project are associated with the potential for Positive Impacts. OM's experience from the 2019 scientific research voyage, and feedback to the subsequent drafting of the Seabed Minerals Bill and Regulations and observing the stakeholder engagement processes is that there is potential for the exploration to have a positive impact on community awareness and perceptions. OM intends to collaborate with Cook Islands agencies to foster these positive impacts by encouraging participation of observers (as successfully implemented in the 2019 scientific research voyage), sharing of regionally significant

data, and generally producing materials and engagement platforms that create awareness. The exploration program has the potential to create tangible high impact with respect to travel, accommodation and support services of exploration crew and scientists and we acknowledge the potential importance of this injection into the local economy in a post-COVID-19 recovery phase.

The risks associated with exploration voyages will be re-assessed after detailed project scoping at the project execution planning stage. Risk mitigations and management are discussed, and the process for reporting and reviewing environmental risks is laid out in document NPPOL-00000-RSKMG-00 - Risk Management Plan.
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Table 7 - Tier 2 activity environmental risks/opportunities and significance

	Potential Significance	MODERATE Logistical impacts experienced during previous campaign	LOW Engaging international supply chain for logistics. Relatively low incremental pressure compared to existing supply, cruise ships etc.	MODERATE Travel and accommodation services hard hit by COVID-19 potentially benefitting from international personnel travel for exploration campaigns	HIGH News stories, independent observers, shared experiences have potential to raise awareness and general knowledge and have a high positive impact in the community.	NEGLIGIBLE Relatively low spatial influence of research vessel(s) in context of EEZ.	NEGLIGIBLE Normal vessel operations controlled by MARPOL and standard vessel procedures.	NEGLIGIBLE Relatively low spatial influence of research vessel(s) in context of EEZ. Standard vessel procedures with respect to avoidance of cetaceans and other fauna.
ance	Potential risks/opportunities	Resourcing and stretching local resources with potential impact to normal logistics, berthing and vessel traffic management systems	Increased pressure on local resources with potential impact to normal berthing, wharfing and shipping services	Positive impact to local travel and accommodation services	Positive impact to societal interest, news, awareness raising and education	Potential disruption of animal communication/migration	Potential introduction of toxicants and contaminants	Potential direct animal strike
אוווונים מווח אווווים	Potential driver	Logistics and vessel traffic	Wharf services	Personnel movements and services	Vessel presence	Underwater noise	Vessel discharges	Vessel travel
	Activity	Mobilisation and demobilisation				Operation		
ו מחוב ו - ווכו ב מטוועונץ	Activity type	Vessel operations						

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NEGLIGIBLE Relatively low incremental increase compared to existing shipping and global GHG emission etc.	NEGLIGIBLE Low existing activity in Application Area. Relatively low incremental increased in spatial influence of research vessel(s) in context of EEZ.	NEGLIGIBLE Multibeam is relatively low energy and high frequency acoustic system, unlike seismic (sub- bottom) acoustic systems. No evidence for lethal or sub-lethal impacts of multibeam echosounding.	NEGLIGIBLE Multibeam is relatively low energy and high frequency acoustic system, unlike seismic (sub- bottom) acoustic systems. No evidence for lethal or sub-lethal impacts of multibeam echosounding.	NEGLIGIBLE Footprint of interaction with seafloor is small (<10 $\rm m^2)$ compared to extent of available habitat.	NEGLIGIBLE Acoustic doppler current meters (ADCPs) emit relatively low energy acoustic pulses intermittently. No evidence for lethal or sub-lethal impacts of acoustic current profiling.
Emission of greenhouse gases	Potential disturbance to shipping and fishing operations	Potential disturbance to plankton and nekton populations	Potential disruption of animal communication/movement/migration	Impact and compaction of anchors with seafloor habitat	Potential disturbance to plankton and nekton populations
Greenhouse gas emissions	Interaction with other marine users	Introduction of acoustic energy		Interaction with seabed habitat	Introduction of acoustic energy
		Sampling		Operation	
		Multibeam echosounding		Oceanographic mooring installation and	

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er sampling CTD profiles Ring rophones Sampling	Introduction of manufactured debris Removal of water and plankton Sensor measurements Sensor measurements Sensor measurements	communication/movement/migration Placement of sacrificial anchors on the seabed upon recovery of the moorings Potential disturbance to plankton and nekton populations Potential disturbance to water column habitat Potential disturbance to water column habitat	Acoustic doppler current meters (ADCPs) emit relatively low energy acoustic pulses intermittently. No evidence for lethal or sub-lethal impacts of acoustic current profiling. LOW Footprint of sacrificial anchors remaining on seafloor is small (<5 m ²) compared to extent of available habitat. Multiple anchors required for sequential deployment and recovery. Anchors will be made from non-toxic materials to the extent possible. NEGLIGIBLE NEGLIGIBLE Vegligible volumes required for scientific sampling. NEGLIGIBLE NEGLIGIBLE NEGLIGIBLE NEGLIGIBLE Forvironmental sensors are low voltage systems with very limited spatial influence. NEGLIGIBLE Passive acoustic ('listening') sensors are low voltage systems with very limited spatial influence.
and Freefall grab nt sampling ig	Interaction with seabed habitat, removal of nodules and sediment	Seafloor impact and substrate removal	NEGLIGIBLE Area of seafloor impact per deployment (<1 m ²) negligible compared to total abyssal habitat. Volume of nodule and sediment removal per deployment (<1 m ³) negligible compared to total abyssal habitat. Total spatial footprint of sampling will be less than 10,000 m ² in area over the life of the exploration program.

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NEGLIGIBLE Abundance of abyssal fauna generally low compared to shallow water habitats. Scales of abyssal community distribution and ecosystem function are very large with typically low levels of small-scale uniqueness. Volume of nodule and sediment removal per deployment (<1 m ³) negligible compared to total abyssal habitat. No macroscopic benthic biota observed in FFG samples from 2019 scientific program.	NEGLIGIBLE Very small spatial scale and volume of sediment disturbance at seafloor. High dilution of escaping sediments in water column during ascent of sampling gear.	LOW Footprint of sacrificial weights remaining on seafloor from FFG sampling is small (<0.5 m^2) compared to extent of available habitat. Multiple anchors required for sequential deployment and recovery. Anchors will be made from non-toxic materials to the extent possible.	NEGLIGIBLE Area of seafloor impact per deployment (~1 m ²) negligible compared to total abyssal habitat. Volume of nodule and sediment removal per deployment (<1 m ³) negligible compared to total abyssal habitat. Total spatial footprint of sampling will be less than 10,000 m ² in area over the life of the exploration program.
Direct removal of benthic biota	Disturbance and redistribution of sediments at seabed due to sampling and introduction of sediments to water column due to recovery of equipment	Placement of sacrificial weights on the seabed upon recovery of the grab	Seafloor impact and substrate removal
Removal of biota	Creation of sediment plume	Introduction of manufactured debris	Interaction with seabed habitat, removal of nodules and sediment
			Boxcore sampling

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NEGLIGIBLE Abundance of abyssal fauna generally low compared to shallow water habitats. Scales of abyssal community distribution and ecosystem function are very large with typically low levels of small scale uniqueness. Volume of nodule and sediment removal per deployment (<1 m ³) negligible compared to total abyssal habitat.	NEGLIGIBLE Very small spatial scale and volume of sediment disturbance at seafloor. Box core is sealed, preventing escape of most sediments.	NEGLIGIBLE Area of seafloor impact per deployment (~5 m ²) negligible compared to total abyssal habitat. Volume of nodule and sediment removal per deployment (<5 m ³) negligible compared to total abyssal habitat.	NEGLIGIBLE Abundance of abyssal fauna generally low compared to shallow water habitats. Scales of abyssal community distribution and ecosystem function are very large with typically low levels of small scale uniqueness. Volume of nodule and sediment removal per deployment (<5 m ³) negligible compared to total abyssal habitat.
Direct removal of benthic biota	Disturbance and redistribution of sediments at seabed due to sampling and introduction of sediments to water column due to recovery of equipment	Seafloor impact and substrate removal	Direct removal of benthic biota
Removal of biota	Creation of sediment plume	Interaction with seabed habitat, removal of nodules and sediment	Removal of biota
		Multicore sampling	

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NEGLIGIBLE Very small spatial scale and volume of sediment disturbance at seafloor. Multicore is sealed, preventing escape of most sediments.	LOW Area of seafloor impact required to achieve desired nodule mass for metallurgical testing is approximately 7,000 m^2 (below the 10,000 m^2 threshold for Tier 3). Reworking of surface sediments spatially constrained and ecological impact of nodule removal is low compared to total area.	LOW Abundance of abyssal fauna generally low compared to shallow water habitats. Scales of abyssal community distribution and ecosystem function are very large with typically low levels of small scale uniqueness. Volume of nodule and sediment removal is low compared to total area.	LOW Relatively small spatial scale and volume of sediment disturbance at seafloor per deployment.	NEGLIGIBLE Very small instantaneous footprint of imaging platform. High attenuation and of light introduced by platform.
Disturbance and redistribution of sediments at seabed due to sampling and introduction of sediments to water column due to recovery of equipment	Seafloor impact, substrate removal and reworking	Direct removal of benthic biota	Disturbance and redistribution of sediments at seabed due to sampling and introduction of sediments to water column due to recovery of equipment	Potential disturbance to plankton and nekton populations
Creation of sediment plume	Interaction with seabed habitat, removal of nodules and sediment	Removal of biota	Creation of sediment plume	Introduction of light, noise and acoustic energy
	Epibenthic dredge sampling			Towed camera, AUV, ROV
				Seabed imaging

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Noise introduced by strumming of tow cables, vibration of towed bodies or motors of AUVs/ROVs is relatively low energy.	NEGLIGIBLE Very small instantaneous footprint and slow movement of imaging platforms. Low electromagnetic energy emissions with no evidence of impact to animal communication, movement or migration.	NEGLIGIBLE Low density of water column fauna that may collide with imaging platform. Slow movement of imaging platform.	NEGLIGIBLE Abundance of deep-sea pelagic fauna generally low compared. Scales of pelagic community distribution and ecosystem function are very large with typically low levels of small scale uniqueness. Volumes of biological samples negligible compared to total open ocean habitat.	NEGLIGIBLE Negligible volumes required for scientific sampling.	NEGLIGIBLE Environmental sensors are low voltage systems with very limited spatial influence.	NEGLIGIBLE Bioacoustic sensing is relatively low energy system, unlike seismic (sub-bottom) acoustic systems. Relatively low spatial footprint of bioacoustic sensing.
	Potential disruption of animal communication/movement/migration	Potential disturbance to plankton and nekton populations	Direct removal of pelagic plankton and micronekton	Potential disturbance to plankton and nekton populations	Potential disturbance to water column habitat	Potential disturbance to plankton and nekton populations
		Direct interaction with biota	Removal of biota	Removal of water and plankton	Sensor measurements	Introduction of acoustic energy
			Net trawls and sampling	Water sampling		Bioacoustics
			Pelagic sampling			

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No evidence for lethal or sub-lethal impacts of bioacoustic echosounding.	NEGLIGIBLE No evidence for lethal or sub-lethal impacts of bioacoustic echosounding.	NEGLIGIBLE Very small footprint of lander platform compared to total habitat extent. High attenuation of light. Sensor systems with low electromagnetic energy.	NEGLIGIBLE Removal of low numbers of benthic mobile species whose populations are large and widespread.	NEGLIGIBLE Negligible impacts of lighting and videography of animals attracted to bait.	LOW Personnel influx relatively low compared to cruise ships and other baseline tourism activity. Project staff induction to include training and compliance in the areas of respectful local engagement and behaviors.	HIGH Personnel and logistical movements and engagement of the project with local providers.
	Potential disruption of animal communication/movement/migration	Potential disturbance to benthic populations	Direct removal of benthic scavenger fauna in baited traps	Attraction of benthic predators	Potential negative impacts of increased personnel movement and local interactions	Potential positive impacts of increased personnel movement and local interactions
		Introduction of light and energy	Removal of biota	Baiting fauna	Personnel movements and interactions	
		Lander experiments	Lander trapping	Lander imaging	Project execution	
		Benthic lander sampling			Cultural and Socioeconomic	

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High positive impact to Cook Islands travel sector, particularly in a post-COVID-19 recovery phase.	HIGH Experience from 2019 scientific research voyage indicates high interest and potential for positive impacts of stakeholder interactions. High positive impact of exploration activity contributing to national scientific knowledge High positive impact of direct observers in exploration voyages.	LOW Experience from OMs past interactions and experience of the SBMA 2020 stakeholder engagement process indicates low risk of negative perceptions.
	Positive impacts of increased awareness and education	Negative impacts of negative perceptions
	Project awareness and positive perceptions	Negative perceptions

6.3 Potential Tier 3 Activities

The need for Tier 3 exploration activities will be determined at the end of Year 2 of the Exploration Work Plan. The need for equipment or process tests/trials is dependent upon the status of engineering design and testing programs currently underway, and on a more fully developed understanding of the nature of seafloor sediments in the contract areas.

The types of Tier 3 activities that could potentially be involved include individual component tests in the midwater column and at the seafloor to integrated systems trials. The nature and scale of Tier 3 activities is unknown at this time and therefore the scale of environmental risk and potential impacts are unknown. However, on the basis of experiences from the CCZ, the types of environmental considerations that might be expected for Tier 3 activities include:

- Potential for increased physical interaction with seabed habitats and removal of nodules.
- Potential for increased disturbance of seafloor sediments and direct impact to benthic fauna.
- Potential for increased generation of near-bottom plumes and sedimentation.
- Potential for generation of water column plumes.
- Potential for increased underwater noise and electromagnetic energy.
- Potential for increased environmental sensor deployments for monitoring.

Should Tier 3 activities be required, these will trigger dedicated EIA and separate assessment of environmental risks. EIA triggered by Tier 3 activities will entail a dedicated and targeted baseline, impact assessment and monitoring program.

6.4 Avoidance, Management and Mitigation Measures

Scientific sampling will be subject to Standard Operating Procedures that will be subject to a full Risk Assessment accompanying annual work plans prior to voyages to assess the risks of the detailed scope of work. Voyage reports and annual reports will acquit against those risk assessments. The Risk Assessment will cover environmental and safety aspects of the operation. The risks associated with issues such as spills, leaks, hazardous chemicals, interaction with marine fauna etc. will be assessed and the SOPs will be lodged with the Offshore Voyage Manager who will be responsible for their implementation. The SOPs will be available for review by regulators and will be subject to monitoring and ongoing improvement as required. All exploration activities will be subject to monitoring and evaluation at-sea by the Offshore Voyage Manager (Party Chief) and Lead Scientists to confirm the predictions of the EMP and identify areas for improvement.

Most Tier 2 activities of the exploration program are of negligible to low significance (see Table 7) and therefore preclude the need for specific mitigation measures. However, specific avoidance and management measures of the program will include:

• Use of state-of-the-art technologies and methods to track sampling equipment interaction with the seabed and clear documentation of cumulative area/tonnages of nodules sampled.

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- Sharp look-out for cetaceans and other marine fauna while transiting and operating.
 - Standard cetacean avoidance measures by vessel Master's course and speed changes to avoid adverse interactions.
 - Scan for presence of marine wildlife in vicinity of vessel prior to deployment of over-the-side equipment.
 - Particular care when approaching or leaving the coastal environment around Rarotonga during the July–October humpback whale season.
 - Adopt principles of regional guidelines (e.g., Australian Government National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna).
 - Register and report any interactions with marine fauna.
- Safe and secure storage of hazardous chemicals onboard as per manufactures Materials Safety Datasheet and vessel operator's requirements.
- Implementation of final Incident Response Management Plan.
- Proper maintenance of equipment and avoidance of leaks and spills from deck cranes, winches etc.
- Proper handling of waste offshore as per MARPOL requirements.
- Compliance with international best practice in ballast water management and the avoidance of introduction of marine pests under direction from Port Authority and vessel operator.
- Compliance with international best practice in freight management and customs to avoid introduction of terrestrial exotic species under direction from customs agents.
- Regular drills, training and checks on all equipment and procedures that are relevant to environmental controls (e.g. spills containment, fire prevention and firefighting, materials handling offshore).
- Comprehensive induction of all personnel that covers international travel, mobilization, interactions with local people, expected behaviours and confidentiality to mitigate the risk of negative perceptions.
- Comprehensive sample security and chain of custody documentation to provide secure and quality assured sample and data transmission.
- Publishing of Notice to Mariners for offshore moorings and communication to Ministry for Transport to avoid collisions or negative interactions with fishing gear.

The following measures will be taken to maximize the potential positive impacts of the exploration program (further details are provided in the Local Engagement, Training and Business Development Plan (NPPLN-32000-LCTRB-00)):

- Maintaining a Rarotonga office, establishing business connections and staffing with individuals who can interface with stakeholders.
- Actively supporting regulator observer attendance.

• Actively supporting training and education.

Producing data and reports for public dissemination and fostering evidence-based decision making.

6.5 Accidents and Emergencies

Accidents and emergencies will be avoided by the implementation of best international practice in offshore exploration as described in the Incident Response Management Plan (NPPLN-41200-INRSP-00). The Seabed Minerals Bill (2019), Environment Act (2003) and best international practice require the reporting of incidents that may be deemed to affect the environment. In the case of accidents and emergencies, these may include:

- Fuel or lubricant spills.
- Chemical spills.
- Animal strikes.
- Serious injury.
- Negative interactions with other marine users such as shipping and commercial fishing.
- Loss of equipment (introduction of manufactured debris) in the water column or on the seabed in the case of malfunction, breakage or loss.
- Loss of samples and data.

Mitigation and controls for potential accidents and emergencies are listed in Table 8.

Table 8 - Controls and mitigation associated with accidents or emergencies

Accident/Emergency	Controls and mitigation
Spills and leaks	International best practice Shipboard Materials Handling
	International best practice Shipboard Oil Pollution Emergency Plan Maintenance and training of spill containment kits and procedures
Animal strike	International best practice vessel strike mitigation processes
	Dedicated offshore observation system for baseline studies feeding back to vessel master Formalized screening/scanning process before deployment of equipment
Serious Injury	Stabilize using onboard equipment Arrange for Medevac
Negative interactions with marine users	Registration and reporting of interactions of sampling equipment with fishing gear
	International best practice in marine operations, use of AIS systems and radar to avoid vessels and fishing gear
	Respectful interactions at-sea

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	Publication of Notice to Mariners for moored equipment
Loss of equipment at sea	Use of experienced scientists, crew and offshore manager Registration and reporting of lost equipment Review of SOPs
Loss of samples and data	Use of experienced scientists, crew and offshore manager Offshore database, data registration and physical sample registration systems Off-ship cloud-based database systems Quality assured chain of custody processes

7 PROGRAM REVIEW AND IMPROVEMENT

Prior to each voyage, a detailed scoping study will be completed to confirm method selection, SOPs, data management processes etc., and a desktop risk assessment will be completed. During each voyage, the activities will be logged and monitored. Unexpected impacts or incidents will be reported through the proper channels in real time. The results of the voyage, along with any identified areas for improvement will be identified in voyage reports, annual reports and consultative processes. As such, a mechanism of review and improvement of the exploration program will exist and OM will report these to regulators and stakeholders.

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Annex 3 - OM-07 NPPLN-31000-ENVMN-01 Moana Minerals LLC - Environmental Management Plan

Final Audit Report

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Cook Islands Exploration License Application

Incident Response Management Plan

As at January 5, 2022

NPPLN-41200-INRES-03



Incident Response Management Plan

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5 Dec 2021	N/A	01	General update incorporating license panel comments
5 Jan 2022	N/A	02	Reference to Contagious Disease Operational Plan
1 Feb 2022		03	Inclusion of insurance requirements prior to work (Section 5)

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1. EXECUTIVE SUMMARY

This document details the standard required for the Incident Response and Management Plan for the Ocean Minerals Group operations in Cook Island waters for managing the risk of incidents.

Ocean Minerals Group of companies (OM) is comprised of US registered parent company Ocean Minerals, LLC (OML) and wholly owned subsidiary companies including US registered OML Rare Earth, LLC and Cook Islands registered Moana Minerals Limited (Moana).

Moana Minerals will conduct an exploration work program using chartered third-party vessels, and this Plan will be used to review and finalize the campaign and vessel specific operational Incident Response and Management Plan together with the relevant Crown Agencies and other bodies with jurisdictional competence. Each Plan will be subject to finalization and approval under section 20(4) of the Act.

This document identifies the major incidents that could occur, a preliminary risk assessment (to be finalized with the signing of the vessel Charter Agreement) and the standards required for incident response, crew competencies and reporting.

