Environmental Assessment Document

Project No: 50110-001

Date: November 2016

Document Status: Draft Final

Cook Islands: Improving Internet Connectivity for the South Pacific Project

Initial Environmental Examination

ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	Affected Persons
BMH/MH	-	Beach Manhole
CIIC	-	Cook Islands Investment Corporation
CITES	-	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSC	-	Submarine Cable System
EA	-	Executing Agency
EEZ	-	Exclusive Economic Zone
ESIA	-	Environmental and Social Impact Statement
ESMP	-	Environmental and Social Management Plan
FAD	-	Fish Aggregation Device
GPS	-	Global Positioning System
GRM	-	Grievance Redress Mechanism
ICT	-	Information and Communications Technology
IEE	-	Initial Environmental Examination
IPP	-	Indigenous Peoples Plan
IPPF	-	Indigenous Peoples Planning Framework
IRDDR	-	Involuntary Resettlement Due Diligence Report
MFAT	-	Ministry of Foreign Affairs and Trade (Government of New Zealand)
MFEM	-	Ministry of Finance and Economic Management
MMR	-	Ministry of Marine Resources
NES	-	National Environmental Service
NGO	-	Non-governmental organization
nm	-	Nautical mile (1.855 km)
OP	-	Operational Policy
OPM	-	Office of the Prime Minister
PAD	-	Project Appraisal Document
PC	-	Project Coordinator
PIA	-	Project Influence Area
PMT	-	Project Management Team
PSA	-	Poverty and Social Assessment
PMU	-	Project Management Unit
PSC	-	Project Steering Committee
Ra'ui	-	A community ban on land or coastal water for a set time to protect it, allowing the resources to rejuvenate.
RP	-	Resettlement Plan
ROW	-	Right of Way
SCS	-	Submarine Cable System
SPRSS	-	Summary Poverty Reduction and Social Strategy
SPS	-	Safeguard Policy Statement 2009 (of ADB)
TA	-	Technical Assistance
TOR	-	Terms of Reference
UNCLOS	-	UN Law of the Sea Convention

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EXECUTIVE SUMMARY

1. **Introduction**. The Cook Islands is a group of 15 islands located about 3000 km northeast of Auckland New Zealand, with the capital at latitude 21°14′S 159°46′W. The Islands are generally split into the southern and northern group with the southern considered subtropical and the northern group fully tropical islands. The Cook Islands' Exclusive Economic Zone (EEZ) covers 1,800,000 km^2 of ocean.

2. The project will link the islands of Rarotonga and Aitutaki in the Cook Islands and Niue (non-member country) to Samoa and French Polynesia via a regional submarine internet cable (Manatua cable) system. The Government of Cook Islands (the government) has requested the Asian Development Bank (ADB) to support a portion of the project cost. The Government of New Zealand, represented by Ministry of Foreign Affairs and Trade (MFAT), will also provide grant to the government to support the project.

3. The project will be completed in two stages: a) the hydrographic mapping to establish the best, or least environmentally intrusive alignment of the cable route to each of the islands, and b) the deployment of the cable offshore and across the intertidal zone to land and to the cable landing stations to be built as part of the project.

4. **Institutional arrangements**. The Cook Islands is a self-governing island country operating in a Westminster parliamentary style of government, similar to that of New Zealand and England. Parliament consists of a single chamber of 24 elected members, 10 of whom are from the main island of Rarotonga and the rest are from the outer islands. Cook Islanders are citizens of New Zealand, but also are Cook Islands nationals, which is not given to other New Zealand citizens.

5. The House of Ariki is the council of chiefs who are the traditional leaders of the country. The House of Ariki has great influence over land and resource use and for that reason they were specifically consulted concerning placement of the cable across the reef flat.

6. The Ministry of Finance and Economic Management will be the executing agency to facilitate the smooth flow of funds and overall management of the project. The government has set up Avarua Cable Company (ACC), a state-owned enterprise that has joined the Pacific Connectivity Cable (PCC) consortium to implement the project. ACC will be supported by a Project Management Unit (PMU) to implement the project including implementation of the environmental assessment in respect of environmental management requirements from the preconstruction through the start of the operating period of the project.

7. **Project influence area**. The environmental assessment has been completed based on clearly defining the project influence area (PIA). Prior to the completion of the analysis of alternatives which led to the selection of two specific landing sites, there were seven locations in the intertidal reef flats-to-shore areas under consideration, and making up two large PIAs on Rarotonga and Aitutaki. The analysis of alternatives resulted in the identification of two recommended landing sites, one for each of the island. These landing sites, the intertidal reef flats to be crossed, the identified channel the cable would be deployed through to reach the shore, as well as the alignment on the seafloor within the country's EEZ make up the project-specific PIAs.

8. For Rarotonga, the PIA includes the lower and upper ref slope, the barrier reef, the natural Ruataki channel and the subtidal and intertidal reef flat terminating at the foreshore rock retaining wall, at the high-water line. From there the cable will be buried at the edge of the road right-of-way (ROW) to the cable landing station.

9. For Aitutaki, the specific PIA includes the route entering the intertidal zone through a rarely used Rautaro boat channel, across the sub tidal and intertidal reef flat landing approximately 300m south of Arutanga Port. From there the cable will be buried form the high-water mark to the road and then along the existing road right of way (ROW) to the cable landing station.

10. Both island PIAs include the cable alignment from the reef to where it meets the main international cable in the deep ocean and for the entire distance while in the Cook Islands' EEZ.

11. **Impacts and mitigation**. The overall potential environmental impacts arising from the project are limited. The key environmental interactions are in the near shore areas where the cable requires burial to avoid potential entanglement with fishing activities and other human activities.

12. The terrestrial environmental and social impacts associated with the proposal are minor. Existing cable connection infrastructure will be utilised at both Rarotonga and Aitutaki; both landside routes situated in public road ROWs. None of the infrastructure placements require clearance of vegetation or interaction with significant habitats, and routes to the cable landing stations will be on public land.

13. Disturbances and impacts caused by cable laying and maintenance should be viewed in the context of the frequency and extent of these activities. The one-of disturbance associated with cable placement is restricted mainly to a strip of seabed less than 2 m wide. Unless a cable fault develops, the seabed will not be disturbed again within the system's design life of approximately 25 years. For comparison, bottom trawl and dredge fishing operations, are repetitive and more extensive and a single bottom trawl can be tens of metres wide, sweep substantial areas of seabed in a single operation and is likely to be repeated over a year at the same site. A single impact, such as a cable placement or burial, is preferred to continuous, multiple or recurring impacts.

14. The Rarotonga landing site at Rutaki will not require any land acquisition, while on Aitutaki, the Arutanga (Rautaro) site will require the temporary lease of a narrow strip (1m x 40m) of land from the high-water mark to the road ROW and a manhole. The government is securing an easement across the land between the high-water mark to the road ROW boundary. The Arutanga alignment will also involve the replacement of an aging septic tank which is in the way of the cable to be buried in an approximately 0.75 to 1m deep trench to the road.

15. These landing sites and all known potential associated issues were discussed at two public consultation sessions (one on each island) where, after a presentation, officials and the general public were invited to ask questions and provide advice. Both sets of participants favoured the selected alignment and it was in fact the participants at the Aitutaki session that suggested the Rautaro boat channel as the best access point. Once they realized how small it is and what little area its deployment would affect, nearly all participants welcomed the cable and in fact were hoping to have it installed as quickly as possible.

16. The project will impact a corridor of not more than 3-4 m wide (including the footprint of the submarine-trenching machine on the sea floor in the inner reef zone, and to a depth of 0.75-1.0 m beneath the sediment. The cable, about 4 cm in diameter (maximum) in the nearshore zone[1], will be buried as it passes through the natural channel (ava) through the barrier reef into the Rarotonga and Aitutaki nearshore zone. Burial of the cable will be done to reduce interference with coastal fishing gear and reduce the risk injury to corals and people during storm events.

17. The underwater transect-type survey of each alignment from the outer reef to shore (see Annex 2 for details) found almost no live coral in the two PIAs.

18. The cable route will avoid sensitive habitats such as corals and areas designated as Ra'ui, with placement of the cables guided by experienced divers who will deploy it according to instructions from the Ministry of Marine Resources (MMR). These measures will limit any chance that the work will negatively impact the marine environment.

19. All land to be traversed by the cable and associated infrastructure is government leased or owned, including the seafloor (according to Cook Islands law), as well as the cable landing stations.

20. **Environmental and social management plan**. The environmental and social management plan (ESMP) defines a full set of working area boundaries, work restrictions and timing limits, which will be included in the construction contract specifications and which the contractor must comply with. The PMU and trained ACC support staff will lead the ESMP implementation and will monitor compliance.

21. Given the small-scale impact of the work, and the fact that nearly all of it takes place on board a vessel at sea with a specially trained crew, no negative social impacts are predicted during any stage of the project.

22. An important yet low level impact will be the access restrictions resulting from the trenching of the cable on land and the need to rapidly repair the damaged vehicle accesses as specified in the ESMP. Further, the trenching must be completed using equipment that creates the smallest possible 'footprint', such as a "Ditchwitch", given that the cable, likely inside a case hardened conduit, will be less than 6cm in diameter.

23. **Monitoring and reporting**. All reporting and monitoring requirements are specified in the ESMP. In addition to submitting oceanographic mapping findings and alignment definition data provided by the contractor, the PMU will be required to submit compliance monitoring checklists describing the progress achieved with ESMP implementation. The PMU will submit this report once during the preconstruction period, twice during the construction period and once during the start of the operating period. This material will be forwarded to the ACC and made available for submission to MFAT and ADB.

24. **Follow-up requirements**. The PMU overseen by ACC will provide full safeguard documentation (e.g., the IEE its ESMP and alignment information) to the two communities affected and will, with local authorities, conduct consultations once the draft of the final

[1] The cable diameter varies depending on depth, thus for deep sea locations it will average 1.7 cm in diameter and near shore about 3.5 cm in diameter.

alignments is ready, inviting the PIA villages to help with final locations, particularly inside the reef boundary. The government recognizes that the specific alignment of the cable and its deployment has not been finalized and as such there may be a need to revise and update this IEE. If this occurs the PMU will adjust the ESMP and discuss these changes with ACC as well as local MMR and NES officers to be sure that protection of the environment is robust. The contractor will then implement any new measures.

25. Should social issues arise such as the need for land, the PMU will seek assistance from the Cook Island Investment Corporation and work with landowners to reach a fair solution.

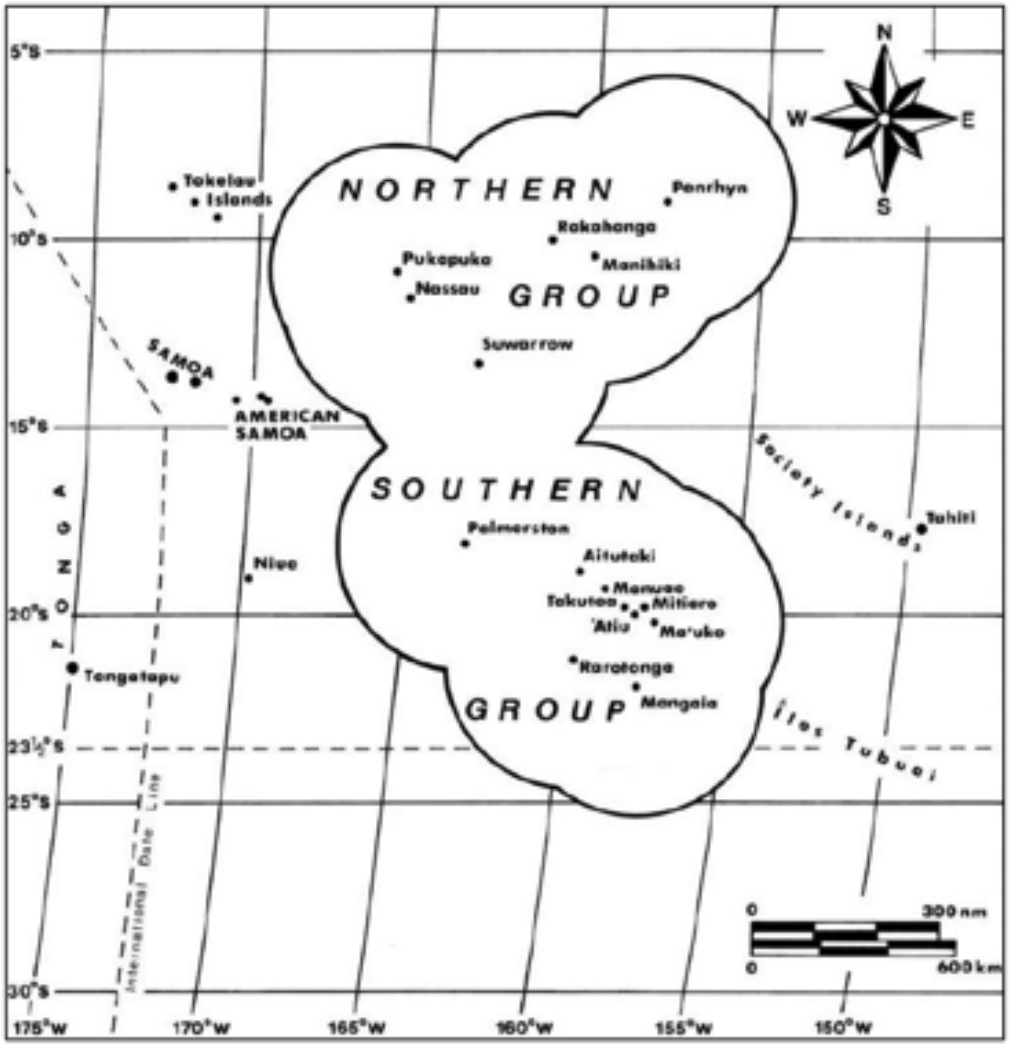
26. **Grievance redress**. The IEE contains a six-step grievance redress mechanism (GRM) defining a procedure that anyone with a complaint about the project could follow and know when answer is to be provided, and by whom. At the consultation sessions, the GRP and its availability was announced. Participants were also urged to review the IEE once it was placed for the 30-day public review according to the Cook Islands' environmental assessment process.

27. **Budget and cost estimate**. If one includes the training costs, with the ESMP implementation for both the environmental and social sector actions, the total estimated cost would likely be around US$95,000 ($10,000 training, $50,000 mitigation and $35,000 for monitoring functions).

I. INTRODUCTION

1. **Location**. The Cook Islands is a group of 15 islands located about 3000 km northeast of Auckland New Zealand, with the capital at latitude 21°14′S 159°46′W. The Islands are generally split into the southern and northern group with the southern considered subtropical and the northern group fully tropical islands. The Cook Islands' exclusive economic zone (EEZ), covers 1,970,000 km^2 of ocean (refer to Figure 1.1.

Figure 1.1: Cook Islands Geographical Location



2. **The project**. The Government of Cook Islands (the government) has requested the Asian Development Bank (ADB) to support a submarine internet cable project. The project will link the islands of Rarotonga and Aitutaki in the Cook Islands and Niue (non-member country) to Samoa and French Polynesia via a regional submarine internet cable (Manatua cable) system. The Government of New Zealand, represented by Ministry of Foreign Affairs and Trade (MFAT), will also provide grant to the government to support the project.

3. The contractor retained to deploy the cable in the Cook Islands will, under the same contract, complete the hydrographic survey, deploy the cable for the entire approximately 3,300

km, including the spurs to Rarotonga, Aitutaki and Niue (the subject of a different project and assessment), as well as lead all trenching activity.

4. **Project purpose and proponent**. The purpose of the overall project is to install a submarine fibre optic cable from Samoa to French Polynesia, with branches to Niue and the Cook Islands, with the focus the branching units and spurs that will connect the islands of Rarotonga and Aitutaki.

5. **Institutional arrangements**. A newly established SOE – Avarua Cable Company (ACC) responsible to own and operate the cable in Cook Islands has joined the Pacific Connectivity Cable (PCC) consortium[2] to implement and operate the Manatua cable system. Cook Islands will own and pay for its spur and branching unit. The installation and operating cost of the main cable will be covered proportionately as per Construction and Maintenance Agreement (C&MA)[3] among the consortium members[4]. ACC will be supported by a Project Management Unit (PMU) who will manage the Cook Islands' component of the work to take place inside its 200 nautical miles (nm) EEZ. The PMU will be responsible for the management of all safeguard activities, with advisory inputs from the National Environment Service (NES) and Ministry if Marine Resources (MMR) as required.

6. **Safeguards screening and due diligence**. The project co-financing parties agreed to a joint-approach to the content and format of the safeguard due diligence documentation to ensure compliance with all relevant safeguard policies. The project has been screened for environmental impacts and due the site-specific nature of impacts and risks and the fact that the majority of impacts can be readily mitigated, following the ADB's Safeguard Policy Statement 2009 (SPS) the project is deemed Category B, requiring an environmental assessment commensurate with the level of impact, which is more or less the same requirements as those of the Cook Islands and the Government of New Zealand through MFAT. This initial environmental examination (IEE) is the appropriate level of assessment and has been prepared to satisfy the safeguards requirements of Cook Islands, New Zealand, and the ADB. The Cook Islands environmental assessment legislation requires a Technical Focus Report and MFAT's environmental safeguards require a basic EIA, both of which are more or less equivalent to the IEE.

7. This IEE includes an environmental and social management plan (ESMP) which will be updated based on the detailed design, surveys and specific cable alignment and made specific by the PMU working with the contractor, to ensure that impacts are avoided or minimized.

8. This IEE focuses on coastal zones and near-shore marine areas, which form the majority of the two PIAs. Terrestrial infrastructure requirements will be limited in extent and utilizing existing facilities (e.g. existing manholes and cable landing stations), all confined to public road easements. Seven marine site surveys were completed and the findings are summarised in this document, and in the detailed reports in Annex 2.

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2 Other consortium members are OPT, French Polynesia, Samoa cable company, Samoa and Niue cable company, Niue.

3 C&MA details down the organizational structure, cost sharing mechanism, role and responsibility for the consortium members to run the submarine cable system.

4 The Cook Islands will have 40% capacity share.

9. **Methodology**. The IEE has been completed based on review of reports and consultations with technical consultants and government officials, followed by field visits to seven landing sites; three on Rarotonga and four on Aitutaki, the two islands where the cable will come to shore. The field visits involved interviews with local residents, village officials, chiefs as well as local government officials on both Rarotonga and Aitutaki.

10. The topics for which data were collected included:

- locations and descriptions of sensitive components of the environment within the PIAs, including coral assemblages, fisheries conservation areas or Ra'ui boundaries and fish aggregation devices (FADs);
- marine ecology of the coastal zone and nearshore waters likely affected by the cable;[5]
- alignments where the cable was proposed to pass across the fringing reef through existing breaks or *ava's* in the reef;
- land ownership details and any potential impacts;
- poverty and gender conditions in relation to the proposed work;
- social impacts of faster and more reliable internet connections; and
- cultural heritage and archaeological sites within the PIA corridor.

11. The following activities were undertaken to assemble the necessary data with which to complete this IEE: (i) inception reporting to establish preferred landfalls for the cables and scope of work; (ii) meeting with MFEM and other agencies that will manage this project; and (iii) one field mission to Rarotonga and Aitutaki to collect primary data on the nearshore marine system as well as the landing sites and record any social issues focusing on land acquisition and the confirmation that no people relocation or land private land acquisition was needed to make way for the cable.

12. This was followed by an analysis of the potential impacts that the construction and operation of the fibre optic cable could have on the two PIA's physical, ecological and socio-cultural environment, as well as more broadly, the island population.

13. Consultation and information sessions were completed in Avarua, Rarotonga on August 26th, 2016 and in Arutanga, Aitutaki on August 31st. Consultation details are provided in Chap VIII of this IEE. Three meeting were held with the National Environment Agency (NES) both in Rarotonga and Aitutaki, and NES was invited to participate in the marine transect survey.

14. The marine assessment of the Rarotonga landing sites, undertaken on Friday the 2nd of September, 2016, focused on the PIA's section from the lower and upper reef slope, the barrier reef, the natural Rutaki channel and the sub-tidal and intertidal reef flat terminating at the foreshore rock retaining wall, at the high-water line. This included three alternative routes, from the outer barrier reef, outer and inner channel, sub-tidal and intertidal lagoon areas and the cable terminal location on the shoreline.

15. The marine assessment of the proposed Aitutaki landing sites focused on four alignments within that PIA; two from an ava through the reef to the north-eastern end of the island, landing either directly west of the old airport runway or directly west of the MMR aquaculture facility within the easement of the government owned road. The 3rd proposed route entered through the shipping harbour channel, directly across the to the shipping wharf. The 4th

[5] MMR was invited to participate as advisors on the field assessment, but this did not materialize.

option, entered through the Rautaro channel across the sub tidal and intertidal reef flat and landing approximately 300 meters south of the islands main port.

16. Survey sampling plots were chosen based on their proximity to the cable route, representative biological habitats and potential conservation status. The assessment methodology, specific site locations and detailed findings and photo records are presented in Annex 1. Information obtained from the marine assessment (see Annex 1) provided a description of the natural reef system and resources associated with the cable alignment. This information was then used to gauge potential environmental impacts that that were then used to decide on which alignment is preferred and what mitigation and monitoring measures are to be applied.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Cook Islands Legal Framework

17. The Constitution Act was enacted by the Parliament in 1964. It is the supreme law of the land that sets out the power and responsibilities of the government and its three main branches: executive, legislative and judiciary. The Constitution also outlines the functions, powers and responsibilities of the Land Court and the Appellate Court.

18. **Environment laws and regulation**. In 1995-6 Mere Pulea undertook a detailed review of the Cook Islands' environmental legislation (Boer, 1996). Since Pulea's review two relevant acts and a regulation were either revised (Marine Resources Act) or newly drafted, as for example the Environment Act 2003 and the Environment Regulations 2011.

19. Although technically not yet law (it is an Order in Council) the *Environment (Permits and Consents) Regulations 2011* is the country's premier environmental legislation and is being applied. It lays out in great details the duties of anyone wanting to undertake a project that impacts the natural environment (the regulation is mostly silent on the social sector) as well as the requirements of the National Environment Service (NES) as the country's authority on environmental assessment (EA) and EA management. The Regulation specifies under what conditions an EA is needed and level of detail and content essentials, depending on the potential impacts. The first step for any proposed project is the completion of an Environment Significance Declaration (ESD) form. NES then assesses the ESD and determines if the project would potentially have significant social, economic and environment effects and then if and what category of EIA would be required. A project Terms of Reference (TOR) is then prepared by NES and submitted to the applicant as a guide for the preparation of the environmental assessment. The regulation contains considerable detail on review and consultation, involving an internal review followed by public review.

20. When NES is satisfied that all concerns (if any) have been addressed, it and MFEM (the proponent in this case) deliberate. NES may then issue any one of three decisions: (i) permit to proceed with no conditions; (ii) permit to proceed with specific conditions; or (iii) refuse to issue a permit to proceed.

21. The government has agreed that for this project the ADB's guidelines formats and documentation details will apply and will augment the Cook Islands' process. The government will however conduct the necessary reviews and consultations using this draft IEE.

22. Other relevant laws that could be applied as compliance or enforcement issues arise are those dealing with protection of marine resources, prevention of pollution from vessels and establishment of national stewardship over the territorial seas and EEZ, are listed in

Table 2.1: Relevant Cook Island Legislation

Legislation	Responsible Government Agency/Office
Fisheries Protection Act 1976	Min. of Agriculture and Fisheries
Planning and Economic Development Act 1987	Min of Finance and Econ. Development
Marine Resources Act 1989	Min of Marine Resources
Prevention of Marine Pollution Act 1998	Min of Transport and Marine Resources
Continental Shelf Act 1974	
Territorial Seas and EEZ Act 1977	Ministry of Marine Resources
House of Ariki Act 1966	Local council involvement in land use decision making

23. **Marine laws and regulation**. In contrast with other states in the Pacific, the Cook Islands does not have legal regulation indicating customary ownership of the intertidal and reef zones. The government owns the seafloor from the high waterline seaward. There may be special arrangements for leasing of plots from the 'crown', but none of this is relevant for the project locations in Rarotonga or Aitutaki.

24. The government has agreed with community leaders to establish community managed marine resource management areas and/or sanctuaries designated as Ra'ui, which technically function as fishing reserves, intended to sustainably manage the stocks for the benefit of the local communities. Ra'ui areas also act as nursery areas for unprotected waters, helping to re-establish overfished species such as the parrotfish (Scaridae). In practice Ra'ui areas are less frequently managed based on sustainable resource management, but more based on when the community want to fish, thus losing the historical intent of this tradition. Additional information associated with Ra'ui in Rarotonga and Aitutaki has been documented in Section IV-B-4.

25. Further, the House of Ariki (Maori Chief's Council) representing the 15 islands was established decades ago. The Arikis give decisions on land use, as well as on the use of intertidal and marine reef areas, especially when cultural and historical values are involved. In reality they have no legal power, since the act only establishes the organization, but they have enormous cultural significance with the people.

26. **Customary ownership**. Generally, the Crown, subject to customary title, owns all land in the Cook Islands. The implication of that qualification is that in the end, land ownership rests with the customary owners, being the Native Landowners who on application to the High Court are determined to be the Landowners. There are a number of categories of land in the Cook Islands including (i) Crown Land, (ii) Customary Land, (iii) European Land, (iv) Native Land, and (v) Native Freehold Land. Generally, land owned by the Crown is Crown Land. Native freehold land, taken by, or transferred to the Crown, becomes Crown Land.

27. Private land in Cook Islands cannot normally be sold to another citizen. This restriction does not apply to the Crown. Accordingly, a Native Landowner may transfer, sell, gift, lease, grant easements on a piece of native freehold land to the Crown; subject to proper payment and/or compensation. So, where one native cannot sell to another native, a native can sell the fee simple Native Freehold land to the Crown.

28. A citizen (native) can lease land or grant an easement in land to another citizen but restrictions apply. Again, many of those restrictions often do not apply to Crown. For example, the term of a lease or an easement to a citizen must be restricted to 60 years but that restriction does not apply to the Crown. The Native could lease the Land or grant an easement to the Crown for as long as the parties wish.

29. The type of land-use the Crown requires will often dictate how and what type of ownership is obtained. For this project's case, and given the relatively small areas required, namely for the manholes and access from the high water mark to a road ROW, an easements would probably suffice.

30. Leases of native lands or freehold native lands are administered by the Cook Island Investment Corporation and are based on the Cook Islands Act 1915 and other relevant legislations summarized below.

31. **Land acquisition**. There is a comprehensive legal framework governing land ownership and transactions in the Cook Islands including but not limited to the Cook Islands Constitution, Cook Island Act 1915, Land Use Act 1969, Lease (Facilitation of Dealings) Act 1970, and Leases Restriction Act 1976.

32. Under the Cook Island Act 1915 (Section 362) acquisition of land through agreement. This section states that the High Commissioner may for any public purpose, for and in the name of Her Majesty, purchase any Native freehold or European land in the Cook Islands. Or acquire by grant, lease or easement or any limited right, title, estate, or interest on any such land. Guides acquisition of land by the Crown for public purposes through agreement with Landowners into sale and purchase of Land.

33. **Cultural preservation.** The Cook Islands Cultural Development Act 1990 aims to preserve, perpetuate and enhance the country's cultural heritage to uphold traditions and develop an appreciation for the Cook Islands' culture. The act also enables growth and expansion of productive economic, social and educational activities that may enhance cultural forms and protect the unique national cultural identity of the people of Cook Islands. The Act also created the Ministry of Cultural Development and the Advisory Technical Committees to advise the Minister on the functions of the Ministry.

34. **International treaties and conventions**. The Cook Islands is a signatory to a number of international treaties and conventions; these are listed in Annex 2.

B. ADB Safeguard Policy

35. The ADB's SPS consists of three safeguard requirements (SR): SR1: environment; SR2: involuntary resettlement; and SR3: Indigenous Peoples. The objectives of ADB's safeguards are to: (i) avoid adverse impacts of projects on the environment and affected people, where possible; (ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. Through its SPS ADB establishes policy objectives, scope and triggers, and principles for three key safeguard areas of environment, involuntary resettlement, and Indigenous People. The SPS sets out the process to be applied from screening, through due diligence and assessment to monitoring and reporting.

36. The objective of SR1 is to ensure the environment soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. To help achieve the desired outcomes, ADB adopts a set of specific safeguard requirements that need to be achieved during the processing and implementation of projects financed by ADB.

37. Through a process of screening, ADB categorizes projects by their potential risk or level of impact, and the category of a project will determine the level of assessment required as follows:

- **Category A**. A proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) including an EMP is required.
- **Category B**. The proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) including an EMP is required.
- **Category C**. A proposed project is likely to have minimal or no adverse environmental impacts. An assessment is not required, although environmental implications are still reviewed and in some cases management guidelines may be required to be included in bid documents.
- **Category FI**. A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all the financial intermediary's business activities have minimal or no environmental impacts or risks.

38. In accordance with ADB's SPS, the project was screened as category B. The approach to completing an IEE is defined in Appendix 1 of SPS 2009. The overarching objective of ADB's SPS is to provide a process which the borrower must use to define, prevent and secondarily mitigate any significant negative effects on the physical, ecological and social environment within a projects' impact area. The SPS goes on to define the content and level of detail of the documentation and public review required. The IEE includes an analysis of potential impacts resulting from project activities, appropriately scaled mitigation measures, a matching set of monitoring measures, framed in an environmental and social management plan (ESMP). It includes the implementation steps and institutional arrangements, mitigations and monitoring requirements, estimated cost to implement the ESMP. The IEE also includes a complete record of the consultations undertaken.

39. **Health and safety**. The SPS requires compliance with the World Bank Group's Environmental Health and Safety Guidelines.[6] Each project will be required to provide workers with a safe and healthy working environment, taking into account inherent risks, any hazards in the work areas, including physical, chemical, biological, and radiological hazards. The SPS also requires that the government, through the implementing agency, will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work.

III. PROJECT DESCRIPTION

[6] World Bank Group. 2007. *Environmental, Health, and Safety General Guidelines.* Washington, DC.

40. **Need for the project**. Rarotonga and Aitutaki, the Cook Islands' two most populated islands and the focus of the project have economies based mostly on tourism, and on businesses associated with tourism. Without adequate internet the ability of the sector to keep pace with the rest of the world is slowing down. This impacts jobs and the country's gross domestic products and business. A number of business leaders are convinced that with high speed internet on the islands, some NZ-based Cook Islanders would bring their businesses back home, creating local jobs and revenue.

41. "Tourism is the economic mainstay, accounting for over 60% of gross domestic product. The growth potential of the industry is constrained as a result of shortages in accommodation facilities, issues with the current land leasing framework, inadequate infrastructure (water supply, sanitation, and electricity), and expensive telecommunication costs. Indeed, tourism and public service are the biggest consumers of internet bandwidth" (ADB Concept Paper, August 2016).

42. The proposed project will contribute to improved public services (including online government services such as health, education and financial services), support the tourism sector, facilitate disaster management and support better trade and communication among south Pacific island economies.

43. **Project components**. The project involves two main components:

- designing, supplying and installing of the submarine cable, landing stations and land-side cable alignment including a submarine cable system to connect Samoa (Upolu) to French Polynesia plus branching units and spurs connecting Niue, Rarotonga and Aitutaki
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- Figure 3.1,[7] and,

- planning, designing and installing of intertidal and shore landing sites, carrying on to a land-based cable stations on Rarotonga and Aitutaki, Cook Islands.

44. **Deep ocean deployment**. The submarine component of the work involves cable placement on the sea floor in the open ocean connecting Samoa and French Polynesia with spurs to Rarotonga and Aitutaki. Two "land side" installations will be required, one at Rutaki on Rarotonga and the second in Arutanga on Atutaki (Figures 3.2 and 3.3)[8]. The facilities will connect the cable to the island users as well as receive the cable from the deep ocean across the coastal coral reef and too shore and beyond. The exact location of the cable routes will be determined following a detailed bathymetric/hydrometric marine survey during the design stage. Hence, the cable alignments described in the following sections are indicative and will be subject to refinement.

45. The marine hydrographic survey will characterize the proposed cable route and allow avoidance of hazards and/or environmentally significant zones. Data collected will include water depth and seabed topography, sediment type and thickness, and potential natural or human-made hazards.

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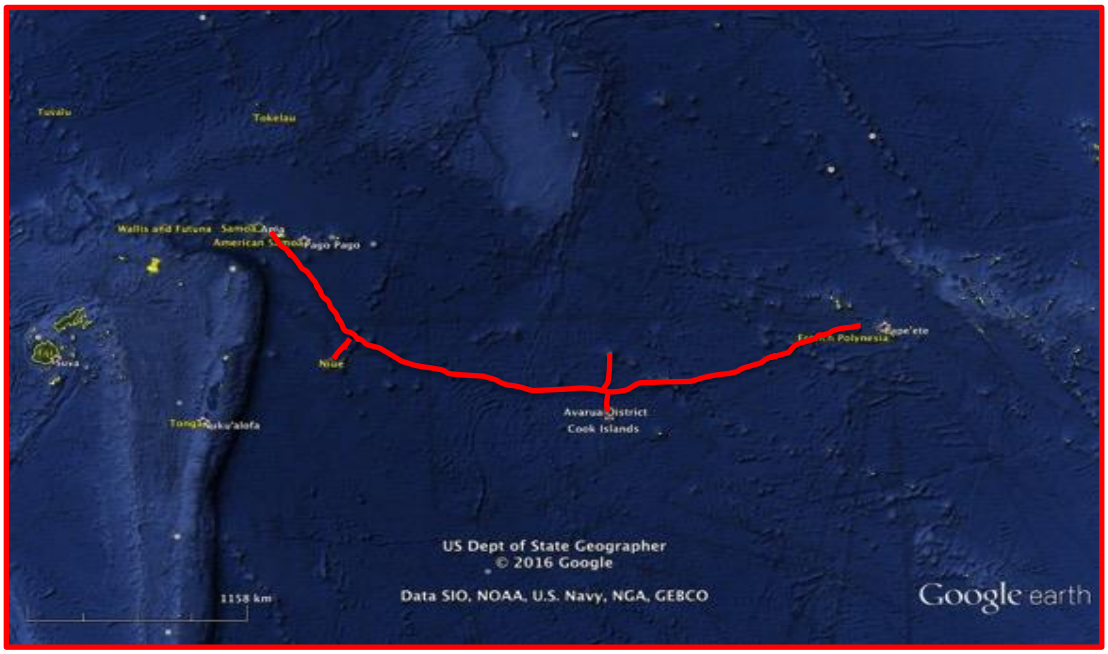
[7] the cable is planned to continue to French Polynesia making a large loop across the South Pacific linking 3-4 countries top the international high speed system

[8] These stations already exist and are fully adequate for placement of new cable electronics

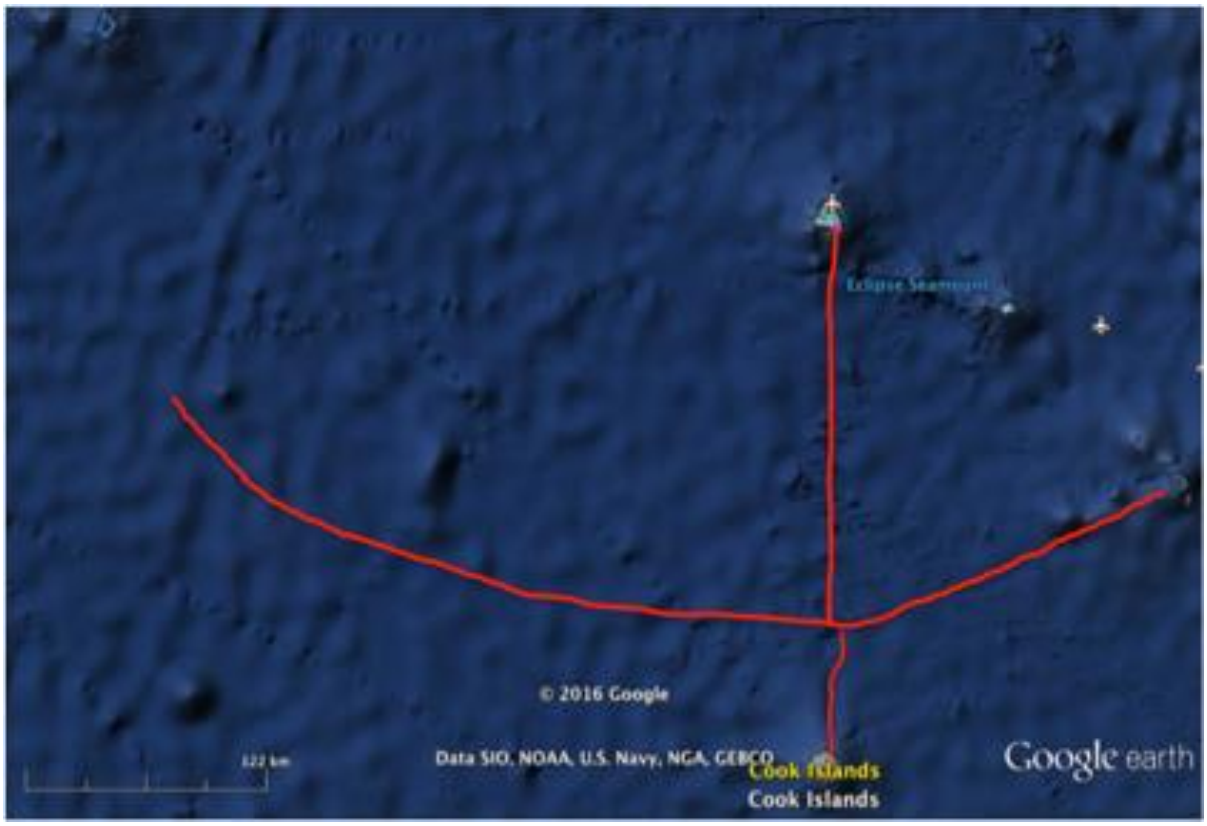
Figure 3.1: Approximate location of Samoa-Cook Islands-French Polynesia Fibre Optic Communications Cable



46. A marine route (Figure 3.2) survey for a cable alignment commonly involves mapping the seabed corridor from 1 to 10 km wide with repeat passes where necessary. The marine survey will determine the final cable route which will avoid sensitive submarine features such as seamounts, hydrothermal vents, coral assemblages, large undersea fishing grounds, near shore fishing reserves and other important environments. There is sufficient flexibility in alignment design such that individual coral heads in near shore environments can be avoided.