Moana and any appointed operators shall ensure that the Exploration Work Program activities are carried out with due diligence and efficiency and according to good industry practice. As such Moana will safeguard the health, safety and welfare of persons engaged in the activities, observe Cook Island labor standards; and avoid, mitigate, or remedy adverse effects on the marine environment.

2. DEFINITIONS, ABBREVIATIONS AND ACRONYMS

Field	Description or Definition
AABW	Antarctic Bottom Water
АСТ	Maritime Transport Act (2008) as amended
ВА	Breathing Apparatus
СІ	Cook Islands
EWP	Exploration Work Plan
GMDSS	Global Maritime Distress and Safety System
GRT	Gross Registered Tons
IRMP	Incident Response Management Plan
ISM	International Safety Management Code
LAT	Average Low water mark
Moana	Moana Minerals Limited
nM	Nautical Mile
OEL	Occupational Exposure Limit
ОМ	Ocean Minerals group comprised of Ocean Minerals LLC, and Moana Minerals Limited
OML	Ocean Minerals LLC
PUE	Priority Unwanted Event
SMS	Safety Management System
SOLAS	Safety of Life at Sea Convention
SOPEP	Shipboard Oil Pollution Emergency Plan
STCW	Standards of Training, Certification and Watchkeeping
Subsidiary	Any company in which OM has a controlling interest
TARP	Trigger Action Response Plans

3. OBJECTIVES

Critical to the success of any exploration activities undertaken by Moana is the state of readiness of any chartered vessel and crew, and their ability to respond effectively to all reasonably foreseeable emergency situations and other incidents. This document acts as a guideline, defining a minimum standard to be met before commencing any work on behalf of Moana, in order to ensure that the arrangements for managing the risk of incidents are clearly understood by all stakeholders.

Where necessary, Moana will provide guidance to the vessel operators and managers, to achieve optimal outcomes from any given unwanted event.

On the basis that prevention is better than cure, the focus of any charter shall be to ensure that proactive practices are in place, to prevent any injuries or harm to people and damage to property. Moana will follow the approach of the four-element emergency management model "Prevent, Prepare, Respond, Recover" through a review of the vessel and operator's policies, procedures, and resources. This process will establish their current capacity to contain, and where necessary respond to an emergency, and to deal with shipboard incidents to ensure that sound maritime operations are practiced, and that the conditions of any approved Consent or Permit are met.

This document applies to any incidents of accident or harm, as defined by the Cook Islands Maritime Transport Act. As such, any vessel used by Moana will be required to comply with this Act.

Incident Response Management Plan

4. CODES AND DOCUMENTATION

This Plan links with:

- Moana's Environmental, Community, Occupational Health and Safety Policy
 - Moana's Risk Management Plan
- Moana Integrated Safety, Health and Environmental Management Plan
- Moana Minerals Contagious Disease Operational Plan

The following key legislation and guidelines are applicable to the implementation of the Incident Response Management Plan

Instrument • Seabed Minerals Bill (2019), • Seabed Minerals Amendment Act (2020), Seabed Minerals (Exploration) Regulations (2020), • Environment (Seabed Minerals Activities) Regulations (2020) Cook Islands Environment Act (2003) Prevention of Marine Pollution Act (1998)	Description Sets out the governance requirements for the licensing of exploration and exploitation activities. Upholds the requirements of the Environment Act (2003) and establishes compliance requirements. Core legislation that controls the permitting of activities that have the potential to cause significant environmental harm.	Responsible Department/Age • Seabed Minerals Aut • Seabed Minerals Commissioner, • Seabed Minerals Adv Board The Cook Islands Natior Environment Service
Prevention of Marine Pollution Act (1998)	An act to provide for the prevention of marine pollution, the dumping and transportation of other waste in Cook Islands Waters by vessels and to give effect to various international conventions on marine pollution and protection of the marine environment	Ministry of Transpoi
Maritime Transport Act (2008)	Provide for the maritime safety of the Cook Islands and Cook Islands vessels and protect the marine environment	Ministry of Transpor

Yoana Minerals

Instrument	Description	Responsible Department/Agency
Maritime Rules (Offences) Regulations (2014), as applicable	Regulations for Charterers, owners and masters of vessels registered in the Cook Islands	Ministry of Transport
Maritime Zones Act (2018)	Declares the territorial sea (LAT to 12 nM), contiguous zone (LAT to 24 nM), exclusive economic zone (LAT to 200 nM), and continental shelf of the Cook Islands as the maritime zones of the Cook Islands. Declares, and expresses the rights of the Cook Islands and other States in relation to, the maritime zones of the Cook Islands consistently with international law. Repeals with Continental Shelf Act (1964) and the Territorial Sea and Exclusive Economic Zone Act (1977).	AI
National Seabed Minerals Policy (2014)	Sets out the Government's sustainable management and regulation of seabed minerals	Seabed Minerals Authority
Te Tarai Vaka (Cook Islands Environmental and Social Safeguards Policy)	Sets out the Government's objectives for environmental and social safeguards for the Cook Islands	Central Policy and Planning Office of the Office of the Prime Minister, Ministry of Finance and Economic Management
Part 7, Employment Relations Act (2012)	Regulations to ensure health, welfare and safety of employees	Ministry of Internal Affairs
Policy: Workplace Health and Safety (Draft June 2020)	Policy aims to further the aims of the National WHS Policy by providing a clear framework for dealing with priority WHS issues	Ministry of Internal Affairs: Labor and Consumer Division
International Convention for the Prevention of Pollution from Ships (MARPOL)	The main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.	International Maritime Organization

Incident Response Management Plan

Instrument	Description	Responsible Department/Agency
International Convention on Safety of Life at Sea, as applicable to class of vessel used to execute the Exploration Work Plan (SOLAS)	International maritime treaty which sets minimum safety standards in the construction, equipment and operation of merchant ships.	International Maritime Organization
International Safety Management Code (1994, as amended) (ISM Code)	International standard for the safe management and operation of ships and for pollution prevention	International Maritime Organization
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)	The Convention prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.	International Maritime Organization
Cook Islands Occupational Safety and Health National Reform Final Draft National Occupational Safety and Health Policy (2019)	Approach to Occupational Safety and Health (OSH), including a comprehensive OSH regulatory framework	CI Ministry of Internal Affairs

5. APPROVAL OF MANAGEMENT PLAN

Moana will enter into Charterparty agreements with established, reputable marine operators to charter ships to execute the Exploration Work Plan (EWP). As such, the ship operator will provide the final Incident Response and Management Plan (IRMP) that will apply to all activities. However, Moana will ensure, through application of this document, that the IRMP meets best practice applicable to the EWP and complies with the Maritime Transport Act.

Prior to the finalization of a charter agreement, the following activities will be undertaken by Moana:

- Review the vessel's risk management processes and identify its major hazards and the critical controls in place to manage those risks; confirming, as a minimum, the major hazards listed in this document are identified and appropriate response plans exist
- Examine the emergency procedures created to mitigate the impact of a failure of those critical controls
- Review the associated documentation that provides input and support to the emergency response process
- Review the procedures in the event of an incident, ensuring that as a minimum, incidents listed in this document are identified and appropriate response plans exist, and
- Ensure that a reliable incident management and reporting system is in operation onboard the vessel.

The following shall therefore be reviewed and agreed between the vessel Manager/Operator and Moana prior to formalizing a charter agreement and exploration work activities at sea.

- Regulatory Environment
- Insurance cover placed (appropriate insurance cover taken out and in place, with reputable insuring organisations, to cover the spectrum of potential exploration program incident, including charterer's insurance, Protection & Indemnity (P&I) Club insurance, Hull & Machinery Insurance, workman's compensation etc.)
- Risk Management
- Emergency Response Plan and Procedures
- Emergency Response Infrastructure
- First Response Escalation Triggers and ongoing response
- Emergency Response Personnel and
- Training and Assessment

The objective of this review is to establish the effectiveness of the vessel's emergency response procedures and capabilities to mitigate the consequences of a priority unwanted event (PUE), and to ensure that appropriate procedures exist to manage any other incidents of a lesser severity.

6. MARINE ENVIRONMENTAL CONDITIONS

The marine environment is defined as:

- The ocean in which the vessel transits
- The ocean in which the EWP is performed including the ocean surface and water column
- The seabed on which exploration activities are conducted
- Marine birdlife in the vicinity of the vessel, and
- Marine life (pelagic and mammal) in the vicinity of the vessel during exploration operations

There is little existing information on deep-sea benthic environments in Cook Islands. Moana's exploration area is at 4,800 to 5,200 m water depth and in general is characterized by the presence of nodules and surficial clays. Mining will target the relatively flat terrain of the abyssal plain. Seamounts and knolls, which can harbor diverse life and may contain sensitive biological communities, are not sites of high nodule abundance and are unable to be traversed by nodule collectors, precluding them from mining. In general, the abundance of organisms and species diversity for most groups (particularly macrofauna and megafauna) decreases with depth.

The water column overlaying the contract area is a subcomponent of a large pool of Western South Pacific oceanic water. At abyssal depths in the area, the dominant water mass is known as Antarctic Bottom Water, a cold (\sim 1°C), dense water mass some 1000 m thick that migrates slowly north towards the equator from Antarctica.

The oceanic waters of the Cook Islands are considered part of a large biogeographic zone. In the expansive habitat of the open ocean, biomass is dominated by small-bodied invertebrates and fishes, that are broadly distributed and occur in generally low abundance. Large-bodied predators such as tunas, billfishes, sharks and dolphinfish are variable in their distribution. Cetaceans (whales and dolphins), and seabirds also occur in the area, and regions of the Cook Islands which have been declared both a shark sanctuary and a whale sanctuary.

Incidents may affect the marine environment through:

- Unattended foreign objects floating on the sea surface that pose a danger to navigation
- Plastics and solid pollutants floating in the water column that pose a danger to marine life
- Foreign objects deposited on the seabed
- Liquid pollutants floating on the sea surface or within the water column that pose a danger to marine life and the environment and / or
- Excess smoke or toxic fumes released to the atmosphere

Incident Response Management Plan

7. ROLES AND RESPONSIBILITIES

An extract of the provisional Moana Minerals operational structure is as follows:



Figure 1: Provisional Moana Minerals Operational Management Structure

7.1 Responsibilities

Responsibilities relating to Incident Management are:

- <u>CEO:</u> Overall accountability for incident response; liasion with government and press. Provide overall steer on incident management
- **Operational Manager:** Liaise with vessel operators and local authorities to facilitate emergency response and shoreside logistics; maintain Incident Response Management Plan; ensuring that the chartered vessel and Operators comply with the minimum requirements of this Plan and Cook Islands legislation, ensure that a Baseline Risk Assessment is conducted and suitable mitigation strategies developed and implemented.
- <u>Offshore Manager:</u> Provides support to Master. Shall notify Moana company management of incident
- <u>Master</u>: Shall notify all local and maritime authorities, and vessel operators. Responsible for ensuring vessel has appropriate emergency response equipment onboard, and that crew is trained, competent and conducts regular emergency drills. In overall charge of managing the incident onboard the vessel.
- <u>Vessel Operators</u>: Providing Master and vessel with sufficient means to comply with the requirements of Cook Islands legislation and this Plan.

Further information is given in Paragraph 11.2

7.2 RESPONSE ACTIVATION AND CO-ORDINATION

The Master, (or first mate in the event Master is incapacitated) will initiate the incident response communications and immediate first response as outlined in this Plan and onboard procedures.

In the event that the vessel is incapacitated and cannot raise an alert, the Operational Manager will alert the authorities and initiate the response.

Details for the co-ordination of emergency response have not yet been developed and will be done so between Moana Minerals Operational Manager, Cook Islands Maritime Authorities and the vessel operators.

In the event of a significant incident, the Operational Manager and CEO shall follow predetermined communications steps to be outlined in a Communications Plan submitted to the Ministry of Transport for review prior to the commencement of offshore operations.
8. SAFETY MANAGEMENT SYSTEM

Moana Minerals currently does not own or operate any vessels.

Moana Mineral's safety management philosophy is described by the following documents:

- OM-10 NPPOL-33000-SHEPL Integrated Safety, Health and Environment Management Plan
- OM-22 NPPLN-00000-RSKMG Risk Management Plan
- OM-08 NPPLN-41200-INRES Incident Response Management Plan

Moana Minerals requires that any vessel chartered to operate on its behalf operates under a safety management system (SMS) that complies with the mandatory safety rules and regulations of the Flag State, Cook Islands and Classification Authority, and follows the codes, guidelines, and standards recommended by the IMO, classification societies, and concerned maritime organizations.

Should Moana Minerals purchase and operate the exploration vessel, a Safety Management System in compliance with the ISM code will be compiled. The system will be based on that of Moana's partner, TransOcean, and will be submitted to the CI Authorities for review prior to the commencement of operations.

The safety management policy should satisfy the basic functional requirements to ensure the safety of the ship, including:

- ISM Code
- Procedure and guidelines to act in an emergency situation (based on the requirements of this Plan)
- Operator's Safety and environmental protection policy
- Procedure and guidelines for reporting accidents or any other form of non-conformities (based on the requirements of this Plan)
- Clear information on the level of authority and lines of communication among ship crew members, and between shore and shipboard personnel
- Procedures and guidelines to ensure safe operation of the ship and protection of the marine environment in compliance with relevant international, Cook Island and flag state legislations.
- Procedures for internal audits and management reviews
- Vessel details

9. INCIDENT IDENTIFICATION

9.1 GENERAL

In the execution of activities under the EWP, the vessel will not proceed or continue with activities: if the crew or onboard personnel are aware of evidence that continuing makes it reasonably likely that an incident will occur; or the vessel will be unable to respond to any incident through implementation of the Incident Response and Management Plan.

9.2 RISK AND HAZARD IDENTIFICATION

The following significant risks are to be addressed as a minimum in the final IRMP:

- Main engine failure
- Electrical power failure
- Grounding
- Fire
- Piracy
- Irreparable propulsion or steering failure
- Man overboard
- Flooding
- Collision at sea
- Helicopter ditching (if fitted with helideck)
- Helicopter crash on deck (if fitted with helideck)
- Serious injury / illness
- Contagious diseases and quarantine requirements, including Covid-19 outbreak, and
- Oil pollution and hazardous spill

9.3 RISK ASSESSMENT

A standard 5 x 5 risk matrix (Figure 2) will be used to assess risks and identify appropriate mitigation actions.

Risks will be ranked based on their consequence (negligible to catastrophic, in one of 6 categories: Safety, Health, Environmental, Social & Community, Legal & Regulatory, and Reputation), and likelihood of occurrence (rare to frequent).

Annexure 2 contains a guideline Baseline Risk Assessment against which the vessel and Operator's risk identification will be verified. Where necessary, a detailed risk assessment of all activities to be conducted in the EWP shall be undertaken by a multi-disciplinary, multi-level team

Incident Response Management Plan

comprising Moana, vessel personnel, and Vessel Operator personnel, as described in the Moana Integrated SHE Management Plan.

		1	2	3	4	5
ſ	ř	Rare	Uncommon	Occasional	Regular	Frequent
5	Catastrophic	110	16	20	23	25
4	Critical	7	12	17	21	24
3	Serious	4	8	13	18	22
2	Marginal	2	5	9	14	19
1	Negligible	1	3	6	10	15

Figure 2: Risk Matrix

	(consider the	Severity maximum reasonable p	· Level otential consequence c	of the event)	
Impact Type	÷	7	ę	Þ	5
	Negligible	Minor	Serious	Critical	Catastrophic
(S) Harm to People- Safety	First aid	Medical treatment	Lost time	Permanent disability or single fatality	Numerous permanent disabilities or multiple fatalities
(H) Harm to People- Occupational Health	Exposure to health hazard resulting in temporary discomfort	Exposure to health hazard resulting in temporary alterations/ limitations (no lost time)	Exposure to health hazards/ agents (over the OEL) resulting in reversible impact on health (with lost time)	Exposure to health hazards/ agents (significantly over the OEL) resulting in irreversible impact on health with loss of quality of life or single fatality	Exposure to health hazards/ agents (significantly over the OEL) resulting in irreversible impact on health with loss of quality of life of a numerous group/ population or multiple fatalities
(E) Environmental Impact	Lasting days or less; limited to small area (metres); receptor of low significance/ sensitivity (industrial area)	Lasting weeks; reduced area (hundreds of metres); no environmentally sensitive species/ habitat)	Lasting months; impact on an extended area (kilometres); area with some environmental sensitivity (scarce/ valuable environment).	Lasting years; impact on sub-basin; environmentally sensitive environment/ receptor (dangerous species/ habitats).	Permanent impact; affects a whole basin or region; highly sensitive environment (dangerous species, protected habitats)

	S	Catastrophic	Major widespread social impacts. Community reaction affecting business continuity. "License to operate" under jeopardy	Significant breach of the law. Individual or Class action law suits, criminal prosecution of Co., Directors/ Managers. Suits against parent Co.; permit to operate substantially modified or withdrawn	Noticeable reputational damage; national/ international public attention and repercussions
of the event)	4	Critical	Significant social impacts. Organized community protests threatening continuity of operations	Breach of the law; may attract criminal prosecution of Operating Co. and/or of Directors/ Managers. And penalties/ enforcement action. Individual licence temporarily revoked	Suspected reputational damage; local/ regional public concern and reactions
Severity Level maximum reasonable potential consequence o	3	Serious	On going social issues. Isolated complaints from community members/ stakeholders	Minor breach of law; report/investigation by authority. Attracts compensation/ penalties/ enforcement action	Local impact; public concern/ adverse publicity localised within neighbouring communities
	2	Minor	Some impacts on local population, mostly repairable. Single stakeholder complaint in reporting period	Breach of regulatory requirements; report/involvement of authority. Attracts administrative fine	Limited impact; concern/ complaints from certain groups/ organizations (e.g. NGOs)
(consider the	-	Negligible	Minor disturbance of culture/ social structures	Technical non- compliance. No warning received; no regulatory reporting required	Minor impact; awareness/ concern from specific individuals
	Impact Type		(C) Social / Community Impact	(L&R) Legal & Regulatory	(R) Impact on Reputation

9.4 ENVIRONMENTAL INCIDENTS

Identification of, and response to, serious environmental incidents are described in this document. However, the vessel must be prepared to respond to all pollution incidents, in accordance with the Prevention of Marine Pollution Act. Such incidents include:

- Oil or pollution discharged into the sea
- Oil or pollution escaping into the sea
- Discharge of garbage into the sea less than 35 nm from land, or without a permit
- Discharge of sewage into the sea, and
- Discharge of plastics into the sea

The vessel shall carry adequate and appropriate type approved equipment to remove, clean up or disperse any pollutant in or on the sea.

Any incident described above must be recorded, and reported to the vessel Managers, and Moana immediately, by voice to CI Maritime Authorities at the first opportunity, and in writing within 24 hours.

10. STANDARD FOR RESPONSE PERSONNEL

10.1 GENERAL REQUIREMENTS AND TRAINING

The Master (ship's captain) shall initiate all response mechanisms. The Ship's Emergency Response structure must identify a deputy, to act if the Master is incapacitated for whatever reason.

Crew and shore-based personnel shall meet the requirements of the Maritime Transport Act as well as the following:

- All personnel are trained in firefighting, first aid, and breathing apparatus use; and these skills are refreshed at least every 5 years.
- Some officers are trained to a higher level in both firefighting and first aid; (e.g., Advanced Medical Care and resources such as the Ship's Captain Medical Guide, or similar).
- Paramedic or advanced medical care facilities are accessible on shore.
- Further on-board training is provided by a subject matter expert.

It is further recommended that the following minimum standard of refresher training apply:

- One-day refresher training be undertaken every 2.5 years or 2 trainings per 5-year cycle counting the STCW as one.
- All personnel be required to undertake all roles prescribed in firefighting a minimum of once per year.
- All personnel demonstrate the ability to don and use BA a minimum of once per year including a minimum of 5 minutes under air.
- Those individuals identified as part of a BA team be provided with opportunity to go under air a minimum of 4 times per year.

Records are required (hardcopy or digital) to be available on board confirming the qualifications of each crewmember, as well as dates of refresher training.

10.2 COMPETENCIES

The Master shall ensure that persons are not knowingly exposed to risk, and that the vessel and operations conducted onboard and off the vessel do not cause any unnecessary danger or risk to any person or property. The vessel IRMP must clearly define the Ship's Masters roles and responsibilities in a major event and how those responsibilities integrate as part of the shore-based Emergency Response team.

The Master, officers and crew shall have an ability to effectively respond appropriately to any given event through evidence of initial and ongoing training related to the incident management process. The structure and responsibilities of the shore-based Emergency Response team must also be well documented, and evidence provided to verify that the individuals identified to fulfil the

designated roles described in the shore-based Emergency Response and Preparedness Plan have had initial or ongoing training in their selected function.