47. The marine survey will also identify design details and clarify the nature of the cable deployment on the seafloor, as well as the surface placement or trenching and burial, and the need for cable armouring as it comes close to shore and reaches the high-water line.

Figure 3.2: Rarotonga and Aitutaki Fibre Optic Cable Spurs



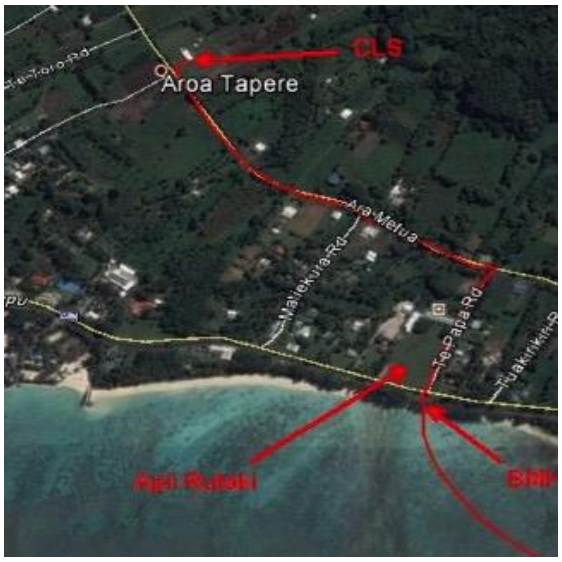
48. **Rarotonga Cable Landing Arrangement and Cable landing station.** Figure 3.3 shows the two indicative marine cable route alignments identified during a previous technical study (No. 1 and 2) and a third identified by the safeguards team in the Rutaki area of Rarotonga's southeast coast. A brief route description follows:

- Marine Cable Route 1: This is an alignment that passes straight through the Rutaki Passage and through the small natural channel and directly to shore, across a small strip of private land and then via a manhole buried underground to the Aroa Cable landing station
- Marine Cable Route 2; Same as No.1 but follows the shoreline within the intertidal reef flat adjacent and parallel to the land and exiting at the Rutaki School landing site on crown land to the road
- Marine Cable Route 3: This alignment would come directly over the barrier reef directly in front of the Rutaki School then onto the road and to the cable landing station at Aroa Tapere

Figure 3.3: Proposed Rarotonga Shore End Cable Routes

49. The route of the new cable on land would start at a beach manhole at the road edge on the west side of the road, and then along the road alignment to the Aroa Tapere cable station (Figure 3.4). The cable may be protected by case-hardened conduit which will be installed in a 30cm-wide trench in the road reserve.

Figure 3.4: Proposed Cable Route from Rutaki BMH to Aroa Tapere



50. **Aitutaki Cable Alignment to High Water Line and to Cable landing station.** Four options have been identified. This includes two more than indicated by an earlier engineering review (Figure 3.5). Two (No.1 and 2) involve passing through a natural channel in the reef and either landing at the end of the old airport runway or at the MMR aquaculture center and two other options (No. 3 and 4) one being deployed in the existing channel into the harbour and the 4th option to bring the cable in through an additional channel to the south of the harbour entrance. The Aitutaki cable would come to shore and pass underground in a trench to the existing cable landing station above Arutanga and beside the hospital (Figure 3.6).

Figure 3.5: Cable Route Options 1 -4 on Aitutaki to shore and to cable landing station

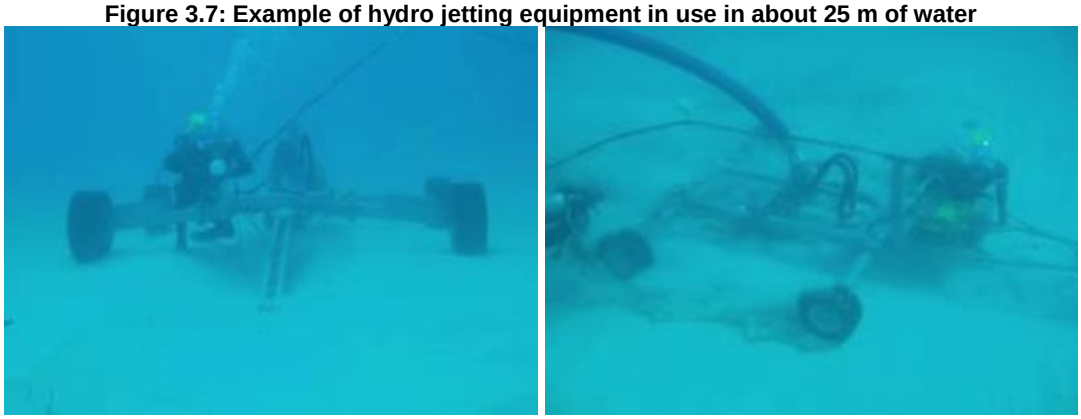
Figure 3.6: Aitutaki Cable landing station site Beside Hospital

51. **The cable**. The glass fibres along which the signal is transmitted is only 0.125mm thick (excluding the protective cladding). A bundle of these fibres makes up the inner workings of a cable, while the other 98% of it is the protective Kevlar-like casing, steel cabling, water proofing and copper casing to transmit power to the repeaters along the cable the main cable connecting Samoa with French Polynesia will be repeatered, while the spurs or branches to Rarotonga and Aitutaki may or may not be repeatered and therefore will or will not have power or a copper cladding.

52. Nearly all the cable laid on the deep-sea floor is between 2cm and 4cm thick and is protected by very durable, extremely dense Kevlar-like covering allowing it to easily sink very easily, and with a lifespan of approximately 25 years. To protect the cable in shallower waters, (<500m) layers of steel cabling, insulation, water proofing and more protective shielding is added.

53. In the deep sea, the cable will be laid on the sea floor, while in shallower waters it will likely be buried in a trench (where it has more protection and as such it approaches 5 cm. The trench will be created by a trenching machine, possibly a hydro-jetter (Figure 3.7) requiring an operating width of approximately 2.5 to 3 meters wide, yet capable of digging a narrow trench of approximately 30cm wide and 1-meter-deep to bury the cable.

Figure 3.7: Example of hydro jetting equipment in use in about 25 m of water



54. The hydro-jetting technique is anticipated to have the least environmental impact in the nearshore marine environment (J. Hibbard, 2015 Pers. communication). Hydro-jetting is useful in applications where seabed materials are consolidated. Hydro-jetting is proposed to be undertaken in submarine areas up to 200m depth (in some cases involving remotely controlled plows). Beyond this depth, the cable will be laid on the sea floor without the need for trenching.

IV. BASELINE DATA

55. The Cook Islands is an assembly of 15 islands situated more than 2000 km northeast of New Zealand (as shown on Figure 1.1). About 85% of the population live on the two main islands of Rarotonga and Aitutaki, with Rarotonga being the national capital and business hub. The population of the other 13 islands account for only 2,600 people (2011 census), and comprises mostly subsistence artisanal economies (Cook Islands Government, 2011).

56. The PIA for Rarotonga is the landing site area between the Rutaki channel and the Rutaki School and road to the existing cable station. For Aitutaki the PIA is the intertidal area from the shipping channel to shore near Arutanga and the cable alignment to the existing cable station along public road allowances. The third, less well defined PIA is the alignment of the cable on the sea floor as it passes through the Cook Islands' EEZ, a corridor no wider than a meter, as the cable is just 2-3 cm in diameter and resting on the seafloor.

57. Based on collaborative efforts of the Cook Islands, Niue, French Polynesia and Samoa the deep-sea fibre optic cable will originate in Samoa, then follow a south-westerly track passing Niue and then between Rarotonga and Aitutaki of the Cook Islands, then swing north to French Polynesia, for total distance of >3,200 km. It was agreed that the cable would have at last three spurs, one to Niue, one to Rarotonga, and one to Aitutaki in the Cook Islands. The cable within the Cook Islands' EEZ is a part of this analysis.

A. Physical Environment

58. **Climate**. The Cook Islands is located north of the Tropic of Capricorn and as such has average temperatures between 18^{o} C to 25^{o} C, with the warmest and wettest period being between December and March. The far southern islands have temperatures 5-7^{o}C colder. The PIA on Rarotonga, is subtropical, while on Aitutaki, the other project island, it in a fully tropical climatic zone (average temperature being 27^{o}C). Both islands are in the cyclone corridor and therefore receive serious to devastating cyclones quite regularly, between November and April. These climatic conditions have significantly impacted the state of the islands' coastal zones, intertidal reef systems and indeed nearshore marine habitats.

59. The Cook Islands experience steady trade winds averaging 10-12 knots/hr., and occasional violent storms during the cyclone season lasting from November to the end of March.

60. The dry period is from June to November, with an average of 106 to 145mm of rainfall per month. The wet season begins in December and last through June with rainfall between 197 and 242 mm of rain per month.

61. **Topography, geology, soils and hydrology**. The Cook Islands has a total landmass of 237 km^2, and is in the South Pacific Ocean, over an area of 1.97 million km^2 between 9° and 23° south latitude and 156° and 167° west longitude.

62. **Rarotonga.** Rarotonga is a volcanic island of 67.1 km^2 in area (Figure 4.1), rising 4,500 meters above the ocean floor, (658m above water) with a base nearly 50 km in diameter. Its highest elevation is Te Manga, an ancient eroded volcanic cone at 658 m above sea level. The island is surrounded by a narrow intertidal shelf/lagoon which often extends more than a hundred metres to the reef crest where ocean swells break. The seafloor then drops rapidly to great depth. Agricultural terraces, flats and swamps surround the central mountain area.

Rarotonga's geology is principally basaltic rock. The island is a large volcano that emerged from the sea during the Pleistocene period about 2 million years ago. It is now covered in dense forests and some areas have been cleared for agriculture, mostly along the more gently sloping eastern and south-eastern coastal areas.

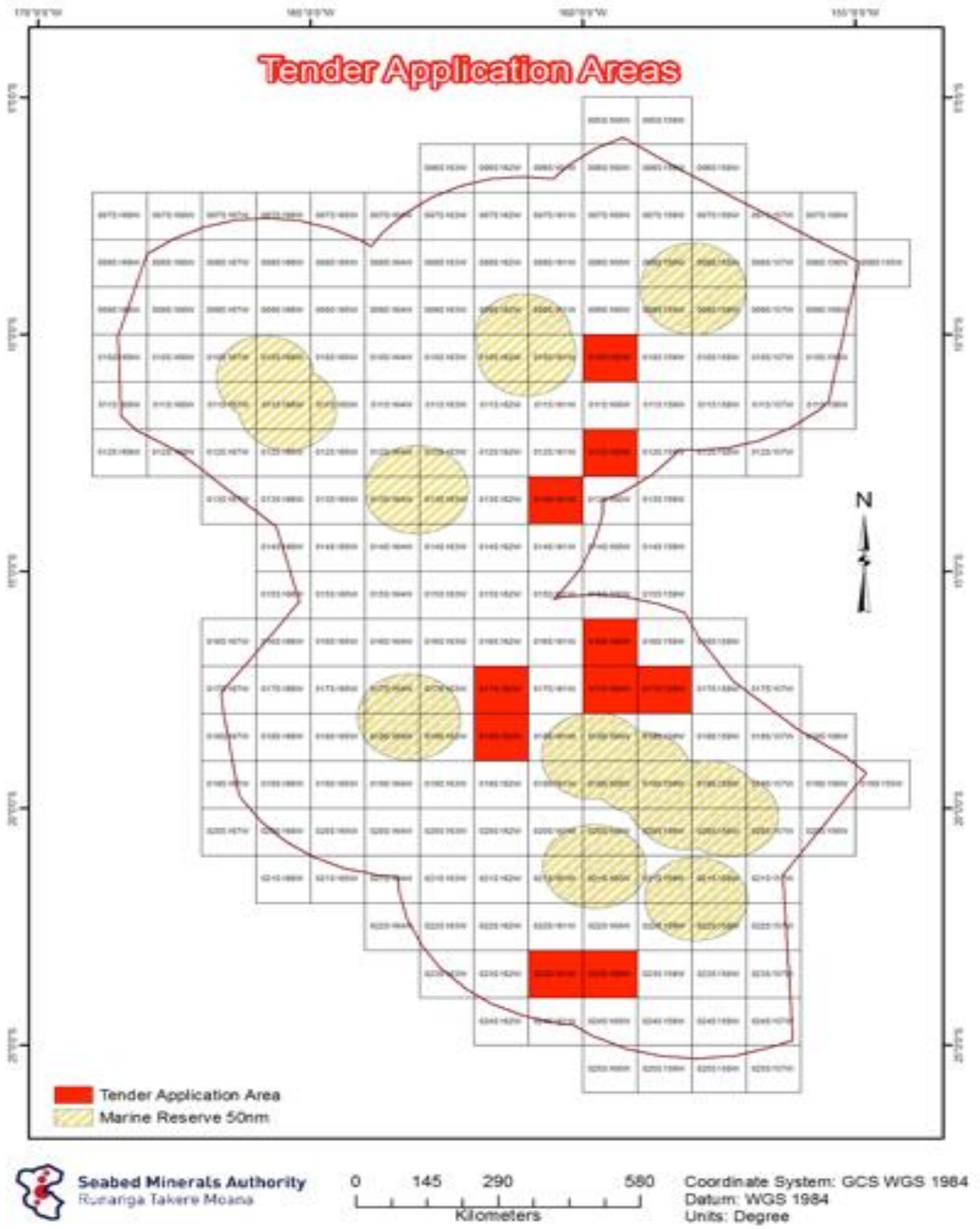
Figure 4.1: Topography of Rarotonga

63. Aitutaki. Aitutaki is a coral atoll with a maximum elevation of approximately 123 metres. The land area of the atoll is 18.3 km2 (of which the landmass, extending directly south from its northern-most tip, makes up 93% of the land area. There are at least another 15 small islets that ring much of the >60 km2 lagoon (**Error! Reference source not found.**). It has a barrier reef surrounding much if the island, and the western coastline has the harbour for the capital Arutanga, other useable channels to land and a good deal of the tourist development. Aitutaki has fertile volcanic soil in the northern part of the main land area were vegetable and tropical fruit are grown, mostly for local consumption, with the exception of bananas which it supplies to Rarotonga.

Figure 4.2: Topography, Roads and Land Area of Aitutaki

64. The government of the Cook Islands is considering leasing areas of the seafloor to explore and potentially allow commercial deep-sea mining targeting deep sea manganese nodules found on the sea floor. To facilitate this possible activity, the Cook Island EEZ has been divided into specific zones, some allowing allow mining while others will be mining-free (**Error! Reference source not found.**). This zoning map will need to be carefully evaluated by all parties involved to make certain that mining and submarine cable deployment locations do not conflict. Current mining zones are to the north of Aitutaki and south of Rarotonga this allowing an undisturbed cable corridor from west to east.

Figure 4.3: Proposed Seabed Mineral Activity, Cook Islands



65. **Seismology and earthquakes**. Earthquakes impact fibre optic cables when there are significant geological plate movements that can stretch, twist or even snap the cable. Rarotonga and Aitutaki both experiences seismic activity and as such cable designers will account for this. The Cook Islands are also located in a volcanically active area with submerged volcanoes erupting periodically.

66. While an earthquake or volcanic eruption could seriously damage the submarine cable, this would not result in negative effect on the physical, ecological or social environment, since cable is made of essentially inert materials and is deployed on the seafloor or in a trench near

shore. Of course, a large eruption or earthquake could have devastating effects on the environment and people.

67. **Tides**. The basic tidal parameters for Rarotonga and Aitutaki include a twice daily maximum tidal variation of 1.2 meters (meso-tidal). Small seasonal and daily tidal fluctuations have been related to sea conditions associated with weather patterns existing at the time data were recording. Inclement weather systems e.g. cyclones, if they coincide with high water periods do have a marked impact on the tidal height and can cause increased coastal inundation and erosion.

B. Ecological Environment

68. **Overview of Rarotonga.** Volcanic Rarotonga has the only cloud forest in the Cook Islands, as well as upland forests along mountain slopes, fern meadows created after primary forest removal, partially drained wetlands and remnants of coastal and strand forests. The cloud and upland forests provide critical habitat for many native species including 24 endemic species. Native marine habitats are limited to fringing coral reef, shallow lagoon systems never exceeding a depth of 4m. There is one shrinking saltwater marsh located in Avana, Ngatangiia. In addition to providing spawning and nursing grounds from many fish species, the marshland also provides for two species of native fiddler crab, the Koiti and Raukura (*Uca crassipes* and *U. tetragonon*).[9] As of 2011 Rarotonga had ten environmental protection/conservation areas, of which six are protected via Ra'ui, three are national reserves and one is a water catchment reserve.

69. **Overview of Aitutaki.** Aitutaki is halfway between being a volcanic island and an atoll and, as shown has a triangular ring of islets encircling a large lagoon. It has a land area of 18 km^2 of land and a well-established coastal coconut and broadleaf tropical forest cover. There are wetlands, providing habitat for freshwater eels and taro cultivation. The surrounding islets are the nesting grounds for many seabirds including the nationally endangered red-tailed tropicbird (*Phaethon rubricauda*). Saltwater marshes, bordering the coral reef, and the expansive lagoon are fringed by the coastal hardwood shrub ngangie (*Pemphis acidulus*) growth. These marshes are key nursery and spawning grounds for many lagoon fish. Aitutaki has a marine hatchery that is successfully breeding the giant clam (*Tridacna maxima*) for restocking around Aitutaki and other Cook Island locations.

70. **Marine ecosystems.** The deep-sea bathymetry associated with the EEZ of the Cook Islands is complex and includes deep ocean ridge, a trench, seamounts, thermal vents, extinct and active underwater volcanoes and remote submerged reefs.

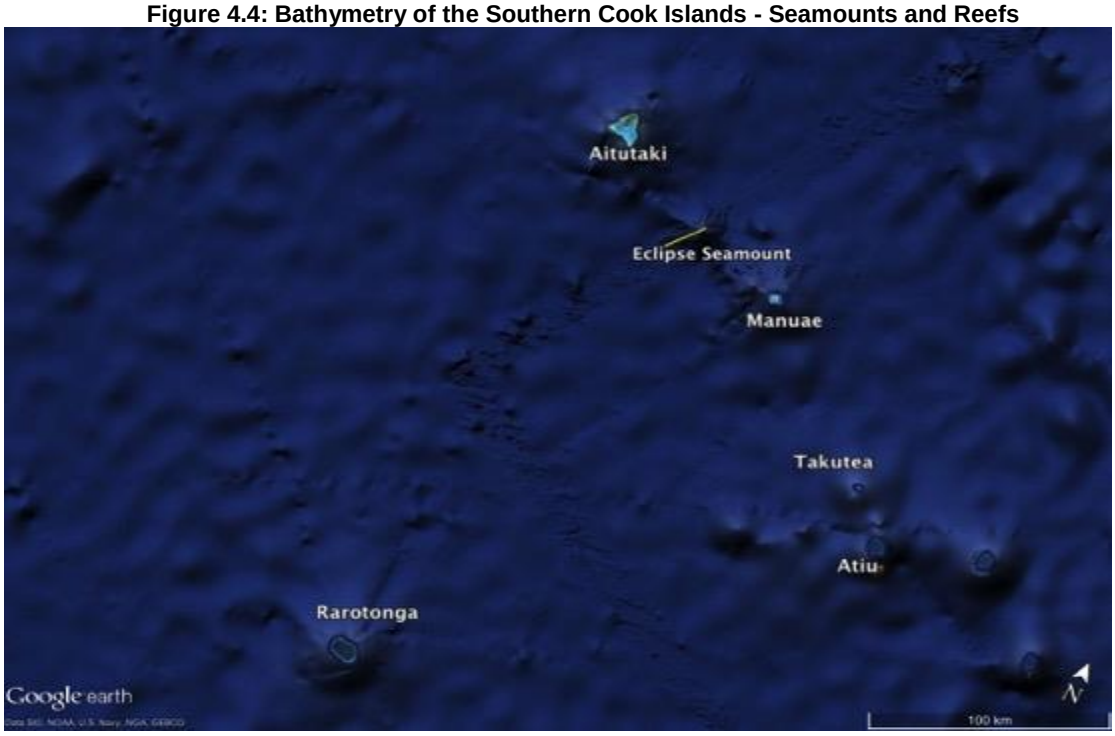
71. The Cook Islands lies to the east of the Tongan trench, which averages over 5000 m deep, while the remainder of the deep-sea floor surrounding the Cook Islands includes an undulating benthic substrate that averages a depth of 3000 m below the surface. The Cook Islands are the result of volcanic activity and coral growth with Rarotonga and Aitutaki emergent peaks of extinct volcanoes.

72. The southern group of islands including the Eclipse Seamount between Aitutaki and Manuae and except Rarotonga and Mangaia, form a linear volcanic chain with a west-northwest trend. This chain, a continuation of the Austral island chain is a result of a significant fracture in

[9] Passfield, K. 2011. Fourth National Report to the Convention in Biodiversity. Cook Island National Env. Service.

the earth's crust. Rarotonga and Mangaia are on the crest of a separate arch surrounding the Mauke - Aitutaki chain.

Figure 4.4: Bathymetry of the Southern Cook Islands - Seamounts and Reefs



73. Two distinct habitats are associated with the deep benthic waters of the Cook Islands; however, their biodiversity is not well known. These are hydrothermal vents and seamounts, both known to host endemic species, with the latter acting as feeding and spawning areas for the large pelagic fish. In general, little is known about deep-water features, however it has been shown that these are unique and important habitats, including some of the richest biological "hotspots" in the ocean.

74. **Hydrothermal Vents.** There are no known studies detailing hydrothermal vents associated with the Cook Islands in general and in the corridor associated with the proposed cable alignment from Samoa to French Polynesia specifically. Hydrothermal vents are present when water, heated through contact with hot magma, issues from cracks in the earth's crust, at depths of 500m or more. Typically, such seawater exceeds 300° C and is prevented from boiling by the immense overlying hydrostatic pressure. The water is also extremely acidic and corrosive and can leach out minerals from the surrounding rock. Despite these extreme conditions the vents support a unique invertebrate ecosystem, including bathymodiolin mussels, "hairy" gastropod, vesicomyid clams, and shrimps (Llodra & Billet 2006).

75. The bathymetric mapping to identify a cable alignment should be able to pinpoint any vent areas, allowing the cable deployment team to avoid damaging them. However, this mapping has yet to be undertaken for this project.

76. **Seamounts.** Seamounts are old submerged volcanic peaks eroded over time and support unique ecosystems that have high biodiversity (endemism is high). The main cause of this increased diversity is up-welling currents and oceanographic phenomena that drive primary productivity and creates additional ecosystem niches that support more species associated with

sea floor vertical rises, such as sea mounts. They are important aggregation sites for pelagic and demersal fish as well as invertebrates, and have been reported to act as important navigational “waypoints” for oceanic migratory species (Rodgers, 2012). On average, 15% of benthic species found associated with seamounts in the Pacific are endemic, either to that specific seamount or to a cluster of seamounts (Alder & Wood, 2004).

77. The location of seamounts within the EEZ of the Cooks Islands are documented, however there are few studies and resulting data available on the makeup of this benthic ecosystems and the organisms associated with them. The largest seamount “Eclipse” is located roughly 50 km to the southeast of the Aitutaki (**Error! Reference source not found.**) while there are several smaller deeper seamounts located south of Rarotonga and utilized by the local fishers. Benthic organisms associated with the deep water of Cook Islands have no current national economic importance and are not harvested commercially.

78. **Inshore marine environments.** The Cook Islands is located in the central south Pacific Ocean, and has a coastline for all island of 120 km (SPC, 2013). All major types of coral reefs systems are found on Rarotonga and Aitutaki including barrier reefs, fringing reefs, shallow water lagoons, barrier islands and submerged reefs. Rarotonga is a volcanic high island surrounded by shallow water reef flat (30-200 m in width), no true lagoon, however a sub tidal reef flat system is sometimes referred to as a lagoon and barrier reef system. Aitutaki is a volcanic island that has eroded over time and is classified as a “near atoll”. It has a land area of 18 km^2 of which 16.8 km^2 is associated with the main island, the rest is associated with a number of small coral islands located on the intertidal reef flat adjacent to the barrier reef. The island consists of a shallow subtidal lagoon (maximum depth 15 m) and is surrounded by an intertidal reef flat and an outer barrier reef. The outer barrier reef of both islands is interrupted at intervals by small shallow water channels which are the only access to the islands.

79. **Threatened and protected marine species**. The Cook Islands has a healthy marine biota, including 178 species of coral, 563 marine finfish species of which 12 are small deep water endemics, six species of freshwater finfish and 70 species of bivalves and gastropods (Cook Island Government, 2011) and a diverse invertebrate and other species such as marine turtles and cetaceans. Detail descriptions of the coral reef habitats associated with the proposed cable alignment PIAs are described in Annex 1of this IEE.

80. The International Union for Conservation of Nature & Natural Resources (IUCN) undertakes a periodic global assessment (Red List) to classify the conservation status of more than 76,000 species. Classifications include critically endangered, endangered, near threatened, vulnerable, of least concern or data deficient. More than 880 coral species are on IUCN’s Red List, and of this more than half are vulnerable or threatened. There are many others that have not been studies enough to make an evaluation.

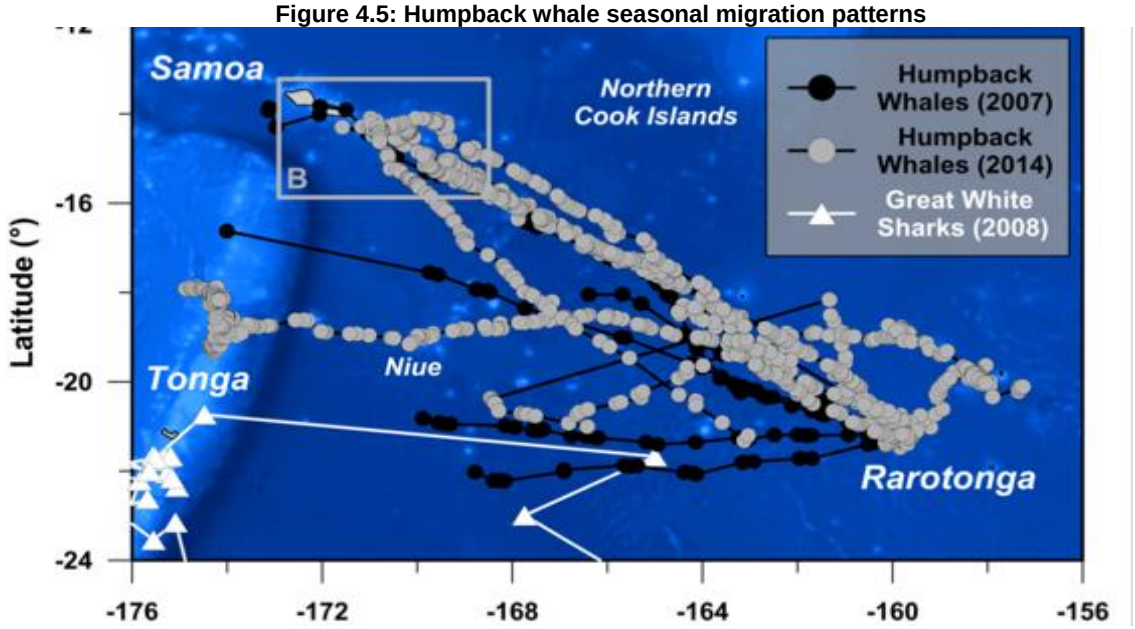
81. The corals around Rarotonga are suffering due to overfishing of the grazer fish community which controls algal growth, nutrient enrichment from untreated sewage, and increasing water temperatures. Recent catastrophic cyclones have severely damaged corals as well. Aitutaki’s corals, impacted by the same effects, are a much healthier than those on Rarotonga due principally to less pollution stress. The US National Oceanographic and Atmospheric Administration (NOAA) South Pacific Region has classified three corals as endangered and another 22 as vulnerable (from the Convention on International Trade of Endangered Species (CITES) Appendix II).

82. These include a number of the corals found around Rarotonga and Aitutaki. Of the three-endangered species listed by NOAA, only *Cantherallus noumeae* (mushroom coral) is found in the PIAs, more specifically on Aitutaki. That being said, the project will have next to no negative impact on corals as the preferred alignment will bring the cables into natural harbours and through passages that have no, or almost no coral cover[10]. The majority of the coral species in the two PIAs are along the outer reef and intertidal zone, which will be carefully navigated and divers will be floating the cable to shore, then sinking it to ensuring absolute minimum coral damage.

83. The other red listed fauna recorded for the oceanic environment of the Cook Islands includes the 20 cetaceans (Table 4.1:), a number of sharks of which the oceanic white tip *Carcharhinus longimanus*, and the silky shark *C. falciformis* are considered endangered and the shortfin mako (Isurus oxyrinchus) as vulnerable. In addition, the whale shark *(Rhincodon typus)* and big eye tuna *(Thunnus obesus*) found in the pelagic (open ocean) zone are also listed as vulnerable.

84. **Cetaceans.** The EEZ of Cook Islands has resident as well as transient or migratory populations of cetaceans (whales and dolphins) and since 2001 has been a dedicated whale sanctuary. Miller (2009) stated that there has been considerable effort within the southern waters of the Cook Islands to study and identify the nation's marine mammal diversity (Centre for Cetacean Research and Conservation based in Rarotonga). Through this work, information on the presence and population status of cetacean within the nation and seasonal migrations of all species is being documented (see Hauser et al., 2010 and Hauser et al., 2016 in prep). Recent surveys and tracking programs based in Avarua, Rarotonga have identified migration paths of the humpback whale (**Error! Reference source not found.**).

Figure 4.5: Humpback whale seasonal migration patterns



Source: Satellite tagging originating from Rarotonga tagged animals (Hauser et al., 2016 in prep)

[10] The marine assessment of the PIA associated with the two alignments showed no live coral present on the seafloor. Some live corals exist on the channel walls leading into the landing sites, but will not be disturbed by the project. The borrower will enforce these boundaries with the contractor.

85. Peak periods of humpback whale migration entering the EEZ waters of Cook Islands occur between the months of July through to November. Frequent travel routes between the Cook Islands and Samoa have been recorded.

86. Cetacean species are commonly seen in southern and northern Cook Islands waters and as a result of the bathymetry associated with the island are found very close to shore. This easy access has stimulated a commercial whale watching industry based primarily on the seasonal migration of the humpback whales. Miller (2009) on behalf of the Whale and Dolphin Conservation Society (WDCS) documented that there are 12 species confirmed in the area, with another eight species likely spending time in these waters (4.1).

Table 4.1: Cetaceans recorded as occurring and likely to occur in the Cook Islands

Species scientific name	Common Name	Status	IUCN Category
Balaenoptera bonaerensis.	Dwarf Minke-whale	Confirmed	DD
Balaenoptera musculus	Blue Whale	Confirmed	VU
Megaptera novaeangliae	Humpback whale	Confirmed	DD
Delphinus delphis	Common dolphin	Confirmed	LC
Globicephala macrorhynchus	Short-finned pilot whale	Confirmed	DD
Lagenodlphis hosei	Fraser's dolphin	Confirmed	LC
Orcinus orca	Orca	Confirmed	DD
Peponcephala electra	Melon-headed whale	Confirmed	DD
Stenella attenuata	Pantropical spotted dolphin	Confirmed	DD
Stenella longirostris	Spinner dolphin	Confirmed	DD
Physeter macrocephalus	Sperm whale	Confirmed	VU
Mesoplodon densirostris	Blainville's beaked whale	Likely	DD
Ziphius cavirostris	Cuvier's beaked whale	Confirmed	LC
Balaenoptera edeni	Bryde's whale	Likely	LC
Balaenoptera borealis	Sei Whale	Likely	LC
Grampus griseus	Risso's dolphin	Likely	LC
Lagenorhynchus australis	Peale's dolphin	Likely	
Pseudorca crassidens	False killer whale	Likely	DD
Stenella coeruleoalba	Striped dolphin	Likely	DD
Tursiops truncatus	Bottlenose dolphin	Likely	LC

DD=data deficient VU=vulnerable, LC=Least Concern

87. Of the species of cetaceans recorded from the EEZ of the Cook Islands, only the sperm whale is considered globally vulnerable (VU). For the remaining cetaceans, there is either not enough information to make scientific assessments--data deficient (DD)--or they have been assessed as being of least concern (LC). The Global status of PIA cetaceans under the Convention on Migratory Species lists threatened species are listed in Table 4.1:. A literature review of potential effects of sonar and entanglement on Cetaceans during oceanic cable deployment is detailed in Annex 3.

88. **Marine Turtles.** Three species of sea turtles are known to live within the waters of the Cook Islands and are on the IUCN red list. This includes the hawksbill (*Eretmochelys imbricata*) which is critically endangered, the green (*Chelonia mydas*) which is endangered and the

loggerhead (*Caretta caretta*), which is also endangered. All species of turtles are protected under Cook Islands law.

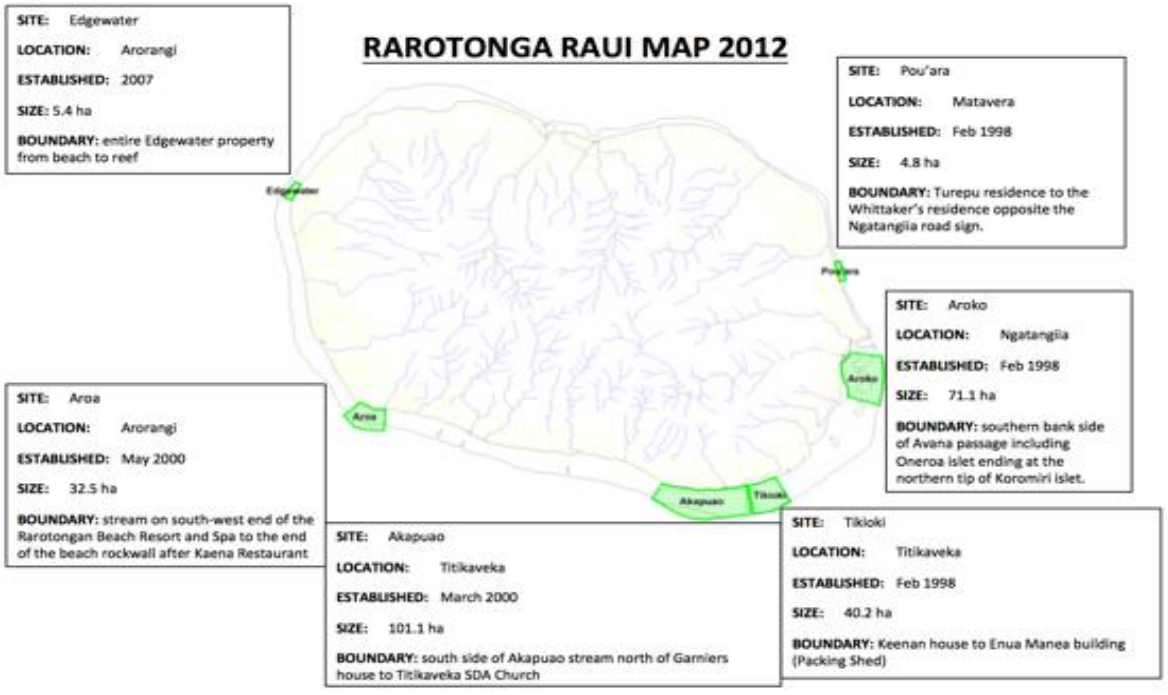
89. Populations of all three species are low with higher abundance reported in the northern atoll islands and all species have been reported feeding within the nation's 12 nm territorial waters. Anecdotal information (MMR-Aitutaki staff Mr. R Story) indicated that the green turtle nest in the northern atolls and infrequently on remote sand islands within the Aitutaki lagoon, far away from the cable alignment. No turtles were observed during the marine assessments.

90. **Seagrass**. A review of the literature indicates that there are no sea grasses recorded for the Cook Islands. There were no seagrass species recorded during the assessment of the inter-tidal cable alignments and landing sites for any cable alignment option.

91. **Marine protected areas**. The Cook Islands have designated its entire EEZ as Marine Park, named Marae Moana. This Cook Islands marine park regulates the use and management of the marine resources in this area. In addition, each island through community, government and public sector groups (NGOs) initiatives supported by national and individual island legislation and traditional ownership systems, has designated a number of marine protected/managed areas as Ra'ui, to assist in the long-term maintenance of coastal and marine resources. Rarotonga has six areas designated Ra'ui (Figure

92. Figure 4.5 all of which extend from the low water mark through the intertidal reef flat and extend outside the barrier reef including the upper and lower reef slope.

Figure 4.5: Location and Description of Six Ra'ui in Rarotonga



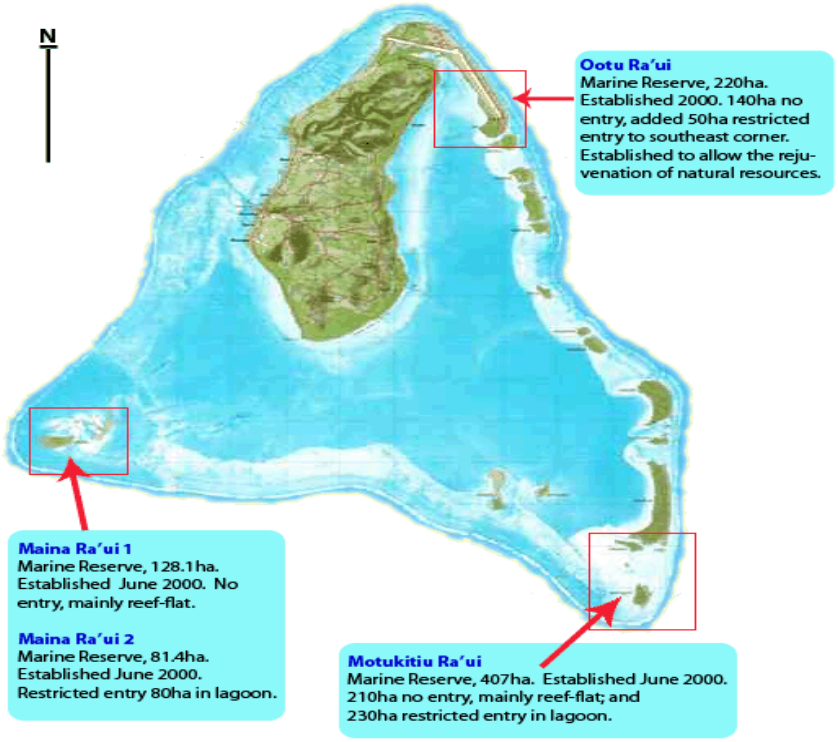
93. All have been developed to manage and preserve specific marine, intertidal reef flat and/or coastal environments including specific habitats and/or species. Two Ra'ui are associated directly with two long term tourist resort operations and are helping to prevent marine resource degradation. The government, communities and resort owners manage these according to Ra'ui tradition. None of the Ra'ui areas will be impacted by any of the assessed cable alignment options. The Aroa Ra'ui, established in 2000 is located 400m to the west of the cable alignment options directly adjacent to the Rarotongan Resort and covers a total area of 32.5 hectares.