Shore based emergency response must have a special focus on internal, contract and external emergency services, medical services and the community in the Cook Islands. Where possible, the Managers must provide an Incident Management process that integrates, or is compatible with, the system used by external response agencies in the vicinity of the Cook Islands.

Documentary evidence must be provided that onboard personnel possess the competencies (skills, training and experience) to perform the roles and duties allocated to them in the onboard Plans. Task cards can be constructed to assist in the process of carrying out the responsibilities of each of the team members. Trigger Action Response Plans (TARPs) should also be formulated to cover all emergency scenarios to assist personnel in identifying the appropriate action to take at any time of an emergency (e.g., escalate / de-escalate, access/locate additional resources etc.).

Ship's personnel must possess competencies in a greater range of emergency risk than those prescribed by legislation – see section 9.1 and 10.3 – to prevent any element of complacency.

Formal mechanisms must be in place to identify the need to escalate the response to any incident e.g., more men, more resources etc. This will avoid sole dependence on the expertise, knowledge and experience of the Master to prompt the escalation.

10.3 DRILLS

Incident and emergency drills must be carried out in compliance with the Flag State statutory requirements. The events of the exercise must be recorded in the Emergency Exercise Book and the Official Logbook. The Master shall ensure that drills are carried out for the identified emergencies as per the Safety Management System (SMS) emergency drills/exercise schedule or as required.

The purpose of the drills is to:

- Improve awareness of potential hazards facing personnel and the ship.
- Improve the standard and speed of response to identified potential incident situations.
- Ensure that emergency equipment is tested and ready for use.

If a drill is not carried out in the required period, the Master shall make an entry in the Official Logbook stating the reason why the drill was not carried out. The drill is to be scheduled for as soon as is practicable thereafter.

The following drills should be periodically carried out:

- Fire in accommodation, engine room and storerooms
- Abandon ship
- Critical equipment failure
- Grounding

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- Collision
- Man overboard
- Personal injury / Illness / Covid-19 suspected case
- Oil pollution
- Power failure
- Steering gear failure
- Escape from enclosed spaces
- Structural failure
- Piracy attacks or suspect vessel approaching the ship
- Sinking
- Helicopter ditching/ crashing on deck (if fitted)

Entries in the Emergency Exercise Book shall include: the type of incident, personnel involved, equipment used, and details of problems encountered; and shall be signed by the Master. The effectiveness of the drill is to be reviewed at the onboard safety meeting.

11. STANDARD FOR SHIPBOARD RESPONSE PLAN

11.1 GENERAL STANDARD

The Shipboard Response Plan is devised to assist the Master and Operators of the vessel to deal with accidents or emergency situations by providing guidance and advice. The Plan is to be kept updated by the Designated Person Ashore, and the Master must be able to advise of possible changes required to the manual. The Shipboard Response Plan must contain sufficient detail to provide a framework on which the Master can build, to cope with a situation at hand, and must include:

- Ship profile: length, beam, cruising speeds.
- Manning and shifts.
- Ship based emergency response structure and infrastructure.
- Any other characteristic that may be valuable to response teams in the event of an emergency or incident.
- Reference to the SOPEP Manual where an oil pollution or hazardous spill has occurred (vessel >400GRT).
- Where a security emergency or incident has occurred reference should be made to the Ship Security Manual.
- Response to each incident identified in sections 9.1 and 10.3 of this document to regain control of the situation.
- The roles and responsibilities of all personnel during an emergency or incident.
- Masters are to be guided by their primary responsibilities, which are, in decreasing precedence, for the safety of life, safety of the ship, the protection of the marine environment, and the safety of the exploration equipment. All other considerations are secondary to these.
- The Master has the responsibility to take whatever action he sees fit to minimize the risks to safety of life and property, or to protect the marine environment.
- The Master is to summon assistance in good time when the ship is in danger.
- The standard marine reporting system, in effect around the Cook Islands, is to be used to notify others of the seriousness of the situation (e.g., Mayday, Pan-Pan etc.).
- Communication methods to use onboard and between ship and shore.
- Procedures for requesting assistance from third parties, if required.
- Emergency contact details (e.g., telephone numbers, cell phone numbers, radio frequencies, etc.) for notifying parties as per the communications plan.
- Checklists or task cards to aid in monitoring and reporting.

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- All emergency actions taken are to be recorded in the Deck Logbook including the Official Logbook.
- The Vessel Operator Company and Moana is to be informed at the first available opportunity, followed by the CI maritime Authority as per the Communications Plan.
- Where the Master has had to breech the requirements of the Act, in the interests of safety, the CI authorities are to be informed as soon as practicable, and the Master must provide a report in respect of the action.
- In salvage situations, the Master remains in command even when Salvors are appointed. A detailed record of any salvage services received must be kept.
- Masters and crew are not to liaise with the media, and any queries are to be directed to the appointed Moana Manager ashore.

11.2 SPECIFIC RESPONSIBILITIES

It is suggested that (to be agreed with finalization of the Plans):

- Master shall take total control of the ship during any shipboard accidents or emergency situations.
- Chief Engineering Officer shall take control of all machinery spaces during accidents or shipboard emergencies.
- Chief Officer shall take control of all deck operations (e.g., fire party, security party, clearing away lifesaving equipment and lifeboats, anchoring, tow lines etc.), during accidents or shipboard emergencies.
- Second Engineer will assist the Chief Engineer, or as otherwise directed, during accidents or shipboard emergencies including taking soundings of tanks, bilges etc.
- Other crew are to carry out functions as directed by the Master or Senior Officers or as per the Shipboard Response Manual.

11.3 COMMUNICATION

Prior to commencing with offshore work, a Communication Plan shall be drawn up by Moana, vessel Managers, and Moana's Agents. This plan is then submitted to the Ministry of Transport and Seabed Minerals Authority to ensure that all relevant national bodies that require notification are correctly identified, together with contact details. This plan shall also include the response agencies operating in the Cook Islands.

As such, the Master has an obligation to report incidents under the terms of the Act.

In the event of a major accident or incident resulting in serious harm, or emergency the Master must report the matter to the Flag State, Cook Islands Port State Authorities, Vessel Operator and Moana as soon as possible. The prime alert mechanism to the authorities will be by radio or internet communications (via satellite)

A initial report must be submitted in writing within 24 hours of the accident or incident and is to

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contain the following (See also Section 13):

- Name of ship and port of registry
- Ship's position, course and speed, and activity being performed
- Call sign
- Closest CI port
- Nature of accident or emergency
- Nature and extent of damage
- Names, nature and number of fatalities
- Nature of service required (towage, helicopters, lifeboat, medical etc.)
- Services already summoned
- State of weather and sea, present and forecast
- Name, nationality, type of situation of other ships involved
- Current situation as to stability status, steaming, at anchor, aground etc.
- Number of people onboard
- Helicopter deck operational or not (if fitted)

The Operator must inform Moana, who in turn must inform the CI Authorities within forty-eight (48) hours after it becomes aware of any information or circumstance that could materially affect its ability to satisfy the requirements of the approved IRMP.

11.4 MINIMUM LIST OF ONBOARD INCIDENT PROCEDURES

- Shore-Based Emergency Preparedness Response Plan
- Shipboard Response Plan
- Emergency Drills Schedule
- Emergency Exercise Reports
- Training Service providers verifications (Flag state, STCW)
- Provision of Emergency Medical Services and Medical Emergency Flow Chart, and
- Work Procedures and Controls (critical tasks as identified in Section 9)

11.5 PROLONGED EMERGENCY SITUATION

The Shipboard Response Plan and the Shore-Based Emergency Preparedness Response Plan must indicate the contingency plans to be activated if the emergency incident extends beyond 24 hours, in order to ensure that those dealing with the incident are not fatigued to the point where judgement becomes impaired.

These contingencies must also detail the shift handover arrangements, in order to ensure accurate handover practices.

11.6 ARRANGEMENTS FOR PROTECTION OF PERSONNEL

A detail description of equipment provided for protection of personnel is not possible at this time as the vessel has not yet been selected and chartered. The vessel shall however be maintained in Class, and compliant with the Flag State and Cook Islands maritime legislation. In addition, a safety review of the vessel will be conducted to ensure that it meets critical control requirements for identified high risks (eg lifting and rigging, working at heights, confined spaces, fire, electrical isolation etc).

A Risk Management Plan has been developed which encompasses the management of risk to an acceptable level through the identification, analysis and mitigation of risk impacts on the Project objectives. Risk Management is considered and recognized as an integral component of good project management and our operations.

As an example, typical critical controls to be in place for lifting and rigging are:

- Is a lifting plan in place for all lifts signed off by a competent technical authority identifying competent operations, suitable equipment, mass calculations and environmental conditions?
- All lifting equipment is certified to meet load and plan requirements, with appropriate provisions for seastates
- Safe working load displayed on all cranes and lifting equipment with unique identity codes.
- Labelled operating controls that are clearly visible and in the appropriate language
- Drop zone properly calculated and barricades are in place to ensure that suspended loads travel over clearly defined, barricaded and posted with warning signage
- Competent Lifting Supervision in place to oversee both serious and an critical lifting operations at all times

11.7 MEASURES RELATING TO THE PREVENTION OF MARINE ENVIRONMENTAL INCIDENTS

A detail description of equipment provided for the prevention of marine environmental incidents and submarine cables is not possible at this time as the vessel has not yet been selected and chartered.

There are no submarine cables in the Moana Minerals Licence application area.

A Baseline Risk Assessment will be performed based on the operations to be conducted by the exploration vessel, and the type of energies and hazards that could be encountered. These risks will be assessed for severity using the Risk matrix provided (Section 9.3), and mitigation plans developed. These mitigations will consist of both preventative and recovery measures. Risks identified as critical or catastrophic, including that of infectious diseases, will also undergo bowtie analysis to ensure that controls are identified for causes and consequences of priority unwanted

events.

Where the exploration vessel is chartered, the safety management system will be reviewed, high risk activities identified, and critical controls reviewed to ensure that the risk to people and environment is managed.

11.8 ASSISTANCE TO PERSONS IN DANGER

The Master and vessel have an obligation, to the extent that it can be done without endangering the vessel and crew, to render assistance to any person found at sea in danger of being lost, vessels involved in a collision, vessels, aircraft or survival craft in distress.

12. STANDARD FOR ONBOARD RESPONSE EQUIPMENT

The Operator shall ensure that sufficient resources (including marine protection products) are provided to ensure compliance with the relevant safety standards. In addition, medical supplies and facilities onboard must comply with the provisions of the Act.

Moana will, in conjunction with the vessel managers, ensure that adequate and appropriate personal protective clothing and equipment is provided to crew and personnel to protect them where a level of risk remains, in spite of reasonably practicable measures to control the risk being implemented. In addition, adequate information, education, training, and supervision will be provided to all onboard personnel so that they can fulfil their work duties without risk to themselves or others.

12.1 SHIPBOARD EMERGENCY INVENTORY

The following must be available in the shipboard Emergency Operations Centre (Bridge):

- Shipboard Response Manual
- GMDSS equipment
- Conference Telephone
- Charts covering area of operation
- Parallel Rulers and Dividers
- Stationery
- Calculator
- Stability Booklet
- Fire Plan
- General Arrangement Plan
- Tank Plan
- SOPEP Manual
- Medical First Aid Guide (MFAG)
- Ship's Captain Medical Guide
- Emergency Logbook
- Local telephone directories of areas of work, and
- Updated Muster Bill

13. INCIDENT RECORDING, REPORTING AND AUDITING

The vessel shall maintain an approved register (paper, or electronic with backup) of accidents and incidents incurred on the vessel. This register must be available for review when requested by the authorities or Moana. Details of incidents arising during the EWP activities and actions taken in connection with the incident response and management plan must be included in Moana Annual Reports to the Authorities.

The Incident Register shall contain the following typical information:

- The name of the worker(s) involved
- Their occupation or job title
- The time and date of the incident
- Activity being undertaken
- A precise description of how the incident occurred
- The nature of resultant harm (quantities and types of pollutant; items damaged or lost; injury and the body part(s) affected
- In the case of injuries, names and positions of witnesses to the injury, if any
- The name and position of the person making the entry, and
- Once available, details of corrective or preventative action proposed, in order to prevent a recurrence of the incident.

On becoming aware of an incident in excess of an agreed consequence level, in relation to the EWP, Moana will notify the Authority immediately by telephone, and within 24 hours in writing. The vessel crew and onboard personnel will immediately implement the approved incident response and management plan and take other steps that are necessary in the circumstances to limit the adverse effects of the incident. Once the Authorities have been notified, and respond with any further instructions, MOANA will ensure that any instructions received from the Authority, in consultation with affected Crown agencies, are undertaken within any time frame stipulated.

The following figure and paragraphs outline the expectations for the reporting and subsequent investigation of direct and contributing factors, and the development of corrective and preventative actions once the consequences have been dealt with in accordance with the Shipboard Response Plan.

The objectives of the incident investigation and analysis process are to:

- Gather all relevant information and evidence,
- Determine what happened,
- Define the sequence of events leading up to, including, and after the incident,

- Determine the direct and contributing factors of the incident to understand how and why it happened, and
- Define actions to prevent similar incidents from occurring



Figure 3: Incident Reporting and Investigation Process

First Response

Any Team Member who observes an incident, or near incident, is responsible for taking whatever steps they can take, to safely stabilize the situation, and for reporting the incident to their supervisor. When aboard a vessel, any incident shall be reported to the bridge watch first, in accordance with the vessel-specific requirements. Timely reporting to the bridge is especially important to maintaining safe operations. All Team Members should be prepared to assist in making additional notifications to regulators or flag-state officials, as required by project specific notification checklists.

Immediately after an incident, the Ship Response Plan must be followed, after which evidence is preserved, witnesses identified, and statements taken.

For incidents which are not significant, the appropriate response must be taken to ensure the scene or situation is made safe, further release of a hazard is prevented, or the necessary engagement with stakeholders or employees is undertaken.

Second Step

Stakeholders are notified as detailed in the Plan. Further evidence is gathered, and a Preliminary Report issued.

Third Step

Depending on the severity of the incident, an Investigation Team is assembled, and a detailed investigation of the incident conducted. The Team gathers all the evidence and assesses it to determine the root cause of the incident, control failures, and identify corrective and preventative measures to prevent a repeat, or similar incidents.

Fourth Step

The Investigation Report is communicated to stakeholders and the actions identified in Step three are implemented.

This Investigation Report will also be made available to the Authority, should a formal enquiry be initiated by the Authority.

14. MAXIMUM CARRYING CAPACITY OF VESSEL

The number of persons onboard the vessel at sea at any time will depend on the exploration vessel deployed and shall not exceed that permitted by law (crew and passengers). Sufficient flotation devices, as required by SOLAS and CI Maritime legislation shall be always provided and maintained in a serviceable and operable condition and will generally determine the maximum number of personnel onboard.

15. EXPLORATION OPERATIONS

Using the environmental baseline needs, engineering data requirements, resource report data, and the Moana team's experience as a foundation, a work program that permits Moana to cautiously and systematically move the company toward achieving our primary objectives has been developed, namely:

- Sample and improve the understanding of the baseline environmental information
- Characterizing the nodules and understanding the associated geology, chemical and physical properties
- Upgrading the mineral resource confidence levels
- Identifying and delineating preservation and mining sites
- Development and validation of mining and processing systems
- Completing an Environmental Impact Assessment
- Acquiring the required environmental permits and permissions
- Initiating the implementation program to economically harvest and process polymetallic nodules thereby generating revenue through the sale of extracted metals

Moana's proposed exploration work program, detailed in the Exploration Work Plan, is projected to be 4 to 5 years in total duration, culminating with securing an Environmental Permit and the submission of a Mining License Application, under the laws of the Cook Islands. Moana's program is broken into three key streams running concurrently, culminating with the submission of the Mining License Application.

The environmental management program is the cornerstone of Moana's work program and dictates the frequency and pace of the campaigns, offshore operations, and program activities. The planned campaigns and offshore operations work programs are augmented with tasks that address resource and engineering program needs and sampling. The overall program schedule is driven by the Environmental Management Plan and the environmental work defines the program critical path.

The resource work scope, developed by Moana, defines the required sample collection spacing and quantity, the protocols needed to ensure data integrity, and the identity of additional data needed (assays, chemical analysis, etc.) by the resource geologists. This data, in turn, permits the resource geologists to better define and understand the areal extent of the resource, nodule distribution and abundance, nodule mineral content, and continuity of the deposit; and thereby permit reporting an improvement in the classification of the mineral resource in the application area.

Moana's engineering and design work scope focuses on, in collaboration with partners, development of optimal mining and processing solutions required to produce salable products from harvested Cook Island nodules. This work scope runs concurrently with the environmental and resource programs.

The Company's mining and processing development programs follow the standard mining

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practice used to improve project and cost confidence levels while mitigating risk. This is an iterative process that starts with the project design and costs at a Scoping level of confidence and incrementally and progressively increases the design and costs estimates to Pre-Feasibility and then finally Definitive Feasibility level of confidence.



Figure 4: Preliminary roadmap to secure approval allowing commencement of mining.

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Moana is presently at Scoping level confidence, having published an independently reviewed Preliminary Economic Assessment (PEA) and Mining System Scoping Study. The PEA study, published in August of 2019, includes an analysis of the potential economic viability of mining nodules and extracting sellable products, and addresses the geological resource, engineering, environmental, and economic factors (costs and markets) that affect the viability of the project.

Data collected during the first two years of Moana's proposed work program, results derived from studying and analyzing the samples and collected data, and the outcome of the process plant pilot testing program will be used to update the PEA report. This PEA update will initiate the Pre-Feasibility Study that, once reviewed and published, will result in the commencement of the definitive Feasibility Study process. Each of these is a project milestone representing significant increase in understanding of the environment, confidence in system design, reduction in project risk, improvement in the accuracy of project economics, increase in project valuation, and a step closer to applying for a Mining License.

16. PERFORMANCE MONITORING AND AUDITING

16.1 PERFORMANCE MONITORING

The risk management process follows a series of steps shown in the figure below (detailed in the Risk management Plan). **Error! Reference source not found.**Risk management is seen as an iterative process and not as an event'



Figure 5: Risk Management Process

Monitoring and review is part of the planned risk management (including incident management) process and will involve regular checking or surveillance. The results will be recorded and reported internally, and used as part of a continuous improvement process.

The vessel will conduct emergency drills as part of its standard marine operations. A Desktop Incident simulation shall be conducted by Moana prior to the commencement of any exploration activities, and then annually thereafter.

This Incident Response Management Plan will be reviewed :

- Annually
- If a drill identifies deficiencies in the plan
- After the investigation into any critical or catastrophic incident to identify deficiencies in the Plan, and the Risk Management Plan.

Such review will ensure that the identified measures remain valid, appropriate and effective. Monitoring of the Risk Management Plan and associated Baseline, risk assessments and critical controls will also be conducted after any serious, critical or catastrophic incident. This activity will

be managed by the appointed Moana Minerals Risk Manager.

16.2 AUDITING

The Incident Response Management Plan shall be audited at a two-year interval by an independent external body. The purpose of the audit would be agreed with the auditor, and typically ensure the following:

- 1. Is the Incident Response Plan approved by Senior Management?
- 2. Is the Incident Response Plan detailed and understood by key personnel?
- 3. Have contact schedules been established for the area of operation and have they been tested in the previous 12 months?
- 4. Are the responsibilities of all classes of organizational staff defined in the incident response plan?
- 5. Have onboard and shorebased personnel been properly trained in technical capabilities for handling onboard incidents?
- 6. Has the vessel been inspected to ensure that appropriate incident response equipment is carried onboard in accordance with the Plan?
- 7. Have emergency drills been conducted on an annual basis?

ANNEXURE 1: DEFINITION OF SERIOUS HARM

SCHEDULE 1(s2(2)) Serious Harm Maritime Transport Act (2008)

As supplemented by draft OHS Act

Any of the following conditions that amounts to or results in permanent loss of bodily function, or temporary severe loss of bodily function:

- Respiratory disease
- Noise-induced hearing loss
- neurological disease
- Cancer
- Dermatological disease
- Communicable disease
- Musculoskeletal disease
- Illness caused by exposure to infected material
- Decompression sickness
- Poisoning
- Vision impairment
- Chemical or hot-metal burn of eye
- Penetrating wound of eye
- Bone fracture
- Laceration
- Crushing
- Amputation of body part
- A serious head injury
- A serious eye injury
- Burns requiring referral to a specialist medical practitioner or specialist outpatient clinic
- The separation of his or her skin from an underlying tissue (such as degloving or scalping)
- A spinal injury
- Serious lacerations

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- Loss of consciousness from lack of oxygen
- Loss of consciousness, or acute illness requiring treatment by a medical practitioner, from absorption, inhalation, or ingestion, of any substance.
- Any harm that causes the person harmed to require treatment other than first aid, or to be hospitalized for a period of 48 hours or more commencing within 7 days of the harm's occurrence.

Similarly, the definition of "Accident" in the above Act will be used to identify major incidents that must be reported immediately, to the Authority, and in writing within 24 hours.

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ANNEXURE 2: GUIDELINE RISK ASSESSMENT

	Priority Unwanted Event	Yes	Yes	Yes
	Max Risk Rank	21 (H)	18 (S)	22 (H)
SMENT	Consequence (should the event happen) (S)	4: Maj	4: Maj	5: Cat
ROL ASSES	Likelihood of the Event (given current controls)	4: Likely	3: Possible	3: Possible
E RISK AND CONT	Current Controls	Monitor weather forecast. At set point, Cease operations. Bow to wind Seek shelter	Electrical isolation critical controls	Hot work critical controls Fire critical controls
RALS BASELIN	Description of Unwanted Event	High Winds - naturally occurring	Failing to Isolate Power Supply	Hot work, electrical heating, faulty electrical components or systems, spontaneous combustion of waste or incorrectly stored chemicals, cooking food (overheating oil or oil splashing onto hot surfaces), incinerator fault or overcharge/incorrectly charged with explosive material, hydraulic systems overheating or bursting, IC engines and hot exhausts, overheated brakes, smoking, helicopter fire on deck.
NA MINE	Hazard	Climatic/ Natural Events	Electrical	Fire
MOA	Step in Operation	Affect all exposed operations onboard and the vessel as a whole	Electrical work	All areas subject to fire risk / Hot work, hydraulics, electrical systems, engines, waste disposal, chemical storage, cooking, helicopter ops.
	Business Area	Vessel	Maintenance	Kesse

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	Priority Unwanted Event	Yes	Yes	Yes	Yes
	Max Risk Rank	18 (S)	19 (S)	19 (S)	14 (S)
SMENT	Consequence (should the event happen) (S)	4: Maj	5: Cat	5: Cat	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	2: Unlikely	2: Unlikely	2: Unlikely
E RISK AND CONT	Current Controls	Monitor weather forecast. At set point, Cease operations. Bow to swell Seek shelter	Watertight integrity Stability book		
RALS BASELIN	Description of Unwanted Event	Swell	Mining system / plant pipe failures, ship structural failures in way of hull or tanks, human error, heavy weather.	Equipment Failure (loss of propulsion or steering control) or Human error (poor navigating or negligent conduct) or bad weather.	Equipment failure (bunker hose failure) or human error (not controlling the operation effectively or monitoring tank levels etc).
NA MINE	Hazard	Climatic/ Natural Events	Water	Land	Chemical
MOA	Step in Operation	Affects all operations onboard	Mining system / plant pipe failures, ship structural failures in way of hull or tanks, human error, heavy weather.	Affects the ship as an entity / Steaming to or from port or between spreads or during RAS ops.	Working with fuel
	Business Area	Vessel	All spaces contributing to buoyancy	Affects the ship as an entity / Steaming to or from port	Any of the fuel tank vents, engine room, pump room, pump points on deck, fuel hose supplying the fuel

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	Priority Unwanted Event	Yes	Yes	Yes
	Max Risk Rank	19 (S)	10 (M)	18 (S)
SMENT	Consequence (should the event happen) (S)	5: Cat	4: Maj	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)	2: Unlikely	1: Rare	3: Possible
E RISK AND CONT	Current Controls	Stability book	Planned maintenance Rounds at set periods	Confined space critical controls
RALS BASELIN	Description of Unwanted Event	Human error (negligence in managing the stability of the vessel).	Equipment failure (engine overspeed due to various factors, crankcase explosion due to ignition of oil mist by a hot spot in the crankcase, turbocharger overspeed due to various factors, any failure of internal parts such as valves, pistons, conrods, crankshaft etc) or Human Error (failure to run and manage a running engine to run and manage a running engine to run and manage a running engine to run and manage a running engine	Human Error (Negligence in establishing a safe work environment or ignorance of safety rules and regulations or lack of understanding of the hazards.)
NA MINE	Hazard	Other - Stability	Mechanical (Fixed)	Confined Spaces
MOA	Step in Operation	Always affects the ship as an entity / All occasions and when the vessel is affoat at sea or in port	All engines onboard. / Running an engine and any maintenance or inspections done on or near a running engine.	Entry into enclosed spaces
	Business Area	Vessel	Engines	Enclosed spaces

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	Priority Unwanted Event	Yes	Yes	Kes
	Max Risk Rank	18 (S)	18 (S)	21 (H)
SMENT	Consequence (should the event happen) (S)	4: Maj	4: Maj	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	3: Possible	4: Likely
E RISK AND CONT	Current Controls	Lifejackets when working within 1m of ship side	Lockout / energy isolation critical controls	Safeguarding Interlocks
RALS BASELIN	Description of Unwanted Event	Drowning - Equipment Failure (working at heights equipment failure or structural failure of whatever is holding the person) or Human Error (failing to adhere to safety to adhere to safety viules and regulations or use safety gear correctly)	Failure to Lockout, Inadequate Lockout, Lack of Skill or Training, Lack of appropriate Equipment to Lockout, Failure to assess risks associated with upstream, downstream and adjacent equipment.	Equipment Failure (Mechanical failure of a guard due to inadequate maintenance, corrosion, vibration or damage) or Human Error (Hazards not identified and guarded, unauthorised removal of guarding, failure identify guarding deficiencies).
NA MINE	Hazard	Water	Energised equipment - unexpected motion	Mechanical (Fixed)
MOA	Step in Operation	All around the ship near the ship's side or when specifically working over the side.	Working on Energised Equipment or Machinery	Work near around or on Machinery where any nip points, rotating or reciprocating parts are exposed.
	Business Area	Vessel	All Areas	Rotatinery

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	Priority Unwanted Event	°N N	No	Yes	Yes	N	N
	Max Risk Rank	6 (M)	6 (M)	21 (H)	21 (H)	1 (L)	1 (L)
SMENT	Consequence (should the event happen) (S)	3: Mod	3: Mod	4: Maj	4: Maj	1: Ins	1: Ins
ROL ASSES	Likelihood of the Event (given current controls)	1: Rare	1: Rare	4: Likely	4: Likely	1: Rare	1: Rare
E RISK AND CONT	Current Controls	Guard in place: procedure training : supervision : interlock on guard	Guard in place : procedure training : supervision : interlock on guard	Inspect the stove before start cooking. Procedure for pots not to be filled to the top request assistance when lifting pots with food Secure pots with safety bar.	Inspect the stove before start cooking. Procedure for pots not to be filled to the top request assistance when lifting pots with food . Secure pots with safety bar.	Wearing correct PPE, Lockout galley vent, Regular cleaning to prevent fat build- up reduces risk of fire hazard and food poisoning.	Wearing correct PPE, Lockout galley vent, Regular cleaning to prevent fat build- up reduces risk of fire hazard and food poisoning.
RALS BASELIN	Description of Unwanted Event	Cut by blades	caught (clothes) by blades	Shocked If water spilled onto stove	Pots falling of stove during ship rolling,	Working over hot range.	Fire hazard
NA MINE	Hazard	Mechanical (Fixed)	Mechanical (Fixed)	Electrical	Gravitational (Objects)	Thermal	Fire
MOA	Step in Operation	Macerator operation	Macerator operation	Galley Range/Stove	Galley Range/Stove	Galley range extractor vents	Galley range extractor vents
	Business Area	Catering	Catering	Catering	Catering	Catering	Catering

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	Priority Unwanted Event	oN	No	No	Yes	ON	No
	Max Risk Rank	13 (S)	12 (M)	(M) 6	14 (S)	5 (L)	5 (L)
SMENT	Consequence (should the event happen) (S)	3: Mod	2: Min	3: Mod	4: Maj	2: Min	2: Min
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	4: Likely	2: Unlikely	2: Unlikely	2: Unlikely	2: Unlikely
E RISK AND CONT	Current Controls	Correct PPE, Safety posters and Manual lifting and carrying procedure.	Good housekeeping, Wearing PPE, 5 min. safety talks, warning signs.	Rubber cloves, Safety posters, Dishwasher	Good housekeeping, Safety posters, Strict control of laundry keys Equipment should be inspected before use, faults and damage if found should be reported immediately do the maintenance department.	Wearing correct PPE, Hazardous data sheets, Supervision. Caution must be exercise when opening the cardboards and lockers especial when the vessel steaming.	Wearing correct PPE, Hazardous data sheets, Supervision. Caution must be exercise when opening the cardboards and lockers
RALS BASELIN	Description of Unwanted Event	slipping & falling	Injuries caused by slipping and tripping	Risk of being cut by unseen knives or broken glasses/plates	Fire hazard	Exposure to chemicals	slipping on wet floors.
NA MINE	Hazard	Gravitational (People)	Gravitational (People)	Other	Fire	Chemical	Gravitational (People)
MOA	Step in Operation	Carrying big pots and trays	Slippery Decks	Washing Kitchen utensils	Tumble Dryer	Cabins and all areas cleaning	Cabins and all areas cleaning
	Business Area	Catering	Catering	Catering	Catering	Catering	Catering

Step in Operation		Hazard	Description of	Current	Likelihood of the Event (given	Consequence (should the event	Max Risk	Priority Unwanted
Unwanted Event	Unwanted Event	Unwanted Event		Controls	current controls)	happen) (S)	Rank	Even
				especial when the vessel steaming.				
Cabins and all Gravitational Falls of tools, areas cleaning (Objects) materials from height, (lockers and cardboards) due items shifted during rough weather or when vessel steaming.	Gravitational Falls of tools, (Objects) materials from height, (lockers and cardboards) due items shifted during rough weather or when vessel steaming.	Falls of tools, materials from height, (lockers and cardboards) due items shifted during rough weather or when vessel steaming.		Wearing correct PPE, Hazardous data sheets, supervision. Caution must be exercise when opening the cardboards and lockers especial when the vessel steaming.	2: Unlikely	2: Min	5 (L)	°Z
Bain Marie Fire Exposure to electrical fire	Fire Exposure to electrical fire	Exposure to electrical fire		Supervision, see that bain- marie is always filled with water. Always switch power outlet off when not in use	3: Possible	3: Mod	13 (S)	No
Handling of Stores Gravitational Movement of vessel (People)	Gravitational Movement of vessel (People)	Movement of vessel		Supervision, 5 minutes safety talk, safety posters	3: Possible	3: Mod	13 (S)	No
Cutting meat and Personal / Fingers/Hands injury vegetables Behaviour due to cut	Personal / Fingers/Hands injury Behaviour due to cut	Fingers/Hands injury due to cut		Chain gloves to be worn all times	2: Unlikely	1: Ins	2 (L)	No
Deep fryer Thermal (Safety) Burned by hot oil oil	Thermal (Safety) Burned by hot oil	(Safety) Burned by hot oil		Training; supervision procedure; request for help when lifting oil drum to change oil. Old oil disposal procedure in place Care should also be taken to avoid overheating the oil as it can ignite	3: Possible	3: Mod	13 (S)	oZ

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	Priority Unwanted Event	ON	ON	Yes	Yes	Yes
	Max Risk Rank	13 (S)	5 (L)	14 (S)	18 (S)	14 (S)
SMENT	Consequence (should the event happen) (S)	3: Mod	2: Min	4: Maj	4: Maj	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	2: Unlikely	2: Unlikely	3: Possible	2: Unlikely
E RISK AND CONT	Current Contro ls	Training; supervision procedure; request for help when lifting oil drum to change oil. Old oil disposal procedure in place Care should also be taken to avoid overheating the oil as it can ignite	Training; supervision procedure; request for help when lifting oil drum to change oil. Old oil disposal procedure in place Care should also be taken to avoid overheating the oil as it can ignite	Watch keeping guideline	- PMO covers maintenance of FRC and crane - Load tested and certified equipment by external contractor - Procedure and on the job training. JSA and Safety Talk	- PMO covers maintenance of FRC and crane- Load tested and certified equipment by external contractor. Procedure and on the job training.
RALS BASELIN	Description of Unwanted Event	(Environment) spill while disposed used oil properly	Pollution from incorrect used oil segregation	Collision	Boat falling in water due to Winch failure	Boat falling in water due to Wire failure
NA MINE	Hazard	Waste	Waste	Mechanical (Mobile)	Gravitational (Objects)	Gravitational (Objects)
MOA	Step in Operation	Deep fryer operation	Used Oil Disposal	Launch approaching and during replenishment operation.	Launching Rescue boat	Launching Rescue boat
	Business Area	Catering	Catering	Launch service	Launch service	Launch service

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	MOA	NA MINE	RALS BASELIN	E RISK AND CONT	ROL ASSES	SMENT Consequence	Max	Priority
Step in Operation Ha	На	zard	Description of Unwanted Event	Current Controls	Event (given current controls)	(should the event happen) (S)	Risk Rank	Unwanted Event
Launching Rescue Gravit boat (Objec	Gravit (Objec	ational cts)	Boat falling in water due to Hook failure	- PMO covers maintenance of FRC and crane - Load tested and certified equipment by external contractor. Procedure and on the job training.	1: Rare	4: Maj	10 (M)	Yes
Launching Rescue Person boat Behavi	Person Behavi	ial / our	Boat falling in water due to Human error	- Experienced and suitably qualified Personnel to be used- Painters to be used and always manned - Safety Talk and JSA to be done prior to operations	3: Possible	4: Maj	18 (S)	Yes
RAS While Vessel Mechar is on DP (Mobile	Mechar (Mobile	nical)	DP Runoff	Procedure- Taut wire on standby- DP Operator familiarization	3: Possible	2: Min	8 (M)	N
RAS While Vessel Mechan is on DP (Mobile)	Mechan (Mobile)	ical	Blackout	System alarms monitoring- 2 way switchboard Split- All available Generators to be on standby-	2: Unlikely	2: Min	5 (L)	N
RAS While Vessel Mechar is on DP (Fixed)	Mechar (Fixed)	nical	Ropes Caught in Props	- Monitor rope and maintain enough tension to keep it floating- Slow steam ahead when letting go to keep lines clear of prop wash	2: Unlikely	2: Min	5 (L)	oN
1.0 Modification of Other equipment	Other		Failure of equipment due to modification	Engineering Change procedure	3: Possible	2: Min	8 (M)	No

	Priority Unwanted Event	No	Yes	No	oZ	ON	ON
	Max Risk Rank	13 (S)	14 (S)	(M) 6	(M) 6	8 (M)	(W) 6
SMENT	Consequence (should the event happen) (S)	3: Mod	4: Maj	3: Mod	3: Mod	2: Min	3: Mod
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	2: Unlikely	2: Unlikely	2: Unlikely	3: Possible	2: Unlikely
E RISK AND CONT	Current Controls	Engineering Change procedure	Engineering Change procedure	Engineering Change procedure SSN-ADP-017	None	MSDS, chemical labelling, IMDG code, PPE, procedure Emergency response Manual and Team.	MSDS, chemical labelling, IMDG code - Segregation tables. Ventilation system of all storage areas. Weekly & Monthly inspection of chemicals and storage. Weekly & Monthly inspection
RALS BASELIN	Description of Unwanted Event	Injury or fatality due to modification	Damage to vessel	Injury or fatality due to modification	Risk of modification not assess resulting in incident	 Inhalation and absorption of Toxic gasses Ingestion and in contact with toxic liquid. Chemicals burns from handling. Water / Air pollution due to spillages 	 Fire due to Reaction of incompatible chemicals due to improper storage or
NA MINE	Hazard	Other	Other	Other	Other	Chemical	Chemical
MOA	Step in Operation	1.0 Modification of equipment	2.0 Modification to structure	3.0 Emergency Repairs	Some modification done without following engineering change process	Receiving and handling	Storage
	Business Area	Engineering Change	Engineering Change	Engineering Change	Engineering Change	Hazardous Materials	Hazardous Materials

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	Priority Unwanted Event		Yes	Yes	Yes	N	° Z
	Max Risk Rank		18 (S)	14 (S)	18 (S)	4 (L)	(M) 6
SMENT	Consequence (should the event happen) (S)		4: Maj	4: Maj	4: Maj	1: Ins	3: Mod
ROL ASSES	Likelihood of the Event (given current controls)		3: Possible	2: Unlikely	3: Possible	3: Possible	2: Unlikely
E RISK AND CONT	Current Controls	of chemicals and storage. Ventilation system of all storage areas. Storage areas design with containment, drainage and venting systems.	Designated lifting cages for transport to be used	Boilermakers to ensure their hands and gloves are free of oil & grease. Inspect fittings prior to connection.	Check for leaks as per procedure	Check for leaks as per procedure	Stock control as per procedure
RALS BASELIN	Description of Unwanted Event	segregation of products. 2. Possibility of Structural damage due to oxidation. 3. Release of hazardous vapours from leaking containers. 4. Water / Air pollution due to spillages	Dropping cylinder from crane	Oxygen cylinder explosion due to grease or oil	Gas leaking, Risk of explosion	Gas Leaking, Loss of production on vessel due to inability to effect repairs	No gas stock left on board for emergency procedures
NA MINE	Hazard		Gravitational (Objects)	Chemical	Pressure / Explosions	Other	Other
MOA	Step in Operation		1.0 Transfer from launch to vessel	3.0 Connecting cylinders to manifold	3.0 Connecting cylinders to manifold	3.0 Connecting cylinders to manifold	4.0 Stock control
	Business Area		Oxy Acetylene System	Oxy Acetylene System	Oxy Acetylene System	Oxy Acetylene System	Oxy Acetylene System

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	Priority Unwanted Event	oN	Kes	oN	Yes	Yes
	Max Risk Rank	8 (M)	21 (H)	12 (M)	10 (M)	15 (S)
SMENT	Consequence (should the event happen) (S)	2: Min	4: Maj	2: Min	4: Maj	5: Maj
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	4: Likely	4: Likely	1: Rare	1: Rare
E RISK AND CONT	Current Contro ls	Procedure and maintenance plan for Oxy/Acet fittings	Isolation to be championed by CEO and 2EO with- Isolation to be conducted as per Guidelines-Isolation checklist-Diving supervisor to sight and confirm Isolation-Diving team to Collect Personal Locks, Isolation Box to be used and All Divers to lock with Personal Locks-Test Starting all equipment before commence of diving ops.	Ship's crew to be stationed at Diving area with radio and in communication with Bridge and Diving team	 Sharp lookout No Galley slops to be dumped overboard 	 Efficient communication between ship, log base and helicopter. Accurate weather reporting to Helicopter. Helideck perimeter lightings.
RALS BASELIN	Description of Unwanted Event	Ruptured hose causing fire	Isolating incorrect equipment.	Failure in communications	-Personal and fatal injuries due to predator's attack.	Chopper can crash on deck / into the side of the ship
NA MINE	Hazard	Fire	Other	Other	Climatic/ Natural Events	Gravitational (Objects)
MOA	Step in Operation	5.0 Gas cutting	Isolation process involving Main and auxiliary propulsion, sea chests, cathodic protection system, plant systems.	Diving operation	Diving operation	Chopper descending to land on deck
	Business Area	Oxy Acetylene System	Diving Ops at Anchor	Diving Ops at Anchor	Diving Ops at Anchor	Helicopter Operations

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	MOA	NA MINE	RALS BASELIN	E RISK AND CONTI	ROL ASSES	SMENT		
Business	Step in Operation	Hazard	Description of	Current	Likelihood of the Event (given	Consequence (should the event	Max Risk	Priority Unwanted
Area			Unwanted Event	CONTROIS		(c) (uaddeu	капк	Event
				 Helideck Team on standby monitoring helicopter progress during landing and taking off. Helideck clear of debris tested and on standby ready for use. 				
Helicopter Operations	Chopper landing	Mechanical (Mobile)	Ground resonance	 Monitor chopper's landing to see if landing gear is clear of any items and are firmly on helideck. Green deck clear for landing and 3 greens signal given to helicopter by HLO 	1: Rare	4: Maj	10 (M)	Yes
Helicopter Operations	Chopper landing	Mechanical (Mobile)	Flying debris	 HLO inspection of helideck before landing. Wash down Helideck twice a week. 	3: Possible	3: Mod	13 (S)	N
Helicopter Operations	Chopper landing	Noise	Noise Induced Hearing Loss	РРЕ	5: Almost Certain	1: Ins	11 (M)	No
Helicopter Operations	Helideck crew approach chopper	Gravitational (People)	Can slip and fall	 Chopper briefing. Helideck surface coated with non-slip material and surface friction tested annually. 	1: Rare	1: Ins	1 (L)	N
Helicopter Operations	Helideck crew approach chopper	Mechanical (Mobile)	Can be struck by blades	 Chopper briefing. Approach chopper in a crouched position Approach chopper at a 90° angle. 	1: Rare	5: Maj	15 (S)	Yes