94. The prevailing shoreline drift and currents entering the reef flat along this coastline may cause disturbed and suspended substrate material from the cable deployment excavation to drift away from the Ra'ui, thus not impacting it.

95. Aitutaki has four areas designated as Ra'ui (Figure 4.6:) extending from the foreshore to the lower reef slope. All have been developed to manage and preserve specific terrestrial, marine, and coastal environments including specific habitats and/or species. The objective of two of the Ra'ui are associated directly with two long term habitat and species conservation for tourism uses as well as for resource management purposes. None of the Ra'ui areas are located anywhere near the proposed cable alignment options and therefore there will be no impacts on these areas.

96. The government, through consultation and inputs from stakeholders, is promoting development and management of tuna and related species, guided by the National Tuna and Other Pelagic Fisheries Management and Development Plan (2000). The overall thrust of the plan is to take an ecosystem-based approach to fisheries management, involving the wider pelagic ocean ecosystem. The project will not affect this initiative.

Figure 4.6: Location and description of the four Aitutaki areas designated Ra'ui.



97. **Terrestrial ecosystems**. For Roratonga, the terrestrial habitat affected in the PIA is a strip of cleared land a meter wide and extending 20-30m to the road ROW, then within the road allowance to an existing cable station. For Aitutaki the terrestrial habitat impacted in the PIA is a few meters-wide cleared patches of shoreline with coconut palms and then along an old access laneway to an existing road ROW and along it to an existing cable landing station.

98. **Landing sites**. The project includes some land-based elements (i.e. cable trenches and a cable landing station at Rarotonga and Aitutaki), however none of this infrastructure will traverse or otherwise impact significant terrestrial habitats. The entire area affected has been fully urbanized.

99. A transect-based field assessment along each alignment was completed on Rarotonga and Aitutaki on August 30th 31st and September 2nd respectively. The area assessed included the inshore marine environments inside cable alignment corridors for the 3 and 4 proposed cable alignments on Rarotonga and Aitutaki respectively. Examinations of outer and inner reef slopes, barrier reefs, reef channels and passes, subtidal and tidal lagoons and intertidal reef areas as well as the landside deployment locations were also included in the surveys.

100. Biological and environmental were recorded at each of a number of survey sites, and with each site selected to represent different habitats associated with the proposed alignment. The assessment methodology and detailed findings are provided in Annex 1.

101. **Rarotonga.** Three possible landing sites were surveyed two using the existing small boat channel and one that would require a new cut through the reef, straight to shore fronting

the Rutaki School and then inside a road ROW to the cable landing station. Survey details are presented in Annex 1.

102. **Aitutaki.** Four possible landing sites were surveyed. Two alignments were to pass across the intertidal zone at the north end of the island to the shore fronting the old airport runway and a second by slightly different routes, but both being deployed for 7 km south along the airport road and through Arutanga up the hill and to the cable landing station beside the hospital. Alignment No. 3 was to pass directly through the main boat channel to the foot of the Arutanga wharf and then up the hill to the cable landing station, for total run on land if <1.5 km. The 4th option was proposed to be deployed through an old boat channel to the south of the main wharf and straight up the hill across private land to the roadside manhole and then to the cable landing station. Survey details are presented in Annex 1.

103. **Mangroves.** No species of mangroves have been reported in the Cook Islands and none were located during the field surveys.

104. The analysis of the seven alternatives, leading to the recommendation of one landing site for each island is presented in Chapter V of this IEE.

C. Socio-Economic Environment

105. **Demographics**. The total population of those who have residence status in the Cook Islands has remained steady between 19,000 and 20,000; increasing from 17,800 in 2012 to 20,000 in 2014 and estimated to be 19,500 in 2016. According to the 2011 Census, the average household size was 4 people. The growth rate over 2015 – 2-16 was -1.1, the population density is 75 people per km^2 and the median age is 36 years. Other information is provided in Table 4.2.

Table 2.2: Cook Islands Demographic Information

Feature	Cook Islands	Rarotonga	Aitutaki
Land area (Km^2)	237	67.1	18.3
Population	17,794	13,095	2,038
Average household size	4	4	4
No. of households	4,499	3,255	502

Source: http://www.mfem.gov.ck/statistics/social-statistics/vital-stats-pop-est

106. The Cook Island's Millennium Development Goal report (2015) recorded that the country is on track to achieving all seven Millennium Development Goals, especially MDG 1 on eradicating extreme poverty and hunger. [11]

107. The Cook Islands, together with Niue and Samoa, have already achieved MDGs 4 and 5 on child and maternal health. However, significant challenges remain since the distribution of development benefits is uneven, especially between urban and rural areas and among the main and outer islands. While extreme poverty and hunger largely do not exist in the Cooks, many households still struggle to meet their basic needs, and a "poverty of opportunity" affects many communities in rural areas and the outer islands.

108. With the adoption by the UN of the Sustainable Development Goals (SDGs) in 2015 and coming into force on 1 January 2017 – there are 17 new and more specific development goals to be achieved in the next 15 years. They apply to all countries and encourage them to

[11] http://www.ws.undp.org/content/samoa/en/home/post-2015/mdgoverview.html

mobilize efforts to end all forms of poverty, fight social inequalities and tackle climate change, while ensuring that no one is left behind.[12] These SDGs are still to be considered by the Cook Islands' social sector agencies.

109. **Transportation and infrastructure**. The Cook Islands' international airport is in Nikao on Rarotonga Island. Seven of the other islands have a loose-surface airstrip, managed by local communities. Air Rarotonga services the other islands with prop planes.

110. A number of port upgrading works have been completed and are now under construction, including the Avatui Port reconstruction and the Avana Jetty construction in the Avana area of Rarotonga. The National Port Authority's Orango project for Aitutaki will include the upgrading of the harbour and boat mooring facility at Arutanga, allowing for the island to take advantage of the cruise yacht business (>1000 yachts sail between French Polynesia, Tonga, Samoa and Fiji annually). More improvements are planned for the other islands, where required.

111. Rarotonga has a good paved highway circling the island providing access to all beaches and lagoons. An inner ring-road covers around 70%, providing a secondary transport route for most of the island. In an effort to further improve the tourist experience, pavement strengthening and improvement are ongoing on most of the island roads.

112. Aitutaki has a main paved road from the airport to Arutanga and across the main landmass back to the airport road. There is also a stretch to tourist developments beside the airport. The road along which one of the cable deployment options proposes to lay the cable is scheduled for resurfacing in the 2016-2017 fiscal year.

113. Rarotonga has undertaken a major potable water improvement work and has replaced much of the old conveyance network thus making the supply safe for human consumption. An improvement to the system for monitoring the groundwater quantity and quality on Rarotonga is also underway.

114. A major works for Aitutaki is the construction of a sewage treatment plant and sanitary sewer network for Arutanga as well as mandatory connections for the coastal resorts that do not have their own treatment facilities (septic tanks are not acceptable substitutes).

115. Rarotonga and Aitutaki have a 24-hr. diesel-powered electricity supply, and the private sector has been moving ahead aggressively with the installation of local solar power facilities.

116. **Tourism**. Tourism is the main economic driver for the Cook Islands, accounting for approximately 70% of GDP. The basic infrastructure services of power and telecom are provided by the national government and Rarotonga and Aitutaki local operators. Municipal water is provided to some facilities on Rarotonga and a few on Aitutaki. Rarotonga has a sewage treatment plant, while Aitutaki operates strictly with septic tank systems. Both islands have made do with whatever has been provided, with many resorts installing their own sewer and water systems. To date, telecommunication has been via satellite connection.

117. Tourism, the economic driver of Rarotonga and Aituatki, depends heavily in good communication, municipal services and basic public facilities. Having a better, more reliable communications system is one of a number of important enablers for economic growth.

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[12] http://www.un.org/sustainabledevelopment/development-agenda/

118. **Economy**. The Cook Islands economy is based largely on international tourism, focused on Rarotonga and Aitutaki which accounts for over 85 % of the country's population. The other 13 islands exist as subsistence agriculture communities with support from the national government and a small tourism and fishing industry. The economy is also dominated by external aid and by remittances from Cook Islanders residing and working abroad, mostly New Zealand.

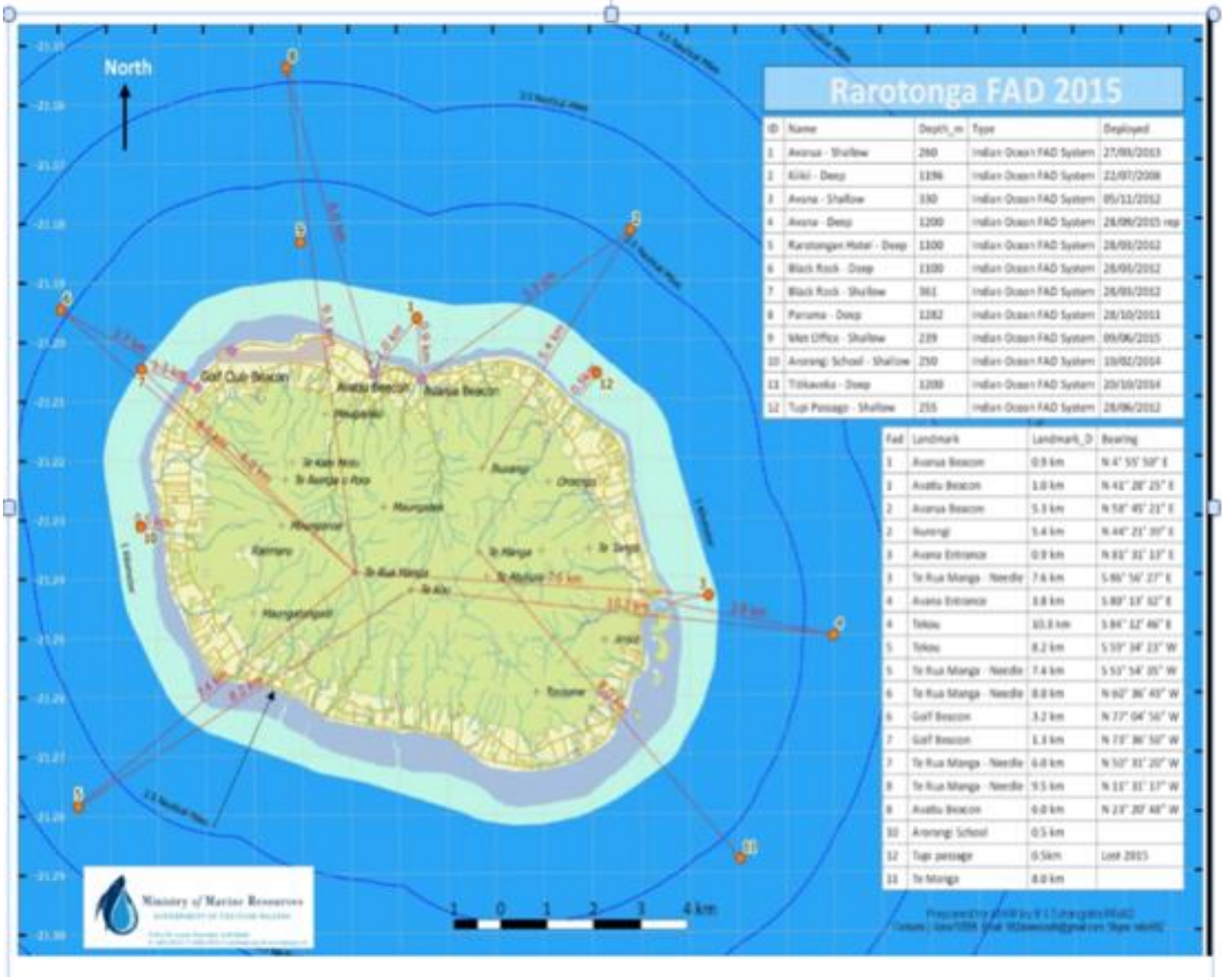
119. **Commercial Fisheries.** The Cook Islands' EEZ waters support commercial purse seine and long line fishing activities that are both locally and foreign owned and operated, targeting mostly tuna. The commercial fishing fleet operates between near shore waters and outer boundary of the 200nm EEZ. The purse seine fishing fleet deploys large circulate net that are closed at the bottom, around schools of pelagic fish. The long line fleet runs lines, sometimes 70 km long, at a certain depth with baited hooks, attached to the surface by fishing floats which are tracked by GPS. In terms of fisheries management these are both highly destructive methods as by-catch is very high and these species cannot sustain such losses.

120. The commercially important and targeted tuna species are highly migratory, move over large distances, and could be within a cable corridor or hundreds of kilometres away. Despite this uncertainty about location there is no activity associated with cable survey or deployment that would impact the tuna and other fast moving pelagic species.

121. **Artisanal fisheries in inshore waters.** There are no large-scale commercial inshore fishing operations in the Cook Islands. The majority of the inshore fisheries target tuna, wahoo and dolphin fish or reef fin fish and invertebrates such as crayfish and molluscs. The pelagic fin fish are captured in open water and at fish aggregation devices (FAD), trolling or drop stone fishing from small local motorised vessels or traditional canoes. The locations of FADs in Rarotonga are shown in Figure 4.7. Inshore reef fin fish are captured using hook and line, spearing and net fishing techniques. Small scale commercial pelagic (e.g. tuna, wahoo, marline) and game fishing (e.g. bone fish) charters cater to the islands' tourist fishers and have become a very positive income generating opportunity for the nation.

122. **Coastal fisheries**. FADs are utilised to support the local commercial fishing fleet for both daily subsistence and small scale commercial activities. FADs act as artificial reefs providing shelter for smaller organisms, which in turn provide food for large organism higher up in the food chain, attracting small finfish that are targeted by large pelagic fish. Thus, congregating pelagic fish around the FADs potentially increase catch rates and decrease fishing effort and expenses for local fishers. The main methods deployed around FADs are trolling, mid water "drop stoning" and hook and line fishing.

Figure 4.7: Location of FADs associated with Rarotonga



123. Coastal FAD in the Cook Islands are positioned in waters between depths of 250 – 1,200 meters, and are deployed by the Ministry of Marine Resources (MMR) in conjunction with local Fisher's Associations and community fishers with support periodically from regional agencies. Due to the bathymetry associated with the two project islands, deep water FADs are close to shore.

124. In 2015, there were 12 FADs deployed and operating within the waters surrounding Rarotonga, one of which is located 3.5 km southwest ($21^0$16.705S $159^0$50.793W) of the cable alignment reef entry location in 1,100 metres of water. In 2015, Aitutaki had four FADs deployed and operating, with Atua Tane located 1.5 km southwest ($18^0$51.508S $159^0$50.071W) of the cable alignment entry location in 1,100 metres of water.

Figure 4.8: Location of deep water FAD (southwest of prosed cable alignment Option 4)

125. There will be no direct impacts to the FADs at either island location from the deployment and operation of the telecommunication cable so long as installation guidelines defined in this ESMP are adhered to. To avoid damage to the FAD notification of their location will be given to the cable-laying contractor and to all vessels in the cable vessel will be required. Similarly, once the cable is laid notification of the cable alignment to MMR and NES is required to ensure future FAD deployment is not on top of the cable alignment.

126. **Cultural aspects**. Cook Islanders identify first with their home islands and secondarily with the country. There is a strong sense of connection with New Zealand since Cook Islanders have New Zealand citizenship and many migrate there or have relatives there.[13]

127. The culture of the Cook Islands reflects the traditions of its fifteen islands as a Polynesian island country, spread over 1,900,000 square kilometres in the South Pacific Ocean. It is in free association with New Zealand. Its traditions are based on the influences of those who settled the islands over several centuries. In the early 19th century missionaries developed a written language, bringing schools and their religion to the Cook Islands. Cook Islands Māori, also known as Māori Kaki 'Āirani or Rarotongan, is the country's official language.

[13] http://www.everyculture.com/Bo-Co/Cook-Islands.html

128. Social hierarchy and tapu (sacred matters) are controlled by the Ariki (high chiefs), with between three and six per island. Each Ariki is the ruler of an ivi or ngati (tribe). Lesser noble ranks in the social hierarchy are the mataiapo and rangatira (minor chiefs). The chief's power is established by his/her mana (power), which is inherited, and by personal achievements. This system, ancient ceremonies and traditions continue to be practised.

129. The House of Ariki (Are Ariki), composed of the high chiefs, is a parliamentary body in the Cook Islands and was established in 1967, with few legal powers, but with great socio-cultural influence.

130. Women's organisations, such as the Cook Islands National Council of Women and the Cook Islands Business and Professional Women's Association, are active in national politics. The largest women's organisations, The Cook Islands Christian Church Ekalesia Vainetini, Dorcas, The National Catholic Women's League, and Women's Harvesters, are affiliated with local churches and remain active.[14]

131. **Poverty.** The Millennium Development Goal report (2015) recorded that the country is on track in achieving all seven Millennium Development Goal indicators especially MDG 1 on eradicating extreme poverty and hunger. The Cook Islands, together with Niue and Samoa, have already achieved MDGs 4 and 5 on child and maternal health. However, significant challenges remain in sustaining and improving achievements.

132. While extreme poverty and hunger largely do not exist in Cook Islands, some households still struggle to meet their basic needs, and a “poverty of opportunity” affects many communities in the outer islands. Thus, connection to the fibre optic cable by Rarotonga and Aitutaki is expected to improve access to reliable and more affordable communication services to facilitate access to e-commerce based income opportunities and provide far better services such as –distance education and health.

133. **Gender.** Cook Islands, together with other Pacific member countries[15], are on track to achieve gender parity in education (MDG Target 3.a). However, only the Cook Islands, Niue and Palau are on track to achieve the broader goal of promoting gender equality and empowering women[16]. That being said the project has no expected negative gender impact. From the consultation sessions, OPM/MFEM was advised that the project is expected to benefit domestic violence victims who will now be able to access improved private communications to reach out to other women and get help without fear of being found out and subject to more violence.

134. **Physical and cultural resources**. The seven locations being proposed for possible cable landings have no archaeologically or historically significant features within at least two km of each site. Also, there are no such features within the road ROW along which the cable would be buried.