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	Priority Unwanted Event	2	Yes	°N N	° Z	°N	0N
	Max Risk Rank	4 (L)	10 (M)	4 (L)	8 (M)	13 (S)	1 (L)
SMENT	Consequence (should the event happen) (S)	1: Ins	4: Maj	1: Ins	2: Min	3: Mod	1: Ins
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	1: Rare	3: Possible	3: Possible	3: Possible	1: Rare
E RISK AND CONT	Current Controls	 Chopper briefing. Helideck surface coated with non-slip material and surface friction tested annually. HLO monitoring and controlling people embarking or disembarking. 	 Chopper briefing at log base. Approach chopper in a crouched position Approach chopper at a 90° angle. 	 Chopper truck to be opened carefully Light items to be put under the heavier baggage 	 Bosun to ask for assistance if loads are too heavy. Items to be offloaded in accordance with agreed Procedure 	 PPE Heli deck team musters on A Deck 	1.Bosun to check whether doors are closed
RALS BASELIN	Description of Unwanted Event	Crew joining can slip and fall	Crew joining can be struck by blades	Loose items can be sucked into the blades	Back injuries resulting from loading / offloading heavy items	Flying debris	Boot door / cabin door not properly closed
NA MINE	Hazard	Gravitational (People)	Mechanical (Mobile)	Pressure / Explosions	Personal / Behaviour	Pressure / Explosions	Gravitational (Objects)
MOA	Step in Operation	Loading and Offload Passengers	Loading and Offload Passengers	Offload / load baggage	Offload / load baggage	Chopper takes off from helideck	Chopper takes off from helideck
	Business Area	Helicopter Operations	Helicopter Operations	Helicopter Operations	Helicopter Operations	Helicopter Operations	Helicopter Operations

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	Priority Unwanted Event		No	Yes	Yes	Yes	Yes	Yes
	Max Risk Rank		5 (L)	21 (H)	18 (S)	14 (S)	14 (S)	21 (H)
SMENT	Consequence (should the event happen) (S)		2: Min	4: Maj	4: Maj	4: Maj	4: Maj	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)		2: Unlikely	4: Likely	3: Possible	2: Unlikely	2: Unlikely	4: Likely
RALS BASELINE RISK AND CONT	Current Controls	 Pilots have an onboard indication of whether doors are closed 	All controls levers to be in their respective neutral positions. All By-pass valves closed.	Remove the safety pin only once the boat is ±1m from sea surface	Monthly PMO (maintenance & inspections). Annual load testing & inspection by 3rd party.	Boat Lowered and Recovered with full complement, no Ladders are to be used	Crew to embark using boarding ladder.	Lifejackets
	Description of Unwanted Event		 Boat falling heavily on the cradle or on the water causing damage to the boat. 	Quick release hooks failure. Boat dropping into the water uncontrollable may cause damage to the boat and injury to people.	Mechanical failure of crane, wire and other accessories.	Embarkation ladder failing.	Crew falling in water.	Drowning
NA MINE	Hazard		Gravitational (Objects)	Gravitational (Objects)	Gravitational (Objects)	Gravitational (People)	Water	Water
MOA	Step in Operation		Lifting the boat from cradle and put boat against the gunwale.	Lowering the boat into the water "free fall"	Lowering the boat into the water "free fall"	Dis/Embark Crew to the craft	Dis/Embark Crew to the craft	Dis/Embark Crew to the craft
	Business Area		Rescue Boat Operations	Rescue Boat Operations	Rescue Boat Operations	Rescue Boat Operations	Rescue Boat Operations	Rescue Boat Operations

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	Priority Unwanted Event	No	Yes	N	No	No	Yes	Yes
	Max Risk Rank	8 (M)	14 (S)	20 (S)	11 (M)	16 (S)	14 (S)	23 (H)
SMENT	Consequence (should the event happen) (S)	2: Min	4: Maj	3: Mod	1: Ins	2: Min	4: Maj	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)	3: Possible	2: Unlikely	5: Almost Certain	5: Almost Certain	5: Almost Certain	2: Unlikely	5: Almost Certain
E RISK AND CONT	Current Controls	Training	Be vigilant and watch every step you take. Check your boots are free of grease.3 points principle. Only 1 hand or one foot of the ladder at a time.	Do not carry anything up in your hands or in your overall pockets. Crane checklist book to be carried in shoulder strap bag provided.	Wear proper PPE. Assess area	Wear proper PPE. Assess area	Check surrounding area for other operations. Barricade area where launch operations are taking place.	Launch Captain/Officer on Deck to assess situation and if not safe or in doubt, operation to be cancelled
SALS BASELINI	Description of Unwanted Event	Finger injuries	Fall from height.	Objects falling from height from crane operator's hands / pockets	Exposure to weather.	Slipping and falling on wet deck	Injuries arising from other operations on deck	Incidents related to working the launch in bad weather
NA MINE	Hazard	Mechanical (Fixed)	Gravitational (People)	Gravitational (Objects)	Climatic/ Natural Events	Gravitational (People)	Other	Climatic/ Natural Events
MOA	Step in Operation	Operating Quick release hook	Climbing up / down crane ladder	Climbing up / down crane ladder	Working on open deck	Working on open deck	Working on open deck	Launch coming alongside
	Business Area	Rescue Boat Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations

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	Priority Unwanted Event	oN	Yes	°Z	oZ	Yes
	Max Risk Rank	1 (L)	15 (S)	3 (L)	6 (M)	22 (H)
SMENT	Consequence (should the event happen) (S)	1: Ins	5: Maj	2: Min	3: Mod	5: Maj
ROL ASSES	Likelihood of the Event (given current controls)	1: Rare	1: Rare	1: Rare	1: Rare	3: Possible
E RISK AND CONT	Current Controls	Inform launch if such a move is to be done and stop crane operation until move is done.	Launch informed if chopper operations are to take place (in advance) and launch will back away from vessel until chopper operations are complete	Ensure SWL is not exceeded. Weigh all skips before backload. Cranes to inspected and tested and entry made in crane logbook. Always use two or more taglines to control the swing, taglines to remain taught always Do not leave suspended weight unattended. Crane driver to confirm the load with Load moment indicator	Ensure SWL is not exceeded. Weigh all skips before backload. Check condition of lifting equipment before use	Never stand or pass under a weight / load Be vigilant and aware of your surroundings
RALS BASELIN	Description of Unwanted Event	Vessel and launch moving away from each other due to vessel making a long move from one priority to the next	Chopper operations compromised due to launch alongside	Damage to cranes	Wire parting.	Falling and dropping weights/loads
NA MINE	Hazard	Other	Other	Gravitational (Objects)	Gravitational (Objects)	Gravitational (Objects)
MOA	Step in Operation	Launch coming alongside	Launch coming alongside	Crane operation itself(Moving lift to and from the launch)	Crane operation itself (Moving lift to and from the launch)	Crane operation itself (Moving lift to and from the launch)
	Business Area	Launch Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations

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	Priority Unwanted Event		Yes	Yes	oN
	Max Risk Rank		23 (H)	22 (H)	17 (S)
SMENT	Consequence (should the event happen) (S)		4: Maj	5. Maj	3: Mod
ROL ASSES	Likelihood of the Event (given current controls)		5: Almost Certain	3: Possible	4: Likely
E RISK AND CONT	Current Controls	Check condition of lifting equipment before use	Always use two or more taglines to control the swing Taglines to always remain taught Counter swing from Crane operator	Never stand or pass under a weight / load Ensure items are properly secured inside skips and cages. Skips and open cages are not overfilled. Inspect the cages and open racks for loose items that fall through meshes such loose bolts and nuts, rod bars etc. Ensure doors are properly secured and lashed with secured and secured and open rack for loose secured and open rack for loose secured areas where personnel cannot retreat, such as the launch's Bridge (Rather ask the Launch to re-position if	Inspect slings and crane pennants before use. Ensure Compliance to SWL
SALS BASELINE	Description of Unwanted Event		Uncontrollable swinging of loads.	Loose Items falling from cages, open racks, MC, TC, etc. racks, MC, TC, etc.	Lifting equipment failure.
NA MINE	Hazard		Other	Gravitational (Objects)	Gravitational (Objects)
MOA	Step in Operation		Crane operation itself (Moving lift to and from the launch)	Crane operation itself (Moving lift to and from the launch)	Slinging loads
	Business Area		Launch Operations	Launch Operations	Launch Operations

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	Priority Unwanted Event	Q	N	ON N	Yes	Yes	Yes	Q
	Max Risk Rank	6 (M)	16 (S)	1 (L)	18 (S)	23 (H)	21 (H)	16 (S)
SMENT	Consequence (should the event happen) (S)	3: Mod	2: Min	1: Ins	4: Maj	4: Maj	4: Maj	2: Min
ROL ASSES	Likelihood of the Event (given current controls)	1: Rare	5: Almost Certain	1: Rare	3: Possible	5: Almost Certain	4: Likely	5: Almost Certain
E RISK AND CONT	Current Controls	Bosun to supervise slinging technique used and ensure load is correctly slung	Be vigilant and aware of your surroundings Wear proper PPE. Practise good seamanship techniques	Use tight fit hand gloves.	Beware of the load. Avoid squeezing load in an awkward position. Maintain good communication with crane operator.	Beware of the load. Avoid squeezing load in an awkward position. Maintain good communication with crane operator.	Always watch your feet and keep the rope away from your feet.	Use gloves when handling taglines.
ALS BASELINI	Description of Unwanted Event	Loads slipping through the sling and falling to deck.	Fingers nipped between load and sling.	Hands caught in the hook	Load landing on your feet.	Hands and fingers caught between load and ship structures.	Caught in the bight of the rope.	Burns from chaffing rope through your hands.
NA MINE	Hazard	Gravitational (Objects)	Mechanical (Fixed)	Mechanical (Fixed)	Gravitational (Objects)	Mechanical (Fixed)	Other	Other
MOA	Step in Operation	Slinging loads	Slinging loads	Unhook loads	Landing loads on deck	Landing loads on deck	Handling taglines	Handling taglines
	Business Area	Launch Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations	Launch Operations

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	Priority Unwanted Event	о Х	ON	No		No	Yes
	Max Risk Rank	7 (M)	20 (S)	4 (L)		1 (L)	18 (S)
SMENT	Consequence (should the event happen) (S)	1: Ins	3: Mod	1: Ins		1: Ins	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)	4: Likely	5: Almost Certain	3: Possible		1: Rare	3: Possible
E RISK AND CONT	Current Controls	Item weights to be carefully considered before lifting Maximum Length of Boom that can be used to be pre- determined and adhered to Ask Launch to reposition if necessary, to avoid over extension Ensure Crane overloads protection systems functional	Only one person to communicate the operation between the launch, the ship and the crane operator. BOSUN. Speak clearly and give clear signals and directions to crane driver. Radios to be checked before launch operation (Battery)	Conduct Weather Assessment and Wear proper PPE	Wear proper PPE, assess area and clear where necessary	Be vigilant of all other operation happening within the area Barricade/Cordon off lifting operational area	Be vigilant and watch every step you take Do not carry anything up in your hands or in your overall pockets
RALS BASELIN	Description of Unwanted Event	Exceeding SWL of Crane	Misinterpretation of the message by the receiver.	Exposure to weather and the elements.	Slipping and Falling on deck	Other operations on deck causing injury	Trips and slips and falling from heights
NA MINE	Hazard	Personal / Behaviour	Personal / Behaviour	Climatic/ Natural Events	Gravitational (People)	Other	Gravitational (People)
MOA	Step in Operation	Heavy Loads (when applicable)	Communication	Working on open deck	Working on open deck	Working on open deck	Climbing up the ladder
	Business Area	Launch Operations	Launch Operations	Lifting Operations	Lifting Operations	Lifting Operations	Lifting Operations

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	Priority Unwanted Event		No	Yes	Yes
	Max Risk Rank		12 (M)	14 (S)	10 (M)
SMENT	Consequence (should the event happen) (S)		2: Min	4: Maj	4: Maj
ROL ASSES	Likelihood of the Event (given current controls)		4: Likely	2: Unlikely	1: Rare
E RISK AND CONT	Current Controls	Check your boots are free of grease	Pre crane checks to be completed before the operation commences Crane SWL not to be overloaded	Only Authorised crane drivers to use the cranes Siren to be operated when loads are being lowered and slung Deck crew to stand clear of loads that are being moved Area of operation to be cordoned off Crane driver to have someone always guide him	Deck crew to stand clear of loads that are being moved Area of operation to be cordoned off Siren to be operated when loads are being lowered and slung Use the correct SWL perdant, slings, chains etc Crane SWL and the SWL of the Pendant, slings, wires to be checked against the load Abnormal lifts or lifts where the weight is not known, are to be approved by the CNO first and load tested
RALS BASELIN	Description of Unwanted Event		Crane can stall while there is a load in the air	Load can injure crew on deck when being lifted and slung	Breaking of slings, wires, chains etc while loads are suspended on it
NA MINE	Hazard		Other	Other	Gravitational (Objects)
MOA	Step in Operation		Transferring loads	Transferring loads	Transferring loads
	Business Area		Lifting Operations	Lifting Operations	Lifting Operations

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ASELINE RISK AND CONTROL ASSESSMENT	tion of Consequence Max Priority Consequence Max Priority Current Event (given (should the event Risk Unwanted current controls) happen) (S) Rank Event	ving out of Cranes not to be used in 5: Almost 3: Mod 20 (S) No Bad weather Crane driver to have someone always guide him at all times2 Tag lines minimum One load at a time to be moved	rs can Multiple crane operations to 1: Rare 2: Min 3 (L) No in more be checked and approved and is by Cochrane arc diagram to be checked beforehand	See burst1. Deck crew to know the position of the pollution control equipment All attempts should be made 	adjacent 1. Crane driver to have 2: Unlikely 2: Min 5 (L) No someone always guide him at all times at all times 2. Tag lines minimum Operation area to be checked before operation commences commences	ing from Tag lines to be of sufficient 3: Possible 3: Mod 13 (S) No tuse of length Tag lines not to be secured to fixed structures, but rather use the cleats
TROL AS	Likelihood Event (gi current cor	5: Almost Certain	1: Rare	4: Likely	2: Unlikely	3: Possible
IE RISK AND CON	Current Controls	Cranes not to be used in Bad weather Crane driver to have someone always guide him at all times2 Tag lines minimum One load at a time to be moved	Multiple crane operations to be checked and approved by Cochrane arc diagram to be checked beforehand	 Deck crew to know the position of the pollution control equipment All attempts should be made not to leave the lift in the air Deck crew to stand clear of loads that are being moved 2. Area of operation to be cordoned off 	 Crane driver to have someone always guide him at all times Tag lines minimum Operation area to be checked before operation commences 	Tag lines to be of sufficient length Tag lines not to be secured to fixed structures, but rather use the cleats
RALS BASELIN	Description of Unwanted Event	Load can swing out of control	Crane booms can overlap when more than one crane is used	Hydraulic hose burst	Damage of adjacent equipment to transfer operation	Injuries arising from the incorrect use of taglines
NA MINE	Hazard	Other	Personal / Behaviour	Pressure / Explosions	Mechanical (Fixed)	Personal / Behaviour
MOA	Step in Operation	Transferring loads	Transferring loads	Transferring loads	Transferring loads	Transferring loads
	Business Area	Lifting Operations	Lifting Operations	Lifting Operations	Lifting Operations	Lifting Operations

	Max Priority Risk Unwanted Rank Event	5 (L) No	10 (M) Yes	8 (M) No	8 (M) No	17 (S) No	13 (S) No
SMENT	Consequence (should the event happen) (S)	2: Min	4: Maj	2: Min	2: Min	3: Mod	3: Mod
ROL ASSES	Likelihood of the Event (given current controls)	2: Unlikely	1: Rare	3: Possible	3: Possible	4: Likely	3: Possible
E RISK AND CONT	Current Controls	Hand signals to be used. Crane operator, guides man and crew to communicate in an agreed language Crane operator and guides man to have a radio each	Deck crew to stand clear of loads that are being moved Area of operation to be cordoned off Tag line to be hooked on and not knotted on	Cranes to be shut down after operation is completed	Be vigilant and watch every step you take Do not carry anything up in your hands or in your overall pockets Check your boots are free of grease	Proper PPE such gloves to be worn at times.	Procedural Control (Garbage to be sorted before incineration)
RALS BASELIN	Description of Unwanted Event	Miscommunication during operation	Injuries from loads being lifted, lowered, slung etc.	Cranes can be left on	Trips, slips, miss steps and fall from heights	Injuries caused by sharp objects	Incinerating materials unsuitable for incineration (Hazardous, Explosives, etc.)
NA MINE	Hazard	Other	Personal / Behaviour	Personal / Behaviour	Gravitational (People)	Other	Personal / Behaviour
MOA	Step in Operation	Transferring loads	Transferring loads (regarding the deck crew)	Shutting down the crane	Climbing down the ladder	Sorting out garbage	Operation of Incinerator
	Business Area	Lifting Operations	Lifting Operations	Lifting Operations	Lifting Operations	Incinerator Operations	Incinerator Operations

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Step in Operation Hazard	Hazard	CALS BASELIN Description of Unwanted Event	E RISK AND CON Current Controls	XOL ASSES Likelihood of the Event (given current controls)	SMENT Consequence (should the event happen) (S)	Max Risk Rank	Priority Unwanted Event
Cleaning Sea Water Water Strainer	Water	Flooding	Alarms	3: Possible	4: Maj	18 (S)	Yes
Cleaning Sea Chemical Water Strainer	Chemical	Accidental discharge overboard due to over-filling of holding tank	Tank level monitoring and alarm system, procedure	3: Possible	1: Ins	4 (L)	N
Cleaning Sea Chemical Water Strainer	Chemical	Accidental discharge overboard via overboard valve	Valve locked closed	3: Possible	1: Ins	4 (L)	N
Cleaning Sea Mechanical Water Strainer (Fixed)	Mechanical (Fixed)	Pump run with valve/s closed, damage to pump	Procedure in place for pump operation	3: Possible	1: Ins	4 (L)	N
Cleaning Sea Other Water Strainer	Other	Failure to comply will legal requirement to enter all bilge operations in Oil Record Book	Procedure and standing orders	3: Possible	3: Mod	13 (S)	°Z
Sampling tool and Gravitational attachment (People) maintenance	Gravitational (People)	Fall off Ladder when using tools	Fall Protection systems and Use Modular Scaffolding for access to Tool	3: Possible	4: High	18 (S)	Yes
Sampling tool and Gravitational attachment (Objects) maintenance	Gravitational (Objects)	Components falling	Inspect Interface and lifting attachments.	5: Almost Certain	1: Ins	11 (M)	°N N

Moana Minerals

	MOA	NA MINE	KALS BASELIN	E KISK AND CON I	KOL ASSES	SMENI		
Business Area	Step in Operation	Hazard	Description of Unwanted Event	Current Controls	Likelihood of the Event (given current controls)	Consequence (should the event happen) (S)	Max Risk Rank	Priority Unwanted Event
Sampling tool	Move sampling tool and components	Other	tool swinging excessively damage to equipment	Tag Lines with turns around a secure point. Ensure good weather window.	5: Almost Certain	1: Ins	11 (M)	No
Sampling tool	Move sampling tool and components	Other	Equipment swinging excessively injury to people	Tag Lines with turns around a secure point. Ensure good weather window.	2: Unlikely	4: High	14 (S)	Yes



AN OCEAN MINERALS GROUP COMPANY

Cook Islands Exploration License Application

Contagious Disease (COVID-19)

Operational Plan

As at January 5, 2022

NPPLN-41200-CNTDS-00



Moana Minerals

Incident Response Management Plan

APPROVAL/S

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5 Dec 2021	N/A	01	General update incorporating license panel comments
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1. EXECUTIVE SUMMARY

The 2019 Novel Coronavirus (COVID-19) is a respiratory virus that was first detected in China in late 2019 and subsequently caused an ongoing worldwide pandemic.

Moana Minerals will provide and maintain, as far as reasonably practicable, a safe working environment without risks to the health of employees. Risk assessments will include the potential hazards posed by exposure to contagious diseases (specifically COVID-19) in workplaces and the implementation of appropriate control measures to mitigate the risk. The Company will collaborate as far as possible with national and the local authorities in dealing with the control of pandemics. This Plan has been compiled specifically with the view to provide guidance to all stakeholders regarding their roles and responsibilities with regards to the mitigation and management of contagious disease outbreaks, focused on COVID-19.

This Plan must be considered as a living document which may need to be updated as new developments on the prevention and management of COVID-19 emerges.