135. **Land ownership at cable landing sites.** The Rarotonga site (Option 2) is on a native freehold land (Te Papa Section 91) via a perpetual lease by the government established in 1969 (public purposes). It is part of a lease for the Apii Rutaki (school) beginning from the mean high

[14] Crocombe, 1990, pp. 27-28

[15] Except for Papua New Guinea, Solomon Islands and Tonga all other Pacific Island Forum countries are on track to achieving this target (2013 Pacific Regional MDG Report).

[16] Pacific Islands Forum Secretariat, August 2013, 2013 Pacific Regional MDG Tracking Report

water mark[17] towards the school compound on the northeast side of the road. The lease is renewable every 20 years with the current lease in effect until 2021.

136. The Aitutaki site (Option 4) is on a private land beginning from the mean high water mark in Reureu Village. The Cook Island Investment Coropration (CIIC) estimated that that there are over 100 landowners for the Aitutaki site, mostly living overseas. The landowner identification process has been started by the government through CIIC.

137. **Cable landing stations.** On Rarotonga, the proposed site is the existing station on private land under lease by the government since 1968 for 60 years, i.e., until 2028 (*Section 83.C Onemaru and Te Mati*). The cable landing station is a modern fully equipped, climate controlled building. The project does not require acquisition of customary or private land nor entail displacement of people, food gardens and physical structures. In Aitutaki, the proposed site the existing station next to the Aitutaki Hospital, and a government leased land since 23 January 1968 for 60 years (Takapora Section 258 Arutanga). The majority of the section is used for telecommunications.

138. **Right-of-way.** In Cook Islands, roads are not public land but land legally proclaimed as roads and deemed to be in the possession of the Crown for the purposes of forming, repairing and maintaining a road. In general, the Crown/Government is not permitted to lay cables (telecom, power) and pipes (water, sewage) for public purposes under sealed roads without the consent of the landowners. But historically there have not been many problems with this because land of a sealed road cannot be used for other purposes. Legislation might change in 2017 (with existing draft) allowing the Crown/ Government to lay cables for services under the road without the consent of landowners.

139. On Rarotonga, from the Apii Rutaki cable landing site the cable will be buried within the existing road ROW leading to the Aroa cable landing station (approximately 1 km). Similarly, on Aitutaki, the cable will be buried from the cable-landing site in the Reureu area (exact location to be confirmed depending on the negotiation with landowners) along the main road to the cable landing station within the hospital compound.

140. **Land affected at landing sites.** On Rarotonga the project will utilize government leased lands (cable landing site and cable landing station) and will use existing public land along the road to lay the cable from landing site to cable station, thus will not require acquisition of private land, the displacement of people, food gardens and physical structures. On Aitutaki, however, the project will have to obtain an easement of an approximately 1 m x 45 m) to cleared land under which the cable will be buried, and then along a main road ROW to the cable landing station (approximately 700 meters).

D. Additional Data Needs

141. The cable alignment in the EEZ waters or the Cook Islands will not be known precisely until after the hydrographic survey is completed and a corridor map produced. Once this is done by the contract any sensitive features will be mapped and presented to the government for

[17] "Mean high water mark" means the line of medium high tide between the spring and neap tides as per the Cook Islands Environment Act 1994-95);

discussion and decision on the best alignment (recognizing that the cable's footprint will be a few cm wide and for a virtually inert small submarine cable.

142. Secondly, the precise methods to use to bring the cable ashore need to be finalized by the contractor and then the exact location of the cable as it passes through the intertidal zone and up to the road needs to be described and any previously unknown sensitive features identified and mitigation measured defined by borrower and the contractor.

143. Thirdly, the operations of the cable deployment vessel of the contractor need to be monitored and to that end the contractor must provide details on the housekeeping operations on their vessels, specifically solid and liquid wastes, and define specific measures to be taken.

V. ANALYSIS OF ALTERNATIVES

144. **Alternative technologies**. Both fibre optic cable and satellite connections were considered during the early feasibility studies[18], but the latter, in use throughout the islands, had serious limitations in available bandwidth and was often restricted by the satellite service provider, solar flare activity and rain, leaving the entire country with limited and unreliable connectivity. The fibre optic cable would allow for much broader bandwidth and a level of service that is controlled by the Cook Islands not an external entity. It was therefore agreed that a new fibre optic cable connection to the country would be pursued.

145. **Alternative alignments**. Based on collaborative efforts of the Cook Islands, Niue, French Polynesia and Samoa the deep-sea fibre optic cable was planned to originate in Samoa, then follow a south-westerly track passing Niue and then between Rarotonga and Aitutaki of the Cook Islands, then swinging north to French Polynesia. It was agreed that the cable would have spurs and branching units to connect Niue, Rarotonga, and Aitutaki.

146. **Landing stations – Rarotonga**. On Rarotonga three landing sites were considered by the government (Table 5.1): (1) Rutaki main Channel; (2) Rutaki Passage, then parallel to coast to Rutaki School beach area; and (3) Straight line from reef to just east of the Rutaki School.

Table 3.1: Comparison of alternative cable landing sites - Rarotonga Island

Factors	**Location options**		
	Option 1	**Option 2**	**Option 3**
Marine/Coastal:			
a. landing engineering	Simple	Simple	Special methods
b. proven reliability	Excellent	Excellent	Not an issue
c. marine traffic	Vessel traffic	Traffic at entrance	None
d. coral	Marginal	Marginal	Good live coral cover
e. existing access	Yes	Yes - Rutaki, but need cut channel to landing	No, need breech reef and cut channel
Social:			
a. Land acquisition b. Displacement	Private land needed None	None None	None None
Environmental:			

[18]ADB. 2016. Concept Paper Project Number: 50110-001 Proposed Loan COO: Improving Internet Connectivity for the South Pacific.

Factors	**Location options**		
a. sensitive sites b. live coral affected c. cetaceans migration	None Marginal Need great care offshore	None Marginal Need great care offshore	Yes-coral reef Yes Need great care offshore
Terrestrial:			
a. trenching distance	3-4 km	5 km	3 km
b. access disruption	Significant but temp.	Significant but temp.	Significant, temporary but more than 1 and 2
Cost:	Not known	Higher than Opt 1	Less than Option 2
Conclusion - ranking	**2nd**	**1st**	**3rd**

147. The examination of most environmental, social and cost criteria clearly favoured Option 3; the straight line cable over a break in the reef straight to a manhole on government land and then along a road beside the school to the BlueSky cable landing station. However, once a thorough reef and coral survey was completed for Option 3 and a very health and diverse coral community was identified in the areas were the cable would breach the reef crest and for some distance to shore, Option 3 was not considered the best. Option 3 has a reef platform along its entirety and healthy coral communities throughout the back reef and outer intertidal area. However, the biggest issue is the ability to get the cable through the reef, since the “rough” heavy wave affect the reef area and the contractors would need a window of 5 days’ calm weather (which for 2016 was for less than one week in total).

148. These conditions would require an intensive and large scale construction activity on the reef. The ESIA team predicted that the work would result in too much damage to the live coral, especially given the low live hard coral coverage for most of the reefs around Rarotonga. Therefore, the OPM/MFEM selected option No. 2 as the preferred alignment. Option No. 2 is about 300m longer than Options 1 and 3, but would still avoid crossing private land (as with Option No. 1), but would have to enter the intertidal zone through the Rutaki Channel (small boat passage).

149. Recommended option No. 2 located on the south coast of the island approximately 12.5 km by road to the west of Avarua, the capital of the Cook Islands and it can be easily accessed by the islands main ring road. The marine ecologist surveyed sixteen sites (or quadrats) along this alignment corridor. Details on the methods and the survey findings for the three options are provided in Annex 1.

150. This reef section of Rarotonga is characterised by year around southern oceanic swells resulting in a high-energy wave-dominated barrier reef with considerable spur and groove formations, breached by a number of small natural open water reef channels. The largest of these is called Rutaki Channel.

151. The inshore marine area is dominated by a narrow (600 m) shallow water intertidal reef flat which is partially exposed during low tide. The flat consists of beach rock and a small sand beach close to shore, and a sub tidal reef flat that extend out to the barrier reef which terminates seaward to a wave dominated reef crest, reef edge and slope which then descends rather steeply to the outer reef slope and beyond.

152. The sub tidal reef flat is roughly horizontal, with an average depth of between 1-3 and is composed of reef derived sand (calcareous origins) interspersed with significant patches and

coverage of hard coral (predominantly massive forms) and macroalgae, with some areas recording live percent coverage above 95%. Sea grass and mangroves are not present at this site location.

153. The site has a natural cut (ava) in the outer reef that opens directly to the open ocean. This ava is used by the local fishers to gain access to the open sea, however usage is totally dependent on weather conditions with frequent access impossible due to oceanic swell and wave action.

154. The site has an ephemeral stream that during seasonal rainfall peak periods discharges considerable freshwater into the area and resulting sediment/rock plume. In addition, during periods of high rainfall natural springs discharge freshwater directly into the shallow waters along the coastline of this site.

155. The recommended option would involve bringing the cable through the Rutaki passage and onwards through the sand/rubble following the shoreline north-westward of the channel to enter the land adjacent to the Rutaki school. The cable would then be trenched at an approximate depth of 1 meter, possibly inside a protective conduit and within the road ROW to the cable landing station.

156. The intertidal shallow water benthos originating from the entry point of the channel through to the shoreline includes a base layer of hard, albeit dead, reef platform which has small to medium size coral rubble and boulders dispersed over the substrate interspersed with smaller coral rubble and reef derived sand.

157. The channel and associated open water ecosystem experiences considerable oceanic swells, waves and tidal water movement (strong currents) and as such sand and rubble are constantly moved throughout this zone. The outer and inner reef slopes directly adjacent to the Rutaki Channel is absent of large coral heads and the substrate is dominated by a hard reef platform (coralline algae dominated the wave zone) which is covered with small to medium coral rubble. The channel floor has no live coral however the channels vertical walls and edges have healthy populations of hard coral and macroalgae.

158. The intertidal reef flat adjacent to the shoreline has healthy populations of hard coral (significant small to medium size *Purities sp*. colonies) and a diverse and healthy macroalgae ecosystem. Invertebrate and finfish population's numbers were low during the assessment which was at low tide. It is imperative that the cable deployment or any movement during operation does not impact the inshore hard coral populations.

159. There are no marine or terrestrial protected areas located within the area of influence of the proposed cable alignment, however a marine/coastal Ra'ui (marine protected/managed area) is located approximately 300 m to the west located adjacent to the Rarotongan Beach Resort and Spa. There are no expected impacts associated from the deployment nor its operation of the cable on this Ra'ui.

160. The shallow benthic (down to 300 m) and oceanic waters directly adjacent to this site are fished by both subsistence, artisanal and inshore small scale commercial vessels. The MMR in association with community fishers have maintained a FAD (21^{0}16.705S 159^{0}50.793W) 3.5 km southwest of the cable alignment reef entry location in 1,100 metres of water. The FAD is expected to remain in existence for the foreseeable future.

161. **Landing stations - Aitutaki**. Four options (as shown in Table 5.2) were considered for the cable landing sites and are compared.

162. While Option 1 and 2 provide a relatively unobstructed alignment from the reef crest to shore and then onward to the cable landing station along a 7-8 km long roadside trench, there are somewhat more complex land issues to address. For example, both options must cross parts or directly cross under the old airport runway which has complicated land ownership provisions. Aitutaki citizens want the unused land, which could be productive agricultural lands to be returned to such used, so there is controversy there and these land use issues would take time to resolve.

163. Option 3 involves a direct deployment through the main harbour channel (Figure 3.5). This would not be an issue were it not for the major widening end deepening of this channel planned in the next few years as part of the harbour reconstruction works. Details of where widening would occur, dredging by as much as 3-5 m, and extensive work on shore would make any alignment tentative until all details are in place, thus significantly delaying the cable deployment.

164. Option 4 has none of these issues and presents only minor environmental problems. It will require crossing private land and the reconstruction of a septic tank (likely badly in need of repair anyway). The government is working with the community and owner(s) to resolve the land-use issues.

Table 5.2: Comparison of alternative cable landing sites on Aitutaki

Factors	**Alternative Landing Sites & Locations**			
	Option 1	**Option 2**	**Option 3**	**Option 4**
Marine				
Engineering a. landing engineering b. proven reliability c. marine traffic d. coral e. existing access	a. Complex b. Excellent c. None d. Good live coral cover e. Road access to landing is public	a. Complex b. Excellent c. None d. Good live coral cover e. Road access to landing is public	a. Complicated by proposed major harbour development b. Not an issue c. Yes extensive d. Marginal to none e. Yes, main harbour	a. no issues as this is rarely used channel b. well protected site c. almost nothing except beyond reef crest seaward d. Good live coral within back reef and intertidal reef flat close to shore e. yes, but on private land
Logistics-landforms	Crossing reef crest via reef “groove”	Crossing reef crest via reef “groove”	No issues	No issue
Cost	Second most expensive	Most expensive	Likely lowest cost	Cost above No. 3 but below 1 and 2
Social a. land acquisition b. displacement	a. All on government land b. none	a. All on government land b. none	a. All on government land b. none	a. Private land from high water line to road, around 45 m x1m temporary use. b. one old septic tank to replace
Environmental a. sensitive sites b. live coral c. cetaceans-migration	a. Yes, marine giant clam hatchery b. Some at reef crest and outer area c. Yes and needs special practices	a. Yes, marine giant clam hatchery b. Some at reef crest and outer area c. Yes and needs special practices	a. no sensitive sites b. marginal live coral only on reef channel edge — mostly macro algae	a. no sensitive sites b. Good live coral within back reef and intertidal reef flat close to shore— c. Yes and needs special practices

Factors	Alternative Landing Sites & Locations			
	Option 1	**Option 2**	**Option 3**	**Option 4**
			c. Yes and needs special practices	
Other considerations	House of Ariki consultation needed	House of Ariki consultation needed	House of Ariki consultation needed	House of Ariki consultation needed
Factors: Terrestrial				
a. trenching distance from reef crest to cable station (km)	8+ km	9 km	2.5 km	2.0 km
b. access disruption	Yes, significant but temporary	Yes, significant but temporary	Yes, significant but temporary	Yes, significant but temporary
c. electromagnetic interference from underground powered cable?	None- no power	None- no power	None- no power	None- no power
Conclusion - ranking	**3rd**	**4th**	**2nd**	**1st**

165. **Recommended option.** The recommended site is Option 4 (Arutanga landing site), and the cable will need to cross private land to get to the manhole in the road ROW. This alignment will need to cross an old septic tank which the government will replace.

166. The western reef sections of Aitutaki is characterised by an outer barrier reef which is subjected to oceanic swells resulting in seasonal high energy resulting in a wave dominated reef comprised of considerable spur and groove formations, breached by a number of small natural open water reef channels that are directly linked to a shallow flat intertidal lagoon and in the north-western corner of the island is strongly influenced by tidal currents. The largest of these is the main commercial shipping channel that is northeast (300 m) of the proposed cable alignment.

167. The inshore marine area associated with Option 4 is dominated by a relatively narrow shallow water intertidal reef flat that is close to shore which is partially exposed during low tide, and consisting of beach rock and a small sand beach close to shore and an extensive sub tidal reef flat (1300 m) that extends out to the barrier reef. This alignment terminates seaward at a wave-dominated reef crest, reef edge and slope which then descends rather steeply to the outer reef slope and beyond.

168. The sub tidal reef flat composed of reef derived sand (calcareous origins) interspersed with significant patches and coverage of hard coral (predominantly massive forms) and macroalgae, with some areas recording live percent coverage above 70%. Sea grass and mangroves are not present at this site.

169. The Rautaro Channel (Option 4) opens directly to the open sea. It is used by the local artisanal fishers to gain access to and from the open ocean however it is dependent on weather conditions with frequent access impossible due to oceanic swell and wave action. The main shipping channel located to the northeast of this site is the main entry point for all boat usage.

170. There are no marine or terrestrial Ra'ui designated sites associated with the proposed cable alignment site.

171. The recommended option will have the cable coming through the Rautaro Channel, located approximately 300 meters to the southwest of the main Aitutaki shipping channel, then

onwards across the intertidal and subtidal reef flat onto the shoreline adjacent to the community pathway to the road 300 m south of the main harbour.

172. Given the significant ocean swells, the cable will likely be buried in a conduit under the seabed as it enters the outer and inner reef slope (70 m deep) and as it is deployed through the Rautaro channel and onto the reef flat proper and back reef. This should minimize any interference with local fishers. The cable is to be trenched to a minimum depth of 0.75 meter across the intertidal and subtidal reef flats until it lands at the shoreline. Consideration for running the cable through a conduit to provide additional protection for all marine sections is recommended.

173. The intertidal shallow waters associated with the Rautaro Channel originating from the barrier reef entry point through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to medium size coral rubble dispersed over the substrate and significant reef derived sand deposits (especially landward).

174. The outer and inner reef slopes directly adjacent to the Rautaro Channel is dominated by a hard reef platform (coralline algae dominates the wave zone) which is covered to some extend with crustose and digitate hard coral colonies in low abundance and small to medium coral rubble in deeper areas. The channel floor has no live coral however the channel's vertical faces and adjacent environment have healthy populations of hard coral and macroalgae.

175. The intertidal reef flat adjacent to the barrier reef edge and close to the shoreline have healthy populations of massive hard corals (significant medium to large size *Porities sp*. colonies associated with the inshore sites) and a diverse and healthy macroalgae coverage is located throughout the area. It is imperative that the cable alignment does not impact the inshore hard coral populations by ensuring the cable is laid adjacent to these colonies. Invertebrate and finfish population's numbers were low during the low tide assessment. The shallow benthic (down to 300 m) and oceanic waters directly adjacent to this site are fished by both subsistence, artisanal and inshore small scale commercial vessels.

176. The MMR in association with community fishers have maintained a FAD ($18^0$51.508S $159^0$50.071W) 1.1 km southwest of the cable alignment reef entry location in 1,100 metres of water. The FAD is expected to remain in existence for the foreseeable future.

177. **Outcomes of alternatives analysis**. Based on the analysis of the alternatives and the marine surveys completed, Option 2 for Rarotonga and Option 4 for Aitutaki will have the least environmental and social impact on the PIAs as defined earlier in the IEE. Therefore, except the public consultation where all options were presented, the remaining analysis in this IEE, will focus on the potential impacts on the physical, ecological and social environment of the project within the PIAs defined earlier.

VI. ANTICIPATED IMPACTS AND MITIGATION MEASURES

178. **Overview**. The terrestrial environmental and social impacts associated with the proposal are minimal and can easily be managed through mitigation measures. Existing cable connection infrastructure will be utilised at both Rarotonga and Aitutaki; both situated in public road reserves. None of the infrastructure placements require clearance of vegetation or interaction with significant habitats, and routes to the cable landing stations will be on public land and >98% within existing road ROWs.

179. Disturbances and impacts caused by cable deployment and maintenance (once every 20 years) should be viewed in the context of the frequency and extent of these activities. The one-of disturbance associated with cable placement is restricted mainly to a strip of seabed less than 2 m wide. Unless a cable fault develops, the seabed will not be disturbed again within the system's design life of about 25 years. For comparison, bottom trawl and dredge fishing operations, are repetitive and more extensive and a single bottom trawl can be tens of metres wide, sweep substantial areas of seabed in a single operation and is likely to be repeated over a year at the same site. A single impact, such as a cable placement or burial, is preferred to continuous, multiple or recurring impacts.