2. DEFINITIONS, ABBREVIATIONS AND ACRONYMS

Field	Description or Definition	
CC	Confirmed Case	
CI	Cook Islands	
Coronavirus	A type of virus that causes diseases in humans and animals. In humans, it usually causes respiratory infections.	
FFP	Filtering Facepiece	
HSE	Health, Safety and Environment	
ОНР	Occupational Health Practitioner	
PCR	Polymerase chain reaction test to detect genetic material from a specific organism, such as COVID-19 virus.	
POC	Point of Care	
PUI	Person Under Investigation	
Routes of transmission	 Direct - by respiratory droplets transmitted via breath, speech, sneezing or coughing and directly inhaled person to person Indirect - with respiratory droplets landing on environmental surfaces and then transferred by contact route by touching contaminated hands to a person's face and mucous membranes 	
RTW	Return to Work	
SC	Suspected Case	
Visitor	Any person visiting a site that is not their normal place of work or who is not permanently working from a site they are visiting	
WHO	World Health Organisation	

3. SCOPE AND OBJECTIVES

This Plan applies to all Ocean Minerals Group (including Moana Minerals) operations, sites and facilities and it covers employees, contractors and visitors working on, attending, or visiting any Moana Minerals sites in any capacity.

The objective of this Plan is to enable Moana Minerals to mitigate the risk of contagious disease, specifically COVID-19 infections, and minimize the spread of COVID-19 at the workplace as far as is reasonably practicable. This guideline outlines the controls that must be implemented by management to ensure the health and safety of employees, contractors and visitors, by:

- Minimizing the risk of transmission of the virus on Moana Minerals sites.
- Identifying suspected infection cases for early diagnosis and prevention of further contamination.
- If detected, containment to prevent further exposure of Moana Minerals employees, contractors and visitors.

The controls identified for the management of COVID-19 impacts are:

- Site Risk Assessments
- Self-Monitoring & Reporting
- Education & Communication
- Screening & Testing
- Sanitary Cordon
- Social Distancing
- Hygiene & Cleaning Measures
- De-Densification of workplaces
- Respiratory Protection
- COVID-19 Contact Tracing
- Emergency response to outbreak on site (including onboard vessels)
- Monitoring to ensure effective implementation and corrective action

4. COVID-19 OVERVIEW

4.1 Symptoms

For confirmed COVID-19 infections, reported illnesses have ranged from people with little to no symptoms to people being severely ill, including fatalities. Symptoms can include:

- Fever or chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle or body aches
- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

Older adults and people of any age who have substantial chronic underlying medical conditions including but not limited to heart disease, lung disease or diabetes (co-morbidities) are at higher risk for developing more serious complications from COVID-19.

4.2 Transmission

It has been scientifically shown that the COVID-19 Coronavirus mutates with time, with different mutations showing different levels of infection and transmissibility. The virus spreads mainly from person-to-person through respiratory droplets produced when an infected person coughs or sneezes. Transmission via contact with contaminated surfaces may also happen.

Moana Minerals will follow five Golden Rules to manage the COVID-19 pandemic

- Separate physically from other people:
 - By working from home where possible
 - By staying home if unwell
- Physical distancing when around other people:
 - Keep a distance of at least 1.5 metres (2 arm lengths) from others, when you have to work with them or serve them.
 - Do not shake hands, hug, fist bump, or elbow bump. Keep your distance.
- Handwashing/sanitising:
 - o Regular handwashing with soap and water for 20 seconds, or rub hands with alcohol-

based hand sanitiser

- o Wash hands after touching people, surfaces and objects
- Practising good hygiene measures:
 - Cough or sneeze into your elbow or a tissue and then put the tissue in a bin and wash your hands immediately.
 - Do not touch your face with unwashed hands.
- Using a cloth face mask to cover your nose and mouth
 - o Don't touch the mask after you put it on
 - Leave the mask on all the time except when you need to eat/drink. For eating/drinking take it off carefully by the strings and place it in a clean paper or plastic bag.

4.3 Incubation

Incubation durations vary with different strains of the COVID-19 virus. The symptoms may appear 2-14 days after exposure with a median time of 4-5 days from exposure to symptoms onset.

4.4 Diagnosis and Testing

COVID-19 must be suspected of patients presenting with fever and respiratory symptoms without any other cause and/or a history of direct contact with a patient diagnosed with COVID-19. An antigen test may be used as a first line of detection, but may not detect all positive cases. The molecular tests done in laboratory (RT-PCR) or using Point-of-Care (POC) devices that can identify the virus causing COVID-19 in respiratory specimens are currently considered as the reference tests.

4.5 **Treatment and Prevention**

There is no specific treatment available for COVID-19. Prevention and mitigation measures are therefore essential.

Treatment of persons infected with COVID-19 will range from provision of immune boosters and medication as recommended by the attending Occupational Health Practitioner, to oxygen administered in hospital in severe cases.

All persons on Moana Minerals sites will be required to be fully vaccinated with vaccines approved by either the United States, New Zealand or Cook Islands health agencies. If Boosters are mandated by the Cook Islands Ministry of Health, these will then be considered the minimum standard for right to enter Moana Minerals sites.

5. GUIDING PRINCIPLES

5.1 Perform a risk assessment of the work site

Each site under the control and management of Moana will expand their site risk assessment to include the risks of COVID-19 and the transmission thereof on the site and will ensure they take and implement appropriate controls to reduce the risks of COVID-19 and the transmission of the disease in the workplace (ashore or at sea) as far as is reasonably practical and to institute a program to monitor the risk. Such controls as a minimum must meet the requirements of this Plan.

The site/workplace risk assessment will be reviewed regularly and whenever circumstances arise or change at any site that could have an impact on the original risk assessment and the risk of contracting COVID-19, for instance:

- Outcomes of local outbreaks or community surveillance become known to Moana or site
- Outcomes of medical surveillance programs indicate the need for it
- · Ministry of Health investigations indicates the need
- New or revised legislation is introduced
- New working methods, process changes or new types of machinery are introduced
- New epidemiological, public health and medical information on the infection, spread of symptoms or any other relevant information comes to light in respect of the pandemic that may influence the risk assessment.

5.2 De-Densification of Workplaces

The objective of de-densification of the workplace is to reduce the number of employees present at work to support social distancing and to mitigate the impact of a COVID-19 infection outbreak. The number of employees allowed onto Moana shore based sites will be limited to the maximum allowed under the Cook Islands Ministry of Health regulations, while at sea to those required to safely and efficiently perform operational duties, in line with statutory regulations.

Subject to instruction by Management, based on the level of risk, employees who are able to work from home may be required to work from home and perform their duties using technology that has been made available to them. If necessary, Moana may implement a split shift arrangement to further reduce the number of persons at work at the same time.

The following vulnerable groups have been identified and if required, special dispensation will be made for them in the workplace to limit possible exposure to COVID-19.

- Persons aged 60 years and older.
- Persons with chronic lung disease or asthma
- Persons with history of previous pulmonary TB
- Immunocompromised persons
- Persons with severe or moderate obesity (body mass index >35)

- Chronic conditions such as diabetes, hypertension, renal failure or liver disease.
- Pregnant women

5.3 Sanitary Cordon

The objective of setting up a sanitary cordon around Moana sites is to:

- Prevent site-visitors infected with COVID-19, or with possible COVID-19 infection from entering the site and interacting with others on site.
- Prevent goods/equipment contaminated with COVID-19 from entering the site.

The following considerations will be used to de-densify Moana workplaces:

- Work shifts and break times will be staggered to minimise the number of employees in common areas at a time.
- Where possible employees will be encouraged to spend their breaks outdoors.
- Visitors will be required to obtain permission prior to enter Moana sites.
- All visitors will be required to complete a COVID-19 Symptom Screening Questionnaire and Declaration prior to entering the site.
- Each site will ensure they have a goods receipting area where goods can be safely delivered and held and where the appropriate sanitization takes place prior to the items entering the workplace.

5.4 Screening & Testing

The objective of screening is to prevent a person infected with COVID-19, or with possible COVID-19 infection from entering the site and interacting with other employees. The screening process aims to check for persons with symptoms associated with the virus or who have been in contact with a confirmed or suspected COVID-19 case or have been in a high risk area, and prevent people who confirm any of these criteria from coming to site until such time as their risk status returns to normal.

Employees should screen themselves at home before they leave for work and if they have symptoms, they should call to inform their manager. All persons will be required to declare if they have any symptoms or have a high-risk exposure before entering any Moana site.

All persons will be required to undertake a temperature measurement, done by trained personnel before entering the workplace, to ascertain which persons are at risk of having the virus. Persons arriving on site with symptoms, an elevated temperature (>37.4°C), or having risk of exposure, will be instructed to:

- Either return to their departure point, or proceed to the isolation room where initial medical assistance will be provided
- They will be provided with a face mask (minimum rating FFP1)
- Arrangements will be made for the employee to be transported, in a manner that does not place other people at the site or members of the public at risk, either to be self-isolated or for a medical examination or testing.

- Ensure the person is tested or referred to an identified testing site
- Anyone who can possibly have contracted the virus based on the screening, will be denied access to the site and will be advised to seek medical assistance

If a person has been diagnosed with COVID-19 and isolated in accordance with the Ministry of Health Guidelines, they will only be allowed to return to work on the conditions described in Section 10. Moana will closely monitor the person for symptoms on return to work.

5.5 Self-Monitoring and Reporting

The objective of Self-monitoring and screening is to prevent a person infected with COVID-19, or with possible COVID-19 infection from entering a Moana site and interacting with other employees. It is the responsibility of Moana employees and contractors who work on Moana sites to take ownership of their COVID-19 status through daily self-monitoring prior to arriving at work.

Self-monitoring will include monitoring for the symptoms of COVID-19 as per WHO which includes:

- Fever
- Dry cough
- Fatigue
- Shortness of breath
- Sore throat
- Headache
- Malaise (general feeling of discomfort)
- Recent loss of taste or smell

Should the employee display any of these symptoms he/she must not come to work, should self-isolate and report this to his/her manager. He/she must also conduct an antigen test before returning to work if symptoms stop.

6. OPERATING PHILOSOPHY

6.1 Overview

The base case philosophy is to continue activities while it is safe to do so, with sufficient personnel (onboard vessels) to maintain operational integrity at all times. Every practical step must be taken to minimize the potential for the introduction or spread of the COVID-19 virus onboard Moana installations.

In the absence of more stringent requirements, these requirements and guidelines take precedence.

All requirements are mandatory unless superseded by a more stringent Cook Islands requirement.

The Operations Manager, in consultation with Moana Minerals Occupational Health Practitioner, may choose to amend Plan requirements due to a change in the COVID-19 situation.

The requirements and guidelines below apply to all Moana Minerals employees, contractors and service providers traveling to, from and when onboard Moana Minerals bases and operated vessels. They are categorized as:

- Prevention and Mitigation
- Response to suspected cases of COVID-19
- Response to confirmed cases of COVID-19

7. PREVENTION AND MITIGATION

COVID-19 is not always immediately detectable, and people may also present as asymptomatic. It is therefore important that the Golden Rules as described in section 4.2 are followed at all times, at home, travelling and at work.

7.1 At-home Guidelines

Enhanced personal hygiene recommendations and social distancing guidelines as per section 4.2 apply. The use of face coverings is recommended when social distancing is difficult to maintain

7.2 **Pre-boarding and Quarantine Requirements**

Personnel working on Moana Minerals vessels and / or visiting Moana Minerals facilities may be locally based, or travelling from outside the Cook Islands.

The following guidelines apply to personnel boarding Moana Minerals operated vessels:

7.2.1 Travelling to Location

Personnel must not travel to the Cook Islands for Moana Minerals work if unwell with any flu-like symptoms, or if in contact with a confirmed COVID-19 case within the preceding 10 days, and must notify the Vessel Operators and Operations Manager. Personnel must adhere to the Cook Islands immigration requirements in force at the commencement of travel, as well as any requirements of transit locations.

7.2.2 Quarantine and Testing

All new arrivals onto the Cook Islands must adhere to the quarantine and testing requirements for entry to the Cook Islands as at the time of travel. Personnel who travel internationally to reach the Cook Islands Moana Minerals base or vessel must document a negative PCR within 72 hrs. prior to departure from their point of origin. A copy of the report must be communicated to the host / Operations Manager. Any personnel based and residing in the Cook Islands will be deemed compliant with the quarantine requirement but must still comply with the testing and vaccination requirements.

A negative PCR test must be submitted prior to joining any vessel proceeding on a voyage. Any person boarding a vessel must have temperature checked on arrival prior to boarding, and hands sanitized on each boarding. If the temperature is higher than 37.4°C, access will be denied.

Personnel may be required to complete additional COVID screening questionnaires.

Unvaccinated personnel will not be granted access to any vessel or Moana Minerals site.

Note: COVID-19 vaccination is considered as effective starting from two weeks after completing the vaccination or booster schedule.

7.2.3 Ground Transportation Guidelines

Company group travel arrangements e.g., crew bus, ride sharing must be reviewed by the Operations Manager to ensure:

- Adequate space is available to maintain safe distancing
- Effective separation between passengers is maintained e.g., personnel should not sit directly beside another individual (every other row to be kept empty). Where employees have to use public transport, ensure that masks are worn properly at all times, do not touch faces, and sanitise hands thoroughly upon exiting.
- Travel provider is aware that vehicle capacity must not exceed 50% and that adequate ventilation is available e.g., setting the air ventilation/air conditioning on non-recirculation mode or opening the windows if required.
- Face-coverings must be used during transportation between residence and airport/vessel(as applicable)

7.3 SHORE-BASED FACILITIES

Employees and visitors to shore facilities will be required to comply to the COVID-19 requirements in place at the site.

7.4 ONBOARD GUIDELINES AND REQUIREMENTS

7.4.1 Health and Safety Orientation (Arrival & Departure) Requirement

A COVID-19 arrival briefing must be provided by the OHP (or designate) during the Health and Safety Induction. The briefing must include:

- An overview of the COVID-19 Pandemic
- Onboard control measures, including but not limited to:
 - Social Distancing. The term 'Social Distancing' is currently being used to describe the approach of maintaining distance between individuals, typically 1.5m
 - Use of face coverings when social distancing is difficult to maintain or is not achievable, e.g., Engine Control Room, Bridge, multi-use labs etc. The use of face coverings must be considered as a part of Task Planning & Risk Assessments to avoid the introduction of an additional hazard (e.g., during welding operations, etc.).
 - Wash hands and/or use hand sanitizer frequently
 - Avoid close contact with other persons e.g., no handshakes when greeting, use of verbal greetings only.
 - PPE must not be shared.
 - Immediately report any flu-like symptoms to the Covid Compliance Officer onboard
- Practices to follow while travelling back home
- Practices to follow while at home

The departure briefing must be conducted by the OHP or designee to reiterate the importance of the mitigation measures when travelling back home and during time at home, in line with local health authorities and the five golden rules.

7.4.2 Screening Guidelines

All personnel onboard the vessel may be subject to daily temperature and health checks by the Covid Compliance Officer onboard during their full voyage onboard as applicable.

7.4.3 Manning Guidelines

Any non-essential personnel should not remain onboard during voyage campaigns.

Non-essential vessel visits are not permitted without approval from the Operations Manager.

In general terms, full use should be made of all cabins.

7.4.4 Meeting Guidelines

The intent of meeting guidelines is to minimize close contact between individuals.

- Non-essential meetings/gatherings of large numbers of personnel is discouraged.
- Take other steps as necessary and possible to ensure sufficient communication of ongoing operational information.
- Minimize the number of personnel attending meetings to essential personnel only.
- Maintain the maximum separation possible from all other persons in attendance at each meeting.
- Wash and/or sanitize hands prior to attending meetings.
- Always start each meeting by reminding all attendees of their responsibility to implement social distancing and maintain rigorous personal hygiene while onboard.
- Note: As an example, sanitization of meeting rooms must be included in the daily cleaning routines.

7.4.5 Galley/Mealtimes/Breaks Guidelines

- Wash and/or sanitize hands prior to eating/using galley facility.
- Strive to have all personnel served their meals (common serving area).
- Strive not to use common use utensils used e.g., self-serve utensils at salad bar, self-serve lines etc.
- Strive to achieve maximum separation between personnel during meal or coffee breaks.
- Stagger meal breaks to minimize the number of personnel in the galley and break room at any one time.
- Frequently touched surfaces must be continually sanitized e.g., handles to refrigerators.

1.1.1. **7.4.6 Cleaning and Sanitizing Guidelines**

Hand sanitizer must be strategically placed throughout the vessel including:

- Determine likely points where people would interact with each other and points /places where contact between people and objects would occur and devise practical measures to limit contact and to disinfect after contact for each point/place
- All offices, labs, common workspaces and meeting rooms
- Galley
- Other communal areas and workspaces where gloves are not worn.

A cleaning/sanitization plan must be developed and maintained. This plan must ensure that all applicable areas/surfaces, both inside and outside the accommodation, are regularly sanitized multiple times per shift.

Cleaning of controls and common workstation areas must be performed at the end of each shift by the operator. This applies to all personnel work areas, change areas and living spaces.

8. REQUIREMENTS TO RESPOND TO A SUSPECTED CASE

The following actions must be followed in response to a Suspected Case (SC) of COVID-19. A suspected COVID-19 case is also named Person Under Investigation (PUI).

8.1 Action List

- 1. Immediately isolate the individual (SC) in their cabin or preidentified isolation room and provide with a face mask (minimum rating FFP1).
- 2. Isolate close contact personnel following discussion/consultation with the Master and Offshore Manager. Close contacts would be disembarked if the SC has been confirmed.
- 3. Sanitize all applicable areas and cabin(s) where SC may have been.
- 4. Disembark SC as soon as practical for isolation/RT-PCR-testing/evaluation.
- 5. Antigen tests may be used to screen Close Contacts in addition to these requirements.
- 6. Make initial preparations to disembark safely the persons who have had close contact with SC in the event the case is subsequently confirmed.

As a general rule, two negative antigen tests performed no less than a 24 hrs. apart, or a PCR test, are required to clear a SC. The SC and Close Contact must be safely disembarked in the event of a positive result.

8.2 Contact Tracing Requirements

Contact tracing must be used to identify close contacts in the anticipation of the suspected case being confirmed COVID-19 positive.

Someone who was within 2 metres of an infected person (laboratory-confirmed or a clinically compatible illness) for a cumulative total of 15 minutes or more over a 24-hour period (for example, three individual 5-minute exposures for a total of 15 minutes).

An infected person can spread COVID-19 starting from 2 days before they have any symptoms (or, for asymptomatic patients, 2 days before the positive specimen collection date).

The determination of which person(s) is considered 'Close Contact' will be made by the Covid Compliance Officer, Master, and Offshore Manager based on the review of the Close Contacts.

9. REQUIREMENTS TO RESPOND TO A CONFIRMED CASE

A suspected COVID-19 case is confirmed after documenting a positive molecular (PCR) test result.

9.1 Action List

- 1. Ensure that close contacts have been provided with face masks (minimum rating FFP1) and isolated pending safe disembarking for evaluation and quarantine, if onboard, or safely transported home if ashore.
- 2. Sanitize all areas where the CC has been e.g., cabin, lab, work deck/office, all applicable workspaces, all common areas, etc.
- 3. Replace with back-up crew members (IF possible) following thorough decontamination of all applicable areas. CC ashore to work from home if possible whilst quarantining.
- 4. Close contact personnel (who have disembarked if onboard) will not be permitted to return until they have been confirmed to be clear of COVID-19 (refer to Section 10).
- 5. Depending on the situation, the Offshore Manager and Master, in liaison with the OHP may schedule full onboard testing after 5 to 7 days to ensure full control of the "outbreak" and repeat the procedure as indicated. Offices may be closed for 5-7 days and decontaminated to control the outbreak.
- 6. Offshore Manager and Master to debrief the crew on action being taken after review with line management, complying with social distancing requirements. Operations Manager will brief shore-based personnel.
- 7. Offshore Manager to notify relevant health authorities (as per local requirements).

9.2 Ability to Continue Operations

In the event of a confirmed case, the ability to continue with exploration activities will be evaluated in coordination with the Master, Offshore Manager, Operations Manager and relevant health authorities as applicable.

Any decision to suspend or continue with operations will be dependent on the ability to maintain operational integrity The Offshore Manager may suspend exploration operations due to lack of personnel to safely and efficiently perform work, but the Master has the final accountability for suspending any and all operations at sea. After work is suspended at his command, the decision to continue operations can be made following evaluation by the personnel listed.
10. REQUIREMENTS FOR RETURN TO WORK (RTW)

The following requirements applies to mild to moderate COVID-19 illnesses. More severe illness cases will be reviewed on case per case basis. The RTW process include a clinical assessment and a COVID-19 molecular testing.

10.1 Personnel Diagnosed with COVID-19 Illness (based on a positive molecular test)

Personnel will observe isolation (quarantine) requirements as promulgated by the Cook Islands Ministry of Health, including resolution of all symptoms for 48hrs prior to documenting a negative PCR test ("Swab sample") using a US Food & Drug Administration (FDA) or Cook Islands Ministry of Health authorized molecular test.

10.2 Personnel Identified as Close Contact

Personnel will quarantine for 10 days from their last exposure i.e., from the date of close encounter with a confirmed COVID-19 case. The quarantine duration can be shortened to 7 days if a negative PCR test is documented at the end of the quarantine period.

10.3 Testing Requirements

Molecular testing (laboratory RT-PCR or POC device) is the retained method for screening, diagnosis and validating safe RTW following a COVID-19 illness. POC tests are diagnostic tests performed at or near the place where a specimen is collected.

Antibodies and antigen tests are not appropriate as they are not sufficiently reliable to be safely used for screening, diagnosis and validation of safe RTW following a COVID-19 illness.

11. ROLES AND RESPONSIBILITIES

11.1 Corporate Operations

• Monitor the situation with other functions and act to minimize the exposure

11.2 Corporate Risk and HSE

- Monitor the situation with other functions and act to minimize the exposure
- Co-ordinate the Medical and Health response in line with Cook Islands Ministry of Health Authority and other related entities

11.3 Operations Manager

- Ensure awareness and response actions and resources are available as required
- Implement response actions and inform Corporate Management
- Inform of any other trends, bans, outbreaks, which may arise in affected areas

11.4 Occupational Health Practitioner

- Act as the Medical Subject Matter Expert on the subject and make recommendations to mitigate the effects on Company personnel and operations
- Monitor WHO and CI regulators guidance and make recommendations accordingly
- Co-ordinate medical and actions with medical network

11.5 Offshore Manager

- Implement the actions required by the OHP and Operations Manager, in consultation with the Master
- Determine who are considered 'Close Contact' in consultation with the Master and Covid Compliance Officer

11.6 Master

- Designate a person to act as the Covid Compliance Officer to manage any actual or suspected COVID-19 outbreak, and to implement the requirements of this Plan onboard.
- Determine who are considered 'Close Contact' in consultation with the Offshore Manager and Covid Compliance Officer

11.7 Covid Compliance Officer

- Implement COVID-19 Screening practices onboard
- Conduct daily temperature checks offshore (if required)

- Deliver the arriving and departure COVID-19 briefing
- Inform Offshore Manager of any issues, trends, cases etc
- Ensure preventive and mitigating materials are available as required
- Determine who are considered 'Close Contact' in consultation with the Master and Offshore Manager.

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Cook Islands Exploration License Application

Integrated SHE Management Plan

As at January 5, 2022

NPPOL-33000-SHEPL-02



Integrated SHE Management Plan

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1 INTRODUCTION

This Integrated Safety, Health and Environmental Management Plan applies to all operations of Ocean Minerals Group at any location, without exclusion, including those of the companies (i.e., Ocean Minerals LLC and Moana Minerals LLC).

Ocean Minerals Group of companies (OM) is comprised of US registered parent company Ocean Minerals, LLC (OML) and wholly owned subsidiary companies including US registered OML Rare Earth, LLC and Cook Islands registered Moana Minerals, Ltd (Moana). Parties to contracts with contractors and consultants will be at subsidiary level whenever practical, and as such meet the requirements for local content and spending. For purposes of the application, when OM is referenced, it could imply either OML or Moana Minerals, or both.

1.1 Purpose

This Management Plan is a top-level bridging document, under which specific activity-based guidance is organized and managed. It articulates the institutional requirements under which staff, affiliates, and subcontractors work. This Plan also stipulates the basic requirements for any subordinate plans and explains the safety and environmental management system mechanisms, risk identification, and a work-planning and authorization process.

This Plan will ensure that safety and environmental risk management is systematically integrated into management and work practices at all levels. It provides a logical and systematic methodology for identifying, analyzing, evaluating, managing, and communicating risks and their potential safety, health and environmental impact on employees, contractors, and the community.

Operations are to be accomplished efficiently whilst protecting the workers, the public, and the environment. As such, this Plan recognizes OM's commitment to safety and health of employees and contractors as a key element of the Best Practice and a key to project success.

1.2 Policy & Commitment

OM has an established Environmental, Community, Health, and Safety Policy (NPPOL-00000-ECOHS-00). OM requires all work to be performed safely, with full regard to the well-being of workers, affiliates, the public, and the environment. This Plan is a key element in demonstrating due diligence in the management of Safety, Health, and Environment issues.

Keys to implementing this policy are the following core safety values:

- OM demonstrates a strong commitment to safety by integrating safety into all facets of its work.
- Managers, supervisors, and work leads are actively involved in planning and demonstrate leadership in performing work safely.
- Individuals take ownership for safety and continuously strive to improve.
- Individuals demonstrate an awareness and concern for the safety of others and strive to prevent harm to other workers, the general public, and the environment.

In its marine operations, OM is committed to the tenets of:

• Safety of Life at Sea (SOLAS) convention

Integrated SHE Management Plan

- International Safety Management (ISM) Code
- The International Convention for the Prevention of Pollution from Ships (MARPOL)
- Applicable Cook Islands Regulations (Workplace Health and Safety and Maritime Transport Act)

OM requires that all contractors be contractually obligated to comply fully with these conventions and codes in addition to applicable national requirements.

OM managed activities shall have a risk management process in place to manage risks to a level that is as low as reasonably practicable (ALARP). This level is achieved when the effort required to establish additional controls clearly outweighs the benefit of those additional controls.

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2 DICTIONARY

TERM	DEFINITION
ALARP	As low as reasonably practicable. The concept of weighting the risk against the sacrifice needed to implement the measures necessary to avoid the risk. In health and safety, it is assumed that the measures should be implemented unless it can be shown that the sacrifice is grossly disproportionate to the benefit.
BRA – Baseline Risk Assessment	A comprehensive risk assessment that establishes a 'starting point' for SHE risk management. Is the process used to identify the most relevant unwanted events in a site/ operation and establish the corresponding controls.
Contractor	A person or company who undertakes work under formal agreement with Ocean Minerals Group.
Control(s)	Control or barrier is defined as "anything used to control, prevent, or impede energy flows or the loss of control of a hazard". Types of barriers include physical, equipment design, warning devices, procedures, work processes, knowledge and skills, and supervision. Controls impact on the risk of the event, whether it is an opportunity or threat. It is essential to consider controls or barriers in terms of their order of greatest effectiveness.
DOE	United States Department of Energy
Hazard	A source or situation with a potential for harm to people or the environment, damage to property, loss of process, or a combination of these.
Incident	The term incident includes accidents, incidents, near misses, and non-conformances that results, or has the potential to result, in harm to people or to the environment, damage to property, or loss of process.
ISM	International Safety Management Code
JHA	Job Hazard Analysis, also known as JRA or Job Risk Analysis. This includes a breakdown of a task, at a level appropriate to the jobs complexity and hazards, and will consider how the worker intends to proceed with that portion of the work. The breakdown will identify the key procedures to do the work. All hazards identified in the Hazard Assessment should be addressed in the JHA.
Moana	Moana Minerals Ltd

Non-conformance	Any deviation from work standards, procedures, processes, legislation, management system performance, etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the environment, or a combination of these.	
ОМ	Ocean Minerals Group	
OML	Ocean Minerals LLC	
Operation	A discrete package of work being performed by, or for OM or one of its subsidiaries. It can include manufacturing equipment, to execution of an exploration campaign.	
PPE	Personal Protective Equipment, such as safety glasses, respirator, hard hat, safety foot ware, etc.	
Risk Assessment	The entire process of hazard identification, determination of risk, and the selection of appropriate risk reduction or risk control measures.	
SHE	Safety, Health and Environment	
SMS	Safety Management System	
SOLAS	Safety of Life at Sea Convention	
Subsidiary	Any company established, in which OM has a controlling interest.	

3 APPLICABLE AND GUIDANCE DOCUMENTS

3.1 OM Internal Policies and Procedures

- NPPOL-00000-CORPL: Corporate Policies and Procedures
- NPPOL-00000-ECOHS Environmental, Community, and Occupational Health and Safety Policy (ECOHS)
- NPPLN-41200-INRES Incident Response Management Plan
- NPPLN-00000-RSKMG Risk Management Plan
- NPPLN-41200-CNTDS Contagious Disease Operational Plan

3.2 Cook Islands Policies

- Seabed Minerals Amendment Act (2020)
- Seabed Minerals (Exploration) Regulations (2020),
- Maritime Transport Act (2008)
- Part 7, Employment Relations Act (2012)
- Workplace Health & safety Draft Policy Cook Islands, Labour and Consumer Division, Workplace Health & Safety Reform (June 2020),

3.3 International Policies and Standards

- International Safety Management Code
- International Convention for the Prevention of Pollution from Ships
- Convention on Safety of Life at Sea
- International Council on Mining and Metals Critical Control Management

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4 SCOPE

This plan applies to all company and subsidiary operations, including marine operations, logistical support, construction, and maintenance operations, over which OM has responsibility. As OM evolves into a mining company, it will periodically update this plan based on formal feedback and review. Reviews permit a comprehensive maintenance of the SHE Plan and the opportunity to keep it current.

This Management Plan is not an ISM Management Plan as OM does not own or operate any ships. It however takes cognizance of the requirements of the ISM Code.

5 SHE MANAGEMENT SYSTEM MECHANISMS

5.1 Introduction to Integrated SHE Management System

The SHE Management System is the means by which SHE requirements are integrated into the planning and execution of work, such that SHE functions and activities become an integral part of project and work execution at all levels throughout OM and its subsidiaries.

A Legal Register must be compiled for OM, and relevant to every OM or subsidiary operation.

Borrowing from the United States Department of Energy (DOE), there are seven Guiding Principles that are the fundamental policies for OM and its contractors to use in the management of SHE. They are:

- 1. Line Management Responsibility for Safety
- 2. Clear Roles and Responsibilities
- 3. Competence Commensurate with Responsibilities
- 4. Balanced Priorities
- 5. Identification of SHE Standards and Requirements
- 6. Hazard Controls (including environmental controls), tailored to work being performed
- 7. Operations Authorization

Risk Assessments must be conducted at all levels of work. The generic risk management process is shown below:

Integrated SHE Management Plan



Figure 1 - Generic Risk Management Process

5.2 Communicate and Consult

The Risk Management process shall involve communication and consultation at every step. People in various roles, from managers and supervisors through to operators and maintenance personnel, will have different inputs to the process. Their input to the process offers the benefit of combined knowledge, experience, and creativity, as well as commitment to outcomes.

It is recognized that specific requirements for employee Health & Safety Representatives and Workplace Health & Safety Committees may exist, and where established, these are to be drawn into all aspects of Safety, Health and Environmental management practices as described in this Plan. These include the election and appointment of Health and Safety Representatives by employees at the 'worker' level and the creation of Health and Safety Committees that will meet at regular intervals.

The over-arching principle is that employees at all levels must be involved in the risk identification and risk management process.

5.3 Establish Context and Scope

The operation shall define the boundaries of the operating concern and activities (process plant, project site, pipeline route etc.) and context (design, construction, on-going operations, closed operation, etc.) where the risk management is to take place. A Scope should be defined that minimally includes the objective, mandate, risk assessment method selection, resourcing (equipment and skills), parallel or concurrent operations, and application requirements. Sufficiently unusual tasks may require a special risk review.

5.4 Identify and Understand the Hazards

Identifying and understanding hazards (sources of potential harm to people, facilities, or the environment) is a key requirement of this process. The quality of this activity will affect the quality of the overall process. It is important to not only identify existence of the specific hazard, "the energy" if physical damage is the concern, but also the magnitude (and toxicity) of this hazard, as this, together with the pathways and exposure (persons, environment), will determine the potential consequences.

Team selection for a hazard identification exercise is critical since the quality of the technique depends significantly on workforce team members, supervisors and other experts who are involved in, or who have knowledge of the task(s) under consideration. The Hazard Assessment team shall start by developing a Process Map of the task/process/operation to ensure that all steps in the operation (with known variations) are captured. After the Process Map is complete the team should identify relevant Hazards. Where physical damage to the health and safety of people or the integrity of the environment is concerned, first identify the potential hazards, which may potentially contribute to unwanted events in the site or area to be assessed, by determining which energy sources are present.

5.5 Identify the Unwanted Events

In this step, the process requires the clear identification of 'what can go wrong' in association with the hazards; or what sort of unwanted events could result from loss of control of the hazards, considering different scenarios. Thorough identification of the unwanted event/s using a systematic and well-structured approach, in the context of the relevant timeframe, is required. An unidentified potential event in this stage would result in a risk not being analyzed. The identification must include all possible events (whether under the direct management control of the organization or not) and their potential consequences in all three areas of safety, health, and the environment.

5.6 Analyze and Evaluate Risks

Analyze the risks through an iterative process involving both this step and the next step. Determine the risk considering the nature and effectiveness of the existing controls in place. Where the existing risk is unacceptable, identify potential additional measures to further reduce the risk of the event to ALARP levels. This step can also identify the need for additional assessment and analysis to achieve a better understanding of the risk.

5.7 Consider the Controls/ Barriers

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For each unwanted event listed in Step 4.5, list the significant existing control measures that are in place. Note that there may be more than one control for each unwanted event. Controls shall be designed in accordance with their potential for effective risk reduction and effectiveness and be approved at the appropriate level in the organization. Identify the most effective controls for a priority unwanted event, recognizing that 'Administrate' and 'PPE' are the least effective approaches.

- Eliminate: the complete elimination of the hazard by design.
- **Substitute** / Minimize: replacing the hazard, material, or process with a less hazardous one, or significantly reducing the magnitude of the hazard or material so consequences are greatly reduced.
- Engineer: design in controls or redesign the equipment or work process.
- **Separate**: placing a physical barrier on the hazard by guarding or enclosing it.
- Administrate: providing control such as training and procedures.
- **Protect with Personal Protective Equipment (PPE):** use of appropriate and properly fitted PPE where other controls are not practical.

Specific controls may be mandated by national legislation and these must be included in the controls identified for each hazard.

5.8 Treat the Risks

Once the unwanted events have been analyzed to establish their control status and the required additional controls, the outputs of the process shall be captured in appropriate registers, plans, procedures etc. Where required, specific action plans, to implement new required controls, shall be developed. Such Job Hazard Analyses will be conducted to cover all activities for each job, as part of the planning for the job. Records of JHA's must be maintained.

Subsequent to the formalization of risk controls, the controls must be formally communicated to all relevant personnel including employees, contractors, and visitors as appropriate. Risk assessment outcomes must be communicated to:

- Persons who are exposed to the hazard
- Persons who are expected to implement/maintain, or monitor effectiveness of controls and recovery measures

5.9 Monitor and Review

Feedback information on the adequacy of controls is gathered, the efficiency of reducing environmental impacts is researched, and verification mechanisms to effectively manage risks are established. This can also include independent assessments. It is a management obligation to verify that approved control measures are in place and functioning correctly.

5.10 Work Authorization & Performance

Work may only be authorized to proceed by the relevant supervisor or manager. In all cases, operations or tasks requiring coordinated activities of multiple personnel shall be actively

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supervised, managed, and directed by a designated person-in-charge.

Any member of the work team is authorized to halt an operation if they believe there is an imminent threat to safety or the environment, unless suddenly halting an evolution poses a greater risk than continuing.

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6 ROLES & RESPONSIBILITIES

Chairman	Accountable to the Board and acts as a direct liaison between the Board and the management of the Company, through the Chief Executive Officer ("CEO") to ensure that the company's operations comply with national and international legislation and sponsor all safety, health, and environment programs.
Chief Executive Officer (CEO)	Responsible for the maintenance and promulgation of this plan and ensuring that it is fully implemented and effective.
Chief Project Officer (CPO)	Responsible for the designation of Project Manager(s) associated with major operations, internal research and development initiatives, or construction / manufacturing of equipment.
Individual Project Manager(s) (PM)	Responsible for defining the scope of work, analyzing hazards, and developing/implementing controls necessary to perform work safely. This includes preparing formal documents to the degree necessary to train and direct all subordinates.
Safety Lead	Responsible for the implementation of this Plan, assisting personnel to perform the requirements contained herein, facilitates risk reviews, and maintenance of all SHE Records.
Shift supervisors	Responsible for conducting and documenting Job Hazard Analyses (JHAs) prior to commencement of any operation. Ideally, JHA should involve all personnel directly engaged in an operation.
Health and Safety Representative	Employee elected person responsible to represent workers, deal with and raise workplace health and safety issues with employers
Workforce	Understand the hazards and control measures associated with the task. Share knowledge and contribute towards the risk assessment, pre task discussion, and / or toolbox talk. Stop the work at any time if concerned about safety. Report any unsafe acts or conditions immediately to supervisor. Identify any lessons learned.

All project team members are responsible for conducting themselves in a safe manner and for reporting any potential hazard they may observe to their direct supervisor.

7 INCIDENT REPORTING AND MANAGEMENT

Refer to the Incident Response Management Plan (NPPLN-41200-INRES) for detailed processes.

7.1 Incident Occurrence

A SHE Risk Log shall be maintained for each operation. This may be at a site where an item of equipment is being manufactured for OM, the OM or subsidiary corporate office, or onboard a vessel conducting exploration work for OM. Feedback shall be provided at agreed intervals to the designated Project Manager.

Any team member who observes a loss, or a near loss, is responsible for taking whatever steps they can take safely to stabilize the situation, and for reporting the incident to their supervisor or the Project Manager.

When aboard a vessel, any incident shall be reported to the bridge watch first, in accordance with the vessel-specific requirements. Timely reporting to the bridge is very important to maintaining safe operations. All team members should be prepared to assist in making additional notifications to regulators or flag-state officials, as required by project specific notification checklists.

In the event of a reportable incident, the senior OM representative, on site and on duty, will assume the role of Incident Commander on behalf of OM, until relieved by the Chief Executive Officer or his designee.

7.2 Evaluating and Resolving Noncompliance

Noncompliance with project protocols or supervisor directives has potentially serious consequences. An incident of noncompliance shall be reported immediately to the Shift Supervisor, who may elect to evaluate and correct it immediately, or refer it to the Project Manager, who, in turn may elect to refer it to the Chief Executive Officer. At a minimum, details of the noncompliance and response thereto shall be recorded in the Incident log.

All cases of non-compliance or incidences must be investigated and closed out by a nominated responsible person.

7.3 Examples of Incidents

Incidents can include, inter alia:

- Injuries and Illnesses, including contagious disease outbreak
- Equipment casualties
- Fires and explosions
- Unsafe working conditions
- Unsafe acts
- Damage to, or loss of equipment
- Spills, near-spills, or other environmental incidents

8 GENERAL REQUIREMENTS

8.1 Vessel and Equipment Leases (Charters)

When OM enters into a charter contract or leases land or equipment, full details of this contract will be checked to ensure that Health, Safety, and Environmental protection standards are not compromised, in accordance with the Incident and Risk Management Plan.

8.2 Inductions

All new personnel (including contractors) arriving at any OM site must attend a SHE Induction where the contents of this Plan shall be made known. In addition, such personnel will be advised of SHE requirements particular to the site or operation. Records shall be maintained of each person so inducted.

8.3 Safety talks

Safety talks (Toolbox talks) must be conducted throughout the operational areas of OM. When serious incidents occur, the information is made available via email by the Safety Lead for briefing to all personnel.

8.4 Performance Measurement and Monitoring

Safety statistics must be recorded, on a monthly basis, and circulated to all. Safety Statistics are used to track targets and objectives.

ANNEXURE A: RECORD OF PREVIOUS INCIDENTS

OM/Moana Minerals

As provided in the separate document **OM-16** *OML 2019 Research Campaign Report* as part of our application, 4 incidents were reported for our 2019 Research Cruise. One was major but without injury. Three were minor incidents. There were no environmental incidents. The incidents as summarized involved:

- 1. Weights (for free fall grabs) in their container broke loose on deck, resulting in vessel needing to return to port to make some repairs and re-secure weights.
- 2. A free fall grab was damaged during deployment, resulting in the grab being retired from operations and the spare unit being put into service.
- 3. During operations, a member of the science team was seated and working in the nodule processing lab when her chair skated across the floor during a particularly strong roll of the vessel. The chair's motion was stopped by a worktable, and no serious injury resulted.
- 4. During loading of weights onto grabs an injury occurred when a finger was pinched between the weight and the grab side plate and a knee was scraped.

Actual incident reports are provided on the next 4 pages.