180. The United Nations Convention on the Law of the Sea (UNCLOS) prescribes the freedom to lay, maintain and repair cables outside territorial seas, but these are not necessarily inconsistent with the need to protect deep-ocean habitats and ecosystems, which is also reflected in UNCLOS:

- cable deployment in the deep ocean, i.e. laying of a 17–20 mm diameter tube on the surface of the ocean floor, has a minor if not negligible one-of impact; and
- cable repairs can result in substrate disturbance. However, cable failures in deep water are relatively rare and are mainly caused by major natural events such as the 2006 Taiwan earthquake and submarine landslide.

181. In addition, the submarine cable industry, together with environmental regulators, attempts to reduce or avoid any impact on vulnerable deep-water ecosystems by: (i) utilizing modern seabed mapping and navigation systems that allow identification of deep benthic habitats in unprecedented detail and accuracy. Together with modern cable-laying techniques, it is now possible to deploy cables to avoid ecologically and biologically sensitive areas; and (ii) avoiding the deployment of cables on or through habitats such as seamounts, submarine canyons and hydrothermal vents, which are also unsuitable as cable routes due to the risk of natural hazards. For example, canyons are often swept by powerful currents that may abrade or break cables; and seamounts can be volcanically active and subject to landslides and hydrothermal venting.

182. Modern submarine fibre-optic cables are composed of several pairs of glass fibres, a copper power conductor[19] and a steel wire strengthening member, which are all sheathed in high-density polyethylene. Where extra protection is required - as for areas of rocky seabed or strong wave and current action - additional steel wire armour is added. Of these materials, cable-grade polyethylene is essentially inert in the ocean (Carter et al. 2009).

[19] The cable spurs to Rarotonga and Aitutaki will not be powered, whereas the main alignment between Samoa and French Polynesia will be powered.

183. Processes such as oxidation, hydrolysis (chemical breakdown in water) and mineralization are extremely slow; the total conversion of polyethylene to carbon dioxide and water will take centuries. The effects of ultraviolet light (UV-B) - the main cause of degradation in most plastics - are minimized through the use of light-stabilized materials, burial into the seabed and the natural reduction in light penetration through the upper ocean, where the photic zone rarely extends beyond 150 m depth. Any mechanical breakdown of a cable's plastic sheathing to fine-grained particles on the energetic continental shelf – a potential hazard for marine life – is minimized by armouring and burial (Carter *et al.* 2009) and placing the cable in a conduit.

184. Hence, the overall potential environmental impacts arising from the project are limited. The key environmental interactions are in the near shore areas where cable requires burial to avoid potential entanglement with fishing activities and other human activities.

185. The precise alignment of the cable in the sea and its exact deployment in the PIA will only be known once the seafloor mapping is completed the cable engineers have established the best method for bringing the cable to shore. Although the boundaries of the alignment from the outer reef to shore is fixed within a few meters, engineering issues could arise forcing consideration of realignment or the use of equipment identified in the IEE as unacceptable. If this occurs the proponent OPM/MFEM and its PC will be responsible for updating the ESMP and instructing contractors on new mitigation measures. OPM/MFEM will consult the MMR and NES for advice on any special issues arising, and will submit such changes to ADB for review and approval.

A. Design and Preconstruction Period – Physical Environment

186. Preconstruction period mitigation measures listed, are all related to defining construction boundaries for equipment and methods applied, and designed to prevent impacts from occurring by careful and sensitive planning (Table 8.2:).

187. Since the hydrographic surveys defining the precise alignment of the cable from the deep ocean to the shore (within EEZ waters) will only be completed after a contractor has been mobilized, and the ESMP is based on data available during the IEE work period, any information on sensitive sites such as new seamounts and hydrothermal vents will be added to the IEE document and its ESMP as an addendum and additional mitigation actions decided on by the borrower and the contractor.

188. **Hydrothermal Vents.** Hydrothermal vents and their associated ecosystems are fragile in nature and are not generally subjected to anthropogenic disturbances. However, these ecosystems and the communities they support are highly ephemeral in nature and are totally reliant on the lifespan of the vents themselves. The environment associated with an active vent is hostile and subsequently during the deployment of the cable these sites would be actively avoided by a minimum of 500 metres. Avoidance will render impacts non-existent.

189. It is likely that the proposed development will have no impact on the hydrothermal vent community associated with Cook Island waters as long as the cable is not laid upon an active vent, identified during the bathymetric survey.

190. **Seamounts and associated bathymetric features.** Seamounts are known to be biodiversity hotspots in the open ocean and subsequently are a target for commercial fishing. These are sensitive in that if cable is placed across them will impact benthic communities such

as deep-sea corals and therefore the cable route should avoid seamounts and associated bathymetric features. Sea mounts will be avoided by detailed design prescriptions and as suck will render impacts non- existent.

191. It is likely that the proposed development will have no impact on the seamount benthic community associated with Cook Island waters as long as the cable is not laid upon or in close proximity to these communities.

192. **Cyclone damage.** In order to prevent potential damage to the environment from cables becoming dislodged during severe cyclones the measures to protect against such damage will be the provision of engineering measures designed to withstand up to category 5 cyclones.

B. Design and Pre-Construction Period - Ecological Environment

193. While inventories on species presence were not done, the examination of habitat and discussion with MMR and NES experts revealed that habitat for the IUCN Red Listed species was not found in the PIAS of the two project islands. Based on these findings the proposed development will likely have no significant impact on any populations of IUCN Red Listed species of concern, such as turtles, or some of the coral species (see Annex 1). As soon as the hydrographic mapping is completed and any previously unknown sensitive features (seamounts or hydrothermal vent areas) are identified, a final assessment of whether the cable's area of influence interferes with any newly identified critical life history stages/habitats such as breeding and/or nesting will be made. The PMU's PC will examine the mapping and any sensitive sites, discuss the alignment with the contractor, seek any specialist advice from MMR and NES, then proceed to revise the ESMP. If the ESMP requires any significant changes it will be submitted to ADB for clearance.

194. **Hard corals.** The placement of the cable will avoid any hard and soft coral species and their communities and therefore the project will likely have no significant impact on any populations of hard coral associated with the cable alignment at both locations in Rarotonga and Aitutaki. A number of hard corals are listed on the UN Red List, however, as the cables area of influence will not impact any coral reef communities and/or species there is no impact to these organisms.

195. **Coral reefs**. The proposed cable alignment for both Rarotonga and Aitutaki will be positioned directly on the sea floor and therefore will have almost no primary or secondary impacts on the coral reef communities, flora and fauna and their ecosystem, located on the reef flat, edge and slope in the vicinity of cable. The cable laying operations will avoid infringing on any live coral or areas where coral is recovering from past degradation (e.g. cyclonic impacts). To that end the oceanographic survey team will receive instructions to align the cable around living reef patches and colonies.

196. Impacts to these reef systems could arise if there is an accident with the vessel due to: (i) direct impact by the vessel itself or a tender; (ii) oil/petrochemical spillage; and/or (iii) collision between large vessels using the water way during cable deployment. These potential risks are deemed very unlikely; the following mitigation actions will be applied:

- Direct collision will be mitigated by having a diver accompany all placement of cable inside the outer reef zone of each PIA.

- A fuel spill will be prevented by vessels maintaining a strict fuel management protocol as defined by the MARPOL conventions which the internationally operating vessel owner comply with and which MFEM will check.
- Collision between large vessels in the same water will be prevented since any vessel entering the country's territorial waters or coming close to shore must report to MMR and often the harbour masters on each island, to alert all that a contractor's vessel is in the vicinity. Further, large vessels have multiple detection systems designed to avoid collision.

197. **Cetaceans.** The project will not have significant impacts on any populations of cetaceans utilizing the oceanic waters of the Cook Islands, notably Rarotonga and Aitutaki. However, there is potential for short-term low level impact on the behaviour and welfare of individuals due to the use of sonar and/or entanglement with the cable as it is deployed. Whales (e.g. humpback) are known to migrate through the waters where the cable alignment survey and cable laying activities will take place in. The work could have two impacts: i) disorientation and communication disruption for whales and dolphins, and ii) entanglement in cable by deep diving cetaceans such as the sperm whale. To reduce the risk of this occurring vessel and survey operators will be instructed to:

- Undertake all work utilizing sonar outside annual whale migration periods (July – October) in Cook Island waters;
- Use best practices for operating vessels in proximity to marine mammals (see Annex 3);
- Post a watch for whales and suspend activities when whales are within 1 Km of vessel;
- Take extra precautions that cables are always resting on the seafloor or buried, and never strung across undersea valleys; and,
- Use multi-beam and/or side-scan sonar only. Use of air guns will be prohibited.

198. If these best practices (also specified in the ESMP) are followed, most of the concerns can be mitigated and the impact, including entanglement would be rendered insignificant.

199. **Turtles.** The green, hawksbill and loggerhead turtles are the only species recorded in Cook Island waters, with all three species more abundant in the northern atolls. There are no recent data that indicate these three-species nest on Rarotonga. There is some anecdotal information from MMR staff that green turtles nest infrequently on remote sand islands within the Aitutaki lagoon, far away from the cable alignment and none would feed in the vicinity of the cable deployment operation, and such work would scare them away.

200. Therefore, the proposed cable alignment should not affect the turtles feeding grounds, turtle nesting beaches nor their movement within the two alignment corridors.

201. **Mangroves.** There are no mangroves associated with the proposed cable PIA of influence and therefore no impacts will occur.

202. **Seagrass.** There were no sea grass communities found in the vicinity of the proposed cable PIA, including the landing site, and therefore no impacts will occur.

203. **Benthic communities associated with the cable alignments.** Individual sessile and/or burrowing benthic species located in the narrow trenching track around 75cm deep x

40cm to 50cm wide will be exposed to small and localized short term impacts during the cable trenching and burial. Recolonization will be rapid (within 12 months) and for these reasons no lasting impact is expected.

204. **Fish aggregation devices.** Prior to any construction mobilization the PC will provide the contractor with the GPS coordinates of the FADs and provide instructions to avoid these underwater reef structures. FAD locations should be avoided by a minimum of 300 meters. Avoidance will render impacts non-existent.

205. **Ra'ui.** Prior to construction mobilization the PC will provide the contractor with maps showing the boundaries of the Ra'ui designated areas and instructions to avoid them.

C. Design and Pre-Construction - Social Environment

206. **ESMP Implementation Monitoring.** Without assigning specific responsibility for the implementation of the ESMP to one person or unit, its effectiveness will be severely degraded. To address this, the OPM will retain the PC who will be responsible for the implementation /enforcement of all ESMP measures.

207. **Land Acquisition and Resettlement.** Land acquisition and resettlement. On Rarotonga the preferred alignment (Option 2 – Rutaki Passage to Apii Rutaki) is located on a combination of crown land (from high water mark) and Native Freehold Land (for beach manhole) leased by the government in perpetuity for public purpose since 1 April 1961. A separate due diligence report has been prepared which will guide the process of providing access to land for the project.

208. The cable landing site is clear of any residential or business structure thus will not require any land acquisition or involuntary resettlement of people, residential or business structures, and food gardens.

209. The cable station site is on an existing government lease (60 years) for telecommunications since 1 July 1968 to 2028.

210. From the cable landing site, the cable will be buried along the existing road leading to the Aroa cable landing station. On Rarotonga roads are legally proclaimed as roads, deemed to be in the possession of the Crown for the purposes of forming, repairing and maintaining the roads. The land on which roads are formed on belong to the adjoining land owners. In general, the Crown/Government is not permitted to lay cables (telecom, power) and pipes (water, sewage) for public purposes under sealed roads without the consent of the landowners. To avoid any issues with the communities and chiefs, and to ensure their support, consultations with them prior to construction, during construction and operations are recommend.

211. On Aitutaki **t**he preferred alignment (Option 4 Reureu Village) is on some private land located just outside Arutanga centre. An estimated 1-meter-wide and about 45 meters long piece will be crossed for trenching the cable and constructing a manhole at the roadside. Also, an old septic tank will need to be replaced. The site is clear of any residential or business structure as alignment would use an existing driveway from the high-water mark to the main road on the way up the hill to the Aitutaki Hospital compound where the existing cable landing station is located.

212. The Cook Island government will negotiate with landowners to secure an easement. instead of permanent acquisition through negotiated settlement with the landowners. Failure of the negotiation could lead to compulsory acquisition (acquisition by warrant).

213. The cable landing station Is located within the Aitutaki Hospital compound. The site is a government leased land thus will not require acquisition of private lands.

214. The Aitutaki cable will be buried from the manhole along the existing road leading to the Aitutaki cable landing station. The Crown and private owner controls over roads are the same as for Rarotonga, and an approach identical to that recommended for Rarotonga will apply to Aitutaki.

215. **Access disruption and landside trenching.** Excavation and placement of the cable will result in temporary roadside access restrictions (no more than 3-4 days). Therefore, a protocol for immediate repair will be established by the PMU, including notifying roadside residents of which access will be cut off, for how long, where, and when repairs will be done. Further the trenching equipment will be a machine capable of digging a trench just wide enough for the cable to be buried along the road shoulder (i.e., not a large backhoe). These requirements are included in the ESMP.

D. Construction Period - Physical Environment

216. **Hydrothermal Vents**. If hydrothermal vents are detected during the bathymetric mapping a 1 km buffer zone requirement, i.e. avoidance of any vent areas, as specified in the ESMP will be enforced by the PMU's PC and with compliance by the contractor.

217. **Seamounts**. The ocean corridor in which the cable is to be placed has not been mapped well and therefore all seamounts have not been identified. The bathymetric survey will provide the necessary information, and, if any new seamounts are detected, the cable deployment work will avoid them.

218. **Ocean water pollution**. The contractor will adhere to MARPOL conventions in management of all wastes at sea and comply with specifications 1-3 as shown in the ESMP.

219. **Water pollution from suspended sediment**. During and after land-side trenching operations contractor will insure that trench areas are cleaned up and runoff is clear of sediment.

220. **Cyclone Damage.** The contractor will design all installations to withstand Category 5 cyclone.

E. Construction Period - Ecological Environment

221. **Coral Communities.** The assessment of the coral communities in the two PIAs indicated that there were no live corals in the channels or routes which the two-cable alignment will follow. Live coral colonies do exist on the vertical walls of the channels which the cable deployment team will be instructed to leave unharmed. In the intertidal zone the cable will be floated into shore sunk into the exact location aided by divers and avoiding live coral.

222. **Cetaceans.** Contractors installing the cables will need to control cable tension so that the placed cable conforms to contours of seabed as per cable laying specification and-or provide anchors if needed. In this way, the cable will be as unobtrusive as possible and eliminate the risk of cable-whale interaction.

223. **Fish Aggregating Device**. FADs are important fishing grounds for local fishers and contracts will avoid these areas, and use the GPS data provided in this IEE and from government sources as provided by the PC.

224. **Ra'ui**. The intertidal areas designated as Ra'ui and identified in the IEE Annex 1 are to be left undisturbed by all construction activity.

F. Construction Period - Socio-Economic Environment

225. **Land use and access.** Given that there are no landside acquisition or access issues in Rarotonga, the only impact possible could arise if contractors stray from the proposed alignment and encroaches into communal resource harvesting areas (refer to the Social Due Diligence Report) for land providing the process in managing this impact). The cable route boundaries have been defined in the IEE and as such the contractor will be required to adhere to these conditions, and be permitted to deviate only after consultation with the Technical Coordinator.

226. On Aitutaki an easement (approximately 1-meter-wide x 45 length) through a private land will be required by the project. As leasing or acquiring private land is a difficult task (with possibly 100 landowners with interest on the land and mostly overseas) the government will prepare an action plan to complete the lease prior to construction (similar to the process the government has followed for an ADB-funded project renewable energy project). Details are provided in the project's Social Due Diligence Report.

227. Construction will only commence once the formal process for the lease of land has been completed. ADB SPS and relevant government policy will apply in case there will be unanticipated impacts.

228. **Information disclosure.** Local communities expressed considerable concern about being excluded from the consultations following the surveys to establish the alignment at sea and on land. They wanted to be involved in that decision-making process. They were also very concerned about the clean up after the landside trenching is complete, having had bad experiences in the past. To address this the PC and contractor will conduct two consultation sessions—one for each village, updating them on results and getting feedback on locations and issues, as well as describing the post trenching rehabilitation actions and timetable-including landscaping. These consultations will be completed before the contractor mobilizes to the field and final alignments are specified.

229. A communications and consultation plan will be prepared for the PMU's PC. This plan will identify when and how stakeholders will be consulted and the type of information that will be shared between the stakeholders and the project.

230. **Health and safety**. The contractor will prepare a health and safety plan as part of the construction ESMP (CESMP), this will adhere to the Environmental Health and Safety Guidelines as required.

G. Operating Period - Physical and Ecological Environment

231. Once the cable is in place it will be an inert, small diameter, glass, metal and plastic conduit buried about 0.75m below the seafloor. In the deep ocean. It will be resting on the seafloor, and will over time be covered by the deep-sea sediment 'rain'. If required, the cable may also be anchored to the seafloor with special anchoring devices. It will be a passive structure, similar to a rock formation and are often quickly colonized by deep-sea invertebrates.

232. There is always the chance that a violent earthquake or a volcanic eruption damages the cable but this cannot be considered an operating period impact.

233. **Marine pollution**. The cable branching units to Rarotonga and Aitutaki will not require power thus no chance that low frequency signals could emitted. The main cable resting in the seafloor will be powered and with no known negative effects. Some species of shark may be attracted to the cable and in rare conditions try to bite the cable, which does no harm to the shark.

234. From the reef to the shore the cable will likely be buried, eliminating any operating period fisheries issues. Since land areas impacted are cleared unused semi urban land and the cable will be buried, no operating period impacts due to the cable are likely. There may also be continued misconception that the cable contains polluting liquids. This misconception needs to be addressed by providing the PC with a length of cable to show to concerned citizens.

235. **Coastal marine waters and reef zone pollution.** The PC needs to conduct a final check to be sure that all trenching areas have been cleaned up and are erosion proof.

H. Operating Period - Social Environment

236. **Impact associated with improved internet access.** The service provider will provide households with information on how to set parental controls on the cable including identifying and blocking undesirable sites.

237. **Impacts associated with increased cost of internet.** To address this issue MFEM and OPM will organize an independent price regulator and consultations to reach an equitable/affordable price for the new service.

238. **Positive impacts and benefits**. If properly prepared, the project will not only improve people's access to income and social services but may also enhance social networks particularly family relationships among Cook Islanders and their respective family members living abroad. Faster internet is also expected to facilitate regular and affordable connections among local and overseas-based groups, particularly women's organizations who rely on internet to be in-touch. Better internet connections should also help with remote medical services and distance education.

239. Business leaders suggested that a high-speed and affordable internet service would encourage businesses owned by Cook Islanders but operating from overseas (due mainly to poor and expensive communication services on Rarotonga and Aitutaki) to bring their businesses back home. In fact, local business owners indicated that they would invite such operations to come back to the Cooks.