Transocean safety statistics are provided following these incident reports.

Annex 5 - OM-10 NPPOL-33000-SHEPL-02 Integrated Safety, Health and Environment Plan

Final Audit Report

2022-01-03

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Cook Islands Exploration License Application Local Engagement, Training & Business Development Plan

As of January 5, 2022

NPPLN-32000-LCTRB-01



Local Engagement, Training & Business Development Plan

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Local Engagement, Training & Business Development Plan

1. INTRODUCTION

This document details the Local Engagement, Training and Business Development Plan for Moana Minerals' nodule exploration related operations in the Cook Islands.

The Ocean Minerals group of companies (OM) is comprised of US registered parent company Ocean Minerals, LLC (OML) and wholly owned subsidiary companies including US registered OML Rare Earth, LLC, US registered Moana Minerals, Inc. (MM Inc) and Cook Islands company Moana Minerals Limited (Moana). For practical purposes, all funding, key management, and key operational activities are performed by Moana Minerals Inc personnel under intercompany agreements. For purposes of this document, when OM is referenced, it could imply either OML, MM Inc, Moana, or any combination thereof.

OML and its Cook Islands registered wholly owned subsidiary company Moana Minerals Ltd, intend to adopt an integrated, holistic, approach to local engagement, training, and business development in order to stimulate local socio-economic development both inside and outside the exploration and later the mining value chain.

The unprecedented Covid-19 restrictions since 2020 have imposed significant challenges in terms of finalizing a local engagement, training and business development plan, and this document describes OM's current best judgement to outline a philosophy and approach/processes in this regard.

If an Exploration Licence has been obtained, and the project team can travel more freely to the Cook Islands, commitments as described in this document will be enacted. These include firstly the identification and appointment of several suitably qualified personnel in the Cook Islands as full-time employees, followed as soon as possible by the relocation of several key OM personnel to Rarotonga to start establishing our operating base and interfacing with the local stakeholders in the leadup to exploration operations.

OM's approach to local engagement, training, and business development, as stated in our Environmental Compliance, Operational Health & Safety Policy is through consultation with communities for whom aspects of our operations have both a direct and indirect bearing on their lives and livelihoods. We will act ethically and ensure that we do not harm or threaten the sustainability of local communities, but rather contribute to sustainable development, assisting communities to live to their full potential. It is recognized that Cook Islanders, and all South Pacific peoples, have a strong spiritual and cultural connection to the ocean, and OM will work with Cook Islanders conscious of this connection.

As such, OM is committed to an exploration partnership with the numerous and varied seabed minerals stakeholders of the Cook Islands. We firmly believe that the ultimate success of any exploration program, and possible future exploitation or mining of the Cook Islands' seabed minerals, hinges upon active participation by the local community, and will require their skills and experiences, as well as the many supporting services offered by local businesses. OM will seek to access local experience and competence. In turn OM will seek to continue to develop skills and competencies of Cook Islanders and contribute to the national interest, continuing from past performance.

OM maintains, as expressed in its Code of Conduct/Values policy, a "Zero Tolerance" position in regard to unethical, illegal, dishonest, or inappropriate behaviors, and strives to ensure our people conduct business with honesty, integrity, and fairness. OM is committed to ethical practices and

Local Engagement, Training & Business Development Plan

views business ethics as fundamental to successful business practices. This means that, as a minimum, we conduct our affairs in accordance with the letter and spirit of the applicable laws of the countries in which we do business. This means we are cognizant of the need for proper environmental management and the protection of human rights. We also ensure all significant associates, affiliates, and subcontractors ascribe to our Code, through contracting terms and conditions.

Local Engagement, Training & Business Development Plan

2. DEFINITIONS, ABBREVIATIONS & ACRONYMS

Field	Description or Definition
CI	Cook Islands
EIA	Environmental Impact Assessment
Environmental Permit	Mining companies typically are required to obtain environmental permits signifying government approval for various aspects of their exploration or mine plans, including those for waste disposal, restoration, sewage treatment, drinking water, and construction of dams and other activities.
ESIA	Environmental and Social Impact Assessment
EMP	Environmental Management Programme
EWP	Exploration Work Plan
Exploration Licence	An exploration licence gives the licence holder exclusive rights to explore for specific minerals within the specified license area. No mining activities can be undertaken on an exploration licence.
Mining Licence	Means a licence granted pursuant to relevant applicable regional laws that entitles the holder to all the relevant rights to undertake mining in respect to the designated land to which such licence applies.
MM Inc	Moana Minerals Incorporated
Moana	Moana Minerals Limited
ОМ	Ocean Minerals Group of companies
OML	Ocean Minerals LLC, parent company of OM group
Q&A	Question and answer
SBMA	Cook Islands Seabed Minerals Authority
STEM	Science, Technology, Engineering and Mathematics

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3. ENGAGEMENT PHILOSOPHY

OM commits to proactive and open engagement with the CI community through our exploration and environmental work programmes. Stakeholder engagement and participation is central to the ESIA and our proposed Ecosystem Based Management. OM has developed a stakeholder engagement plan as part of our ongoing Environmental and Social Impact Scoping Study, which will be finalized upon award of exploration license based upon coordination with the SBMA. This plan includes a detailed list of local stakeholders, proposals on screening and analysis to help define the appropriate levels of engagement for each stakeholder group, and ideas for approaches to or methods of engagement. Finally, we propose best practices in terms of record keeping and monitoring, evaluating, reporting and improvement relative to our stakeholder engagement plan, to ensure that we are measuring and reporting outcomes in terms of our overall stakeholder engagement objectives.

It is recognized that Cook Islanders' traditional subsistence and artisanal activities may be limited to the coastal environment, but there are cultural considerations with deep-sea mining that will be investigated through the ESIA and incorporated in OM's planning. We recognize the rights of Cook Islanders as 'principal rights holders' and 'resource owners' (or custodians) rather than simply stakeholders and propose a participatory approach to planning and development of exploration related activities (including environmental work).

OM recognizes the need for genuine community engagement not just when applying for licenses and permits, but during the term of operation under them. This includes engaging with the community to:

- Ensure ongoing review of environmental monitoring and the EMP.
- Develop and improve the capacity of the Cook Islanders to participate in adaptive environmental management.
- Ensure ongoing review of priority issues and monitoring through provision of technical advisory resources and third-party review.
- Facilitate a forum wherein the community can make recommendations to OM.
- Integrate and promote use of traditional knowledge in environmental monitoring and management.
- Wherever possible, promote efficiency through the reduction of costs and coordination of efforts.; and

The OM team has, through the 2019 Research Program and prior activities in the CI, established a network of contacts. This network will be used to grow a wider consultative forum(s), from which a point person will be identified and employed full time by Moana Minerals Ltd as our Community Liaison. This point person will serve as the primary local contact for engagement on, and implementation of Local Engagement, Training, and Business Development. This liaison will assist our local Environmental Manager in the planning and managing of our environmental and stakeholder engagement programs throughout exploration.

Local Engagement, Training & Business Development Plan



Figure 1: Organizational Structures

The community liaison will work with SBMA and other Crown agencies to facilitate a meaningful dialogue with the community, to assess current expectations from Cook Islanders of OM, work with OM management to determine how these can be aligned to OM's strategic requirements and expectations, and to identify opportunities for local engagement, training, and business development. Following this, the community liaison will work together with all stakeholders to draft a five-year engagement plan (duration of the exploration permit).

In August of 2018, OML entered into a lease contract on a commercial office space in which we intend to be operational immediately if in receipt of an Exploration Licence. Our plan is to locate key management and operations personnel to this local office. This will also be the place our other company personnel (non-CI based) "lands", and from which it operates when in the CI, as well as where consultants and advisors will assemble, and from which they will mobilize. This ensures a positive local 'face' to OM, ensures a place of contact for Cook Islanders, and will provide a suitable location for hosting meetings with government, local associates, and contractors as needed. OML currently holds a consent from the Business Trade and Investment Board to carry on business in the Cook Islands but these will need to be reviewed and updated for Moana.

To the maximum extent possible, Moana intends to use local CI talent for conducting marine operations, fabrication, and installation of special purpose equipment on chartered vessels, augmenting the scientific crew for resource and environmental research aspects of our program, and handling the logistics associated with receipt, storage, and shipping of all the supporting equipment and consumables associated with our planned campaigns. In fact, OML hired a Cook Islander as part of the team that compiled our NI 43-101 Resource Report and employed 5 Cook Islanders to sail onboard (over and above crew) as part of the 2019 Research Expedition.

Examples of our plans, with regards to employment/training/capacity building, include:

- Employment and Service Contracts:
 - Engagement of Community Liaison
 - o Engagement of Environmental Manager
 - Engagement of Accounting and Office Administrator
 - o Engagement of Configuration and Data Manager
 - \circ Vessel/Crew

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- Fabrication and installation team
- Legal representation
- Accounting and tax services
- Provisioning
- Administration support
- o Logistics co-ordination
- Leasing commercial office space
- Training:
 - Environmental monitoring and sampling
 - o Contributing data to environment-related studies
 - Marine operations (including SHE Management)
 - Advanced welding
 - QA/QC non-destructive testing of welds
 - Material testing
 - Work with local training institutions to establish new training courses and certifications and providing scholarships
- Capacity building:
 - Vessel modifications
 - Use of local fabrication capabilities and enhancing their capabilities
 - Linking with existing environmental research

Opportunities will also be ranked, as:

- Opportunities for Cook Islanders to contribute immediately to Moana's work program
- Opportunities to develop Cook Islanders, to be able to support Moana's work program in the short to medium term, and
- Opportunities for Moana to contribute to training and skills development

The primary focus is thus on services and skills to support exploration related operations as defined in the EWP; then developing skills for the wider maritime industry, that can be used to source support for potential future mining operations, including seagoing and shore support.

Moana will also seek opportunities to work with stakeholders to contribute to academic research so that Cook Islanders can contribute to Moana's environmental baseline and monitoring program.
Local Engagement, Training & Business Development Plan



Figure 2: Government and community members attending a briefing post the 2019 Research Campaign

Moana will report progress on local engagement, training, and business development bi-annually as part of its management reporting process to the SBMA. This plan will be reviewed and updated annually or when significant changes require amendment.

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4. ENGAGEMENT & COMMUNITY AWARENESS

Participation in OML's 2019 Research Cruise by 5 local Cook Islanders, as well as the chartering of a CI flagged and crewed ship, was the first opportunity to begin the sort of partnership envisaged, even before formally beginning any sort of exploration program or formal commitments in this regard. The CI crew was not only crucial in terms of conducting the operations, but the opportunity to share ideas and philosophies and find common ground upon which to build a path to responsible development of the seabed resource provided a step change in mutual understanding and commitment to common goals.

Locally in some manner or another, everyone will be impacted by exploration activities, and it is entirely possible that these impacts will not always be positive. However, what we learned in our December 2019 Research Cruise program was how important it is to understand the delicate balance of supply chains, the significance of certain holidays and religious customs, the scarcity of certain resources, and the lack of control over things like weather and its impacts to operations. At times, difficult decisions had to be made, which required understanding and compromise by all parties involved.

The experience was invaluable. The 2019 research cruise was small scale compared to expeditions planned for exploration, but the experience of working with the local team solidified some key ideas for our community engagement plans going forward:

- 1) Appointment of a well-respected local advocate for Moana and OM is fundamental.
- 2) Community understanding of the operations planned as part of the overall exploration program, as well as specific campaigns is important. A set of presentations, tailored for public engagements, which lay out the multi-year program will be prepared. These presentations will describe how the resource is developed, how the project economics can be understood, and the environmental research that will be part of the exploration license activities to be undertaken ALL before applying for a mining licence. Our objective is to set peoples' minds at ease so they do not perceive the contractors as rushing to do mining without understanding the impacts. Additional engagements, supported as necessary by presentations, which we believe would prove valuable for community understanding overall, would include:
 - a. Overview of 5 Year Exploration Program (mentioned above)
 - b. Products of Interest and what are the steps required to enable the CI Resource to be a Global Game Changer (Contribution to Global Greening)
 - c. Exploration Operations Explained grab sampling, box coring, dredging, piston coring; surveying (bathy, backscatter, video/photography); water chemistry, environmental arrays, marine environment observation recordings using PelagOS
 - d. "Crowdsourcing" Environmental Data Collection roll out PelagOS to any vessels that will be transecting operational areas near/around application area

Several methodologies exist for community engagement sessions – many of these have been proven elsewhere and would be tailored as necessary to match local CI practices:

• Open House/Social at the Moana Office – consider periodic socials with a focused 15minute presentation and Q&A. Handout materials should be available.

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- Community gathering session ("Town Hall") at a central community venue especially suited for large gatherings and presentations, and engagement sessions outside of Rarotonga. As above, a focused presentation, followed by Q&A, and supported by handouts.
- Social media an appropriate social media account(s) will be set up, e.g., Facebook, Twitter, Instagram
- Downloads material will be made available on our website which can be accessed by interested parties, and where necessary downloaded for detailed review.

We recognize the importance of conducting community engagement, not just in Rarotonga and Aitutaki, but also Atiu and the Northern group of Islands (on a less frequent basis).

The frequency of these engagements will be finalized quickly as part of stakeholder engagement plan finalization with the SBMA, should an Exploration Licence be granted. In addition, a permanent information area will be available in Moana's local office.

Moana aims to contribute to long term social development initiatives identified in consultation with stakeholders. The benefits of such engagement would extend well beyond our proposed exploration program and be intended to have lasting positive impacts within the community.

Local Engagement, Training & Business Development Plan

5. EMPLOYMENT OF COOK ISLANDERS

It is of fundamental importance to OM and Moana that every employee, regardless of origin and gender, is safe, and has equal opportunity to meaningfully contribute to our success as a team; 'how' we work is as important as 'what' we do. We will seek opportunities to maximize the employment of Cook Islanders in conducting EWP activities.

Hiring preference will be given to Cook islanders who possess the required competencies or can develop within realistic timeframes to possess the required competencies.

Roles that can ably be filled by Cook Islanders include:

- Community Liaison
- Environmental Manager
- Accounting & Office Administrator
- Configuration & Data Manager
- Seafarers, crew (support roles on vessels sourced from outside the CI, to full crews for vessels sourced within the CI)
- Seagoing operators (operate OM supplied exploration and sampling equipment)
- Shore support office and logistics (all office staff and logistics coordinators)
- Researchers and monitors for environmental work
- Light industrial manufacturers

It is noted that our activities will also create secondary employment, e.g., companies providing logistic support to our campaigns will create additional employment opportunities.

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6. TRAINING AND CAPACITY DEVELOPMENT

OM is committed to the provision of comprehensive training and capacity development to nationals of the CI as part of our operations. Ideally, we want to identify sustainable "skills for the future" partnerships between Cook Islanders and OM. It is important to note that it is during the potential future mining phase (with continuous operation) rather than the exploration phase (with intermittent voyages) where qualified personnel will be most needed (e.g. engineers, surveyors, geologists, marine biologists, etc.) with good prospects of long term career employment. However, at the exploration phase Moana will be looking to engage Cook Islanders who are already well qualified and are either living in the Cook Islands and are seeking employment, or who have migrated overseas due to an absence of opportunity in their own country, school graduates suited to in service vocational training and recent tertiary graduates seeking internships.

The most pressing skills Moana will need will be at the trade skill level (electrical, hydraulic, mechanical, seamanship) and recent graduates lacking practical experience, mainly in environmental and geological disciplines will receive in service training and mentoring from Moana Minerals' experienced team members and contracted scientists.

The following training and capacity development opportunities have been identified. This list will be expanded as further opportunities are identified, through stakeholder and community engagement forums. We will provide opportunities to grow skills and competencies by involving Cook Islanders in our various campaigns, working alongside the OM team, as follows:

• Marine skills

Where non-CI vessels are chartered, OM will seek to provide opportunities for Cook Islanders, with the requisite basic competencies to further develop these through working alongside international seafarers. Where necessary, OM will ensure additional training is provided. Where CI vessels are chartered, and berth space is available, OM will seek opportunities for trainees or cadets to sail on our campaigns alongside the permanent crews

Environmental Monitoring skills

OM will repeat the successful initiative in our 2019 research campaign by employing Cook Islanders with appropriate backgrounds to join the team as environmental monitors. Our scientists and teams will train these monitors onboard. In time, these individuals could run future monitoring programs

<u>Resource sampling skills</u>

OM will repeat the successful initiative in our 2019 research campaign by employing Cook Islanders with appropriate backgrounds to join the team to support sampling activities. This will include training and operation of sampling equipment, logging, handling, and reporting of samples.

Occupational Health and Safety (Offshore)

Candidate trainees for offshore occupational health and safety positions will be identified and provided the necessary training and exposure on risk identification, establishment of controls, safe working practices, incident investigation, and reporting. These skills can also be applied onshore.

Where opportunity presents, OM will offer bursaries for further academic studies, to enable

Local Engagement, Training & Business Development Plan

technical roles in later EWP campaigns and mining activities. These professional development programs will benefit a wider community, in association with our scientists (refer to the application for CVs of our team), the opportunity to contribute to academic papers, and in time possibly in association with international or local academic institutions.

OM recognizes the United Nations Sustainable Development Goal #5 of promoting gender parity and will seek to identify opportunities for women in STEM.

OM commits to working with the Authority and other Crown agencies, as well as with CI based schools and training institutions, to identify appropriate focus areas, establish operating budgets, develop programs, and identify individuals to participate in the programs, through a fair and transparent process. Moana Minerals will also look to work with the Cook Islands Training Institute to give apprenticeships and post-graduation internships to some of its students so they can acquire on the job experience as they are learning their skills.

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7. PROCUREMENT OF LOCAL GOODS AND SERVICES

OM commits to prioritize the procurement of goods and services from appropriate, established entities in the CI. As the exploration work program progresses, and using information from our community engagement forums, we will seek opportunities to add to the identified list below and to grow the capacity of those we deal with to provide goods and services for deep sea exploration. Forecast local expenditures will be finalized with the completion of the EWP budgets

Goods and services to be procured locally, in addition to those set out above, will include:

- Establishment and operation of our local office
- Logistic support for campaigns
- Accommodation and transport (full time personnel stationed in Rarotonga as well as periodic working visitors in support of focused operations)
- Provisions, fuel, spares
- Light manufacturing goods and skills / capability transfer
- Local vessels

Annex 6 - OM-11 NPPLN-32000-LCTRB-01 Local Engagement, Training and Business Development Plan

Final Audit Report

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Cook Islands Exploration License Application

MOANA

MINERALS

Terms and Schedule of Relinquishment

As at January 5, 2022

NPPLN-00000-RELQH-00



Terms and Schedule of Relinquishment

APPROVAL/S

Name & Title	Signature	Date
Hans Smit Chief Executive Officer	Hans Smit Hans Smit (Jan 2, 2022 15:41 EST)	Jan 2, 2022

AUTHOR/S

Name & Title	Signature	Date
Hans Smit Chief Executive Officer	Hans Smit Hans Smit (Jan 2, 2022 15:41 EST)	Jan 2, 2022

REVIEWER/S

Name & Title	Signature	Date
Laurie Meyer Chief Projects Officer	Jan 3, 2022	
Gary van Eck Consultant	<u>Gary van Eck</u> Gary van Eck (Jan 3, 2022 08:42 GMT+2)	Jan 3, 2022

CHANGE HISTORY

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LIST OF FIGURES

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1 INTRODUCTION

This document defines the terms, schedule and areas that may be subject to relinquishment in accordance with section 78 of the Act.

The areas subject to relinquishment are reviewed and updated on an ongoing basis as part of Moana's larger environmental management process (that include adaptive management) and resource development activities. Factors considered during review of the application area to determine blocks for relinquishment include identified areas set aside for preservation and protection of biodiversity, habitat, topology, and finally areas of mineralization to be targeted during extractions.

Currently there are no areas allocated for relinquishment, however this may change as Moana's exploration and environmental programs advance and more information to inform the process is available.

Terms and Schedule of Relinquishment

2 DICTIONARY

TERM	DEFINITION
Act	Cook Islands Seabed Minerals Act of 2019 as amended in 2020 and 2021.
Moana	Moana Minerals Ltd
ОМ	Ocean Minerals Group
OML	Ocean Minerals LLC

Terms and Schedule of Relinquishment

3 RELIQUISHMENT SCHEDULE

As at the issue date of this document, the following areas have been allocated for relinquishment in accordance with the terms of section 78 of the Act.

Table 1 – Exploration	License A	Area Block	Coordinates
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Block Name	Coord1	Coord2	Coord3	Coord4
None	N/A	N/A	N/A	N/A

Annex 7 - OM-24 NPPLN-00000-RELQH-01 Terms and Schedule of Reliquishment

Final Audit Report

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