I. Cumulative Impacts and Mitigation Measures

240. **Environmental impacts**. Given that the cable installation involves the placement of a 2-6 cm diameter solid nearly 100% inert cable (containing no liquids), deployed by floating it into place, guided by divers, and buried in the shallower waters in a narrow trench on the seabed, all done within a few day work, no cumulative effects are foreseen. There are no other known activities occurring at the same time that the cable is to be placed on the seafloor. There may be

other construction activities on land, but since both landing will only require some trenching within a road allowance, no cumulative effect will be triggered.

241. A potential seafloor mining operation may start after the cable is deployed and cable contractors will need to use the mapping available to ensure that the mining locations will not overlap with the cable alignment.

242. The minimal upgrading of the Rutaki small boat harbour on Rarotonga and the much larger planned reconstruction of the Arutanga harbour on Aitutaki will occur after the cable has been deployed and will likely be operational. Again, no cumulative effects are expected.

243. **Socio-economic impacts**. There are no expected cumulative social impacts resulting from the fibre optic cable project. Due to its small footprint, and even though the Aitutaki landing will cross a small corridor of private land it will not require a land acquisition or damage to property other than the replacement of an aging, probably leaking concrete septic tank in need of upgrading.

244. **Irreversible and irretrievable impacts**. Based on an intensive but short field survey at both PIAs and after consultation with affected people as well as the House of Ariki (Indigenous people's parliament), no permanent negative impacts were identified. The government will however conduct further consultation with the House of Ariki to provide additional details of the project on Rarotonga in order to avoid any future miss-steps.

245. This cable will be quickly covered over by sediment on the seafloor and after burial in a narrow trench in the nearshore zone, will create a very small footprint, and very little impact from the work will be visible within 1 year of construction. Past experience has shown that the small disturbed areas are recolonized by local benthos very quickly.

246. The cable will be on or buried below the seafloor thousands of m below the surface and could in very rare situations entangle a deep diving whale. This has been recorded for large diameter cables but none for fibre optic cables, if the contractor implements the preventative measures defined in the ESMP, e.g., no stringing across valleys, entanglement is a non-issue.

247. The meeting with the island chiefs on Aitutaki resulted in a unanimous approval of the work and with no mention of any permanent damage due to the project.

VII. CONSULTATION AND INFORMATION DISCLOSURE

248. **Consultations**. A pillar to the successful implementation of the project is continued consultation from design through project completion and operations, with stakeholders engaged. Key stakeholders include landowners, communities, business owners, and traditional leaders (House of Ariki) in both Rarotonga and Aitutaki. To ensure continued stakeholder engagement, a project community consultation plan will be prepared by the PC in coordination with the contractor. Also, the PC will act as a community liaison officer to continue to direct engagement with stakeholders as defined in the communications plan.

249. **Rarotonga.** At least 45 people from government and civil society organizations including private sector, NGOs, chiefs, and community representatives were consulted (22 to 31 August 2016) during the preparation of this IEE in Rarotonga. A part of these consultation activities was a half-day wider stakeholders' meeting attended by at least 15 government and leaders of civil society groups' on 26 August held at the MFEM conference room. This was followed by a

separate consultation with the Paramount Chiefs in Rarotonga (House of Ariki) on 1 September 2016.

250. **Aitutaki.** At least 52 people from government, civil society organizations including private sector, environmental organizations, community and women's organizations were consulted from 29-30 August 2016. Similar to Rarotonga, a half-day wider stakeholders' consultation attended by government and non-government representatives was also conducted on 30 August 2016 in Aitutaki.

251. Annex 5 contains a summary table and the details of consultations.

252. **Consultation results**. The consultation results for Rarotonga and Aitutaki were used to select the preferred alignment option and confirmation of landownership for each site. Also, the consultation feedbacks are expected to contribute to refining project technical/detail design. Moreover, the results identified potential environmental and social issues and allowed the team to develop mitigation measures with the communities and other stakeholders during project implementation.

253. All participants attending the public consultations indicated a very strong interest to be involved in the different stages of the project. As mentioned above, the House of Ariki chiefs highlighted the need to consult the communities and the landowners along the project site even though the project sites are on a government leased land and on an existing road to ensure project support. MFEM and OPM will follow up with at least on additional information sessions, further elaborating on the project and reviewing alignments, etc.

254. The majority, if not all stakeholders support and welcome the project. Except from concerns mentioned above, the community is hopeful that the project will happen very soon and make the communications more reliable and affordable.

255. **Disclosure**. Project documents, including safeguards due diligence reports, will be made available to the public. A project communications and consultation plan to be prepared for the project will provide the process, timing, methods etc. of various interactions with stakeholders and affected people. Disclosure protocols will be set out in that plan and will follow Cook Islands' requirements and ADB's Public Communications Policy 2011.

256. The grievance redress process is discussed in Section VIII.

VIII. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

A. Implementation Arrangements

257. **Overview.** The MFEM will be the executing agency for the project, while the OPM will be directing it. OPM/MFEM will establish a PMU and retain the PC to manage all implementation arrangements, including ESMP oversight.

258. ADB will support as necessary through ongoing technical assistance to build the capacity of the envisioned cable operating entity in the development of the project. The procurement packages for works, goods and consulting services, will be detailed in the project

design and described in the project administration manual. Procurement of equipment or consulting services covered by ADB's loan will comply with ADB procedures and guidelines.

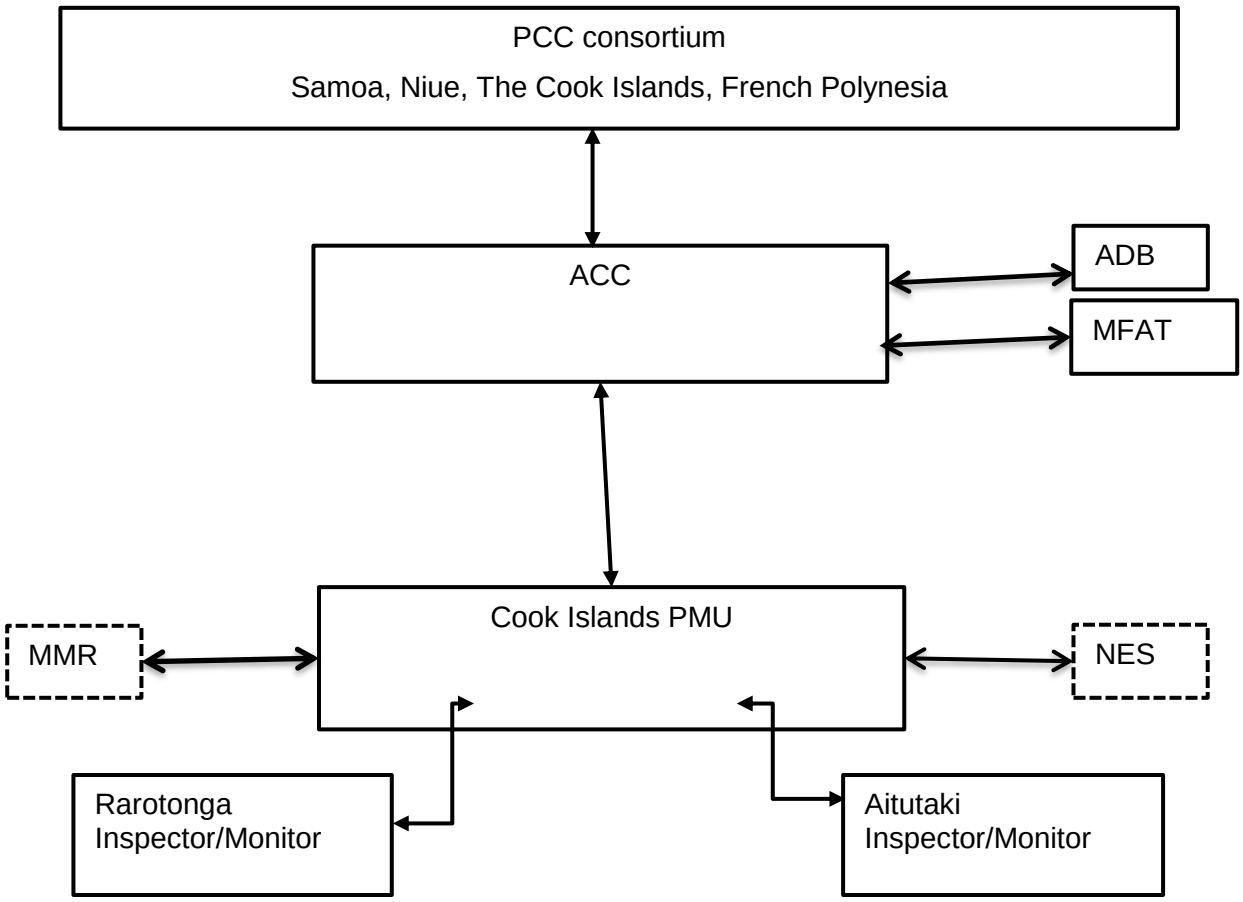
259. **Preconstruction period**. During this stage of the project the ESMP will be updated based on detailed information form the surveys to be undertaken, at this time the existing information gaps in the baseline will be filled. The responsibility for oversight of these activities is with the OPM and its PC. As soon as the hydrographic surveys have been completed, the PC with the contractor, and with any necessary advice from MMR as well as NES, will review the alignment plans and decided if new surveys and revisions to the ESMP are needed. The PC will then make any necessary changes to the ESMP and prepare to brief the contractor. If the ESMP is revised the OPM will submit suggested revisions to ADB for review and approval.

260. **Construction period.** During this stage of the project the PC will oversee the implementation of all actions defined in the ESMP. This means confirming with the contractor that all actions are implemented in a timely manner. Since the majority of work will take place on the high seas aboard hydrographic and cable laying vessels OPM will see written assurance from the vessels that they will abide by the measures defined in the ESMP. OPM is also discussing placing a monitor on the vessels while they are working in the country's EEZ. The contractor will be responsible for MARPOL compliance related reports as well as the ESMP compliance monitoring checklist, signed and delivered to MFEM.

261. The PMU will be directly responsible for inspecting the two landing sites and confirming that access along the roads, after the trenching has been completed, have been fully re-established. Further, the Cook Islands' PMU will have two inspectors who will oversee the contractor's work at the two landings and make sure that mitigation measures are applied (as defined in the ESMP).

262. **Operating period.** The newly established ACC will be responsible for implement and operate the cable system in Cook Islands in collaboration with PCC consortium. ACC will be the wholesale bandwidth provider to local telecom operator.

Figure 8.1: Proposed Command and Reporting Protocol for Cook Islands Cable Project



Note: Arrows indicate important reporting requirements; dashed boxes are advisory

263. The ESMP implementation will require an approximate 4-5-month preconstruction period, plus a 1.0 to 1.5-year construction period and less than 3-month operating period compliance monitoring function. The main responsibility for implementation of the ESMP will be the PC and the contractor with guidance from specialists (marine ecologist from MMR or NES) as needed. Overall country-level management will come from the OPM.

264. The supervision of all the cable works on each island will be dealt with via a subproject inspector reporting to the PC.

265. **Institutional capacity**. The Cook Islands has competent environmental compliance staff (within MMR and NES) with adequate capacity to fulfil their role in project delivery. Project management staff will have overall responsibility to ensure safeguard compliance in the preparatory phase and will work in collaboration with key agencies with regard to safeguard requirements. In addition, OPM has experience with ADB safeguard requirements.

266. That being said, there is a weakness in implementation of environmental assessment and ESMP procedures, compliance monitoring, information analysis and reporting. The review of a few environmental assessment completed (namely the 2008 Avarua Port Improvement Project) suggest that ESMP implementation has not been carried through properly.

267. MFEM has determined that the delivery of a 2-3-day workshop to NES and MMR staff working in both locations and on these topics, by either the Government of New Zealand, SPREP or a private consultant would be very beneficial since more donor funded project are in the pipeline.

268. The contractor will receive a briefing from the PC and OPM detailing mitigation measures to be implemented to ensure environmentally-responsible construction activities in sensitive marine habitats and a timely implementation of mitigation measures. The bid documents will include a clause requiring bidders to have basic ESMP implementation skills. All revisions to the ESMP (if needed) will be led by the PMU's PC and discussed between OPM/MFEM and ADB prior to implementation. Based on the ESMP in this IEE (including Table 8.2), the contractor will prepare the construction ESMP (CESMP) which will detail their methodology for installing the cable and undertaking works at the landing sites for which site-specific plans and drawings will be required.

B. Mitigation Measures and Performance Indicators

269. Given that nearly all the potential negative impacts would occur during the construction period, and that robust environmental contract clauses will be able to avoid all impacts. Key performance indicators will be:

i) confirmation that the ESMP is updated and required specific individual or grouped environmental and social clauses in the contract bid documents.
ii) confirmation that environmental management criteria are included as part of the contractor selection process, including their experience preparing and implementing ESMPs, working in sensitive tropical locations such coral reefs, recognizing fish aggregation/spawning areas, and seamounts;
iii) a marine ecologist (coral specialty) located and retained as an advisor by OPM and the PC, likely sourced from MMR or NES, providing assistance with coral management issues as well as briefing the contractor on marine habitat protection, and cable placement;
iv) a written record of the briefing on safeguards and inspection of vessels, according to the tasks as they are defined in the ESMP and contract specification, completed with the survey and cable placement contractors, as soon as the contractors have been selected;
v) Contractors to prepare the CESMP based on the items i) – iv) above for review and clearance by the PMU prior to any works being undertaken;
vi) compliance monitoring checklists prepared using the ESMP (Table 8.2:) as the basis, and being used by the contractor and PC, due diligence notes, completed as defined in the ESMP, and making the notes available in an easily accessible file for the contractor, PC, OPM, ADB; and,
vii) a written mitigation and monitoring checklist, listing all mitigation and monitoring measures defined in the ESMP, their implementation timing, monitoring and any follow up actions using Table 8.2.

270. The PC will be responsible for preparing a performance indicator report, by listing the six items above and providing a short text to indicate how these items were implemented and their success as of the start of the operating period of the project.

C. Monitoring and Reporting

271. The executing agency is required to implement safeguard measures and relevant safeguard plans, as provided in the loan and/or project agreements, and to submit periodically monitoring reports on their implementation performance.

272. In consultation with executing agency and ADB, the PMU will establish a system for preparing quarterly progress reports (QPR) which will include safeguards (environmental performance i.e. compliance with ESMP and approved CESMP, GRM implementation and issues resolution, audits/compliance checks and corrective action plans, and training and capacity building). The safeguards sections from the QPR can be aggregated to provide information for the semi-annual safeguards monitoring reports. The semi-annual safeguards monitoring reports will be submitted to executing agency and ADB. ADB will disclose these on the website.

273. Overall, the ESMP for the project will be implemented by the PMU. The ESMP will include the outline plan for monitoring and supervision, and will be implemented by the PMU. Progress on the preparation and implementation of the CESMP will be included in the QPR. Specific monitoring activities defined in the ESMP will be carried out by the contractors and monitored by the PMU.

274. In general, the overall extent of monitoring activities, including their scope and periodicity, should be commensurate with the subproject's impacts identified by a risk assessment undertaken by the contractor during preparation of the CESMP.

275. In respect of monitoring and reporting, the executing agency through the PMU will:

(i) ensure the baseline conditions are recorded and properly benchmark the elements to be monitored;
(ii) establish and maintain procedures to monitor the progress of implementation of environmental safeguards;
(iii) verify the compliance with environmental measures and whether they are achieving the intended outcomes (mitigated level of impact);
(iv) identify necessary corrective and preventive actions including actions required when the grievance redress mechanism (see sub-section D) has been triggered i.e. the report will outline where work has not complied with the ESMP and what steps (and timeline) were taken to rectify it;
(v) document and disclose the monitoring results;
(vi) follow up on these actions to ensure progress toward the required outcomes;
(vii) where required (for complex subprojects or subprojects in locations with particularly sensitive receptors) retain qualified and experienced external experts or qualified CSOs/NGOs to verify monitoring results; and
(viii) submit periodic monitoring reports on safeguard measures as agreed with ADB.

276. Monitoring for this project will be essentially compliance monitoring, i.e. recording that the mitigation measures defined in the ESMP (Table 8.2:) are fully implemented in a timely manner. This will be best achieved with a compliance monitoring checklist. The base checklist will be prepared using the ESMP and adding three columns labelled "action taken, date, and by whom". Much of this will be implemented by the PC, working with the contractor. Checking that the ocean-going vessels comply with mitigation measures will be limited to getting written assurance from the contractor that MARPOL Conventions regarding sewage, solid waste and

bilge water management will be adhered to, checking the records on quantities and locations where waste was discharged and possibly having a monitor on board the contractor's vessels.

277. Preconstruction period monitoring will be undertaken by the OPM and the PMU as soon as it is formed, specifically the PC.

278. Construction period monitoring will be completed by the PC working closely with the contractor. OPM is presently considering placing a monitor on board the contractor's vessels to conduct compliance monitoring during that period.

279. Operating period monitoring will be completed by the OPM working with the cable operator.

D. Grievance Redress Mechanism

280. A grievance redress mechanism (GRM) is required for the project. The GRM is scaled to the risks and adverse impacts of the project. If promptly addressed, and using an understandable and transparent process that is gender responsive, culturally appropriate, and at no costs and without retribution, the concerns and complaints of potentially affected people will usually be resolved. The GRM mechanism does not impede access to regular judicial process, but provides a simpler access to complaint resolution.

281. The Cook Islands Cable company via the PMU, will appropriately inform Rarotonga and Aitutaki community members about this GRM before commencement of any civil works. This will be done as part of consultation session where engineering details costs and feasibility will be tabled. Also, leaflet summarizing the process, structure, and timeframe for filing and achieving a resolution for a complaint, will be provided to the contractor's site office, House of Ariki headquarters, Chamber of Commerce headquarters, Office of the Prime Minister in Rarotonga, and the Mayor's Office in Aitutaki for use by potential complainants.

282. A grievance redress committee will be established to (i) record, categorize and prioritize the grievances; (ii) settle the grievances in consultation with complainant(s) and other stakeholders; (iii) inform the aggrieved parties about the solutions; and (vi) forward the unresolved cases to higher authorities. The six-member committee will be comprised of one member of the OPM, CIIC, and civil society representatives that may include Chamber of Commerce, a representative from an environment organization, and two representatives from the project community, with at least one female member from each community. The chair of that committee has yet to be named, but it will likely be someone from OPM. The following six-step mechanism (Table 8.1) is proposed for grievance redress of social and environmental matters.

283. During implementation, the Cook Island Cable Corporation as well as OPM, will have a designated staff member responsible for interacting with the GRM. The OPM Chairperson and the PMU will be the grievance focal point, and receive and address project related concerns, via the designated staff member. Concerns will be resolved first by the PMU and contractor. Affected people will be made fully aware of their rights regarding land ownership and environmental degradation by the PMU and contractor. During the construction period, the contractor will be a key participant in the grievance redress process, and the OPM will need to confirm that the contractor has assigned a GRM coordinator.

284. Any complaint will be recorded and investigated by the OPM and PMU staff working with the project manager and the contractor (as appropriate). A complaints register will be

maintained, and will show the details and nature of the complaint, the complainant's name, the date and actions taken as a result of the investigation. The register will also cross-reference any non-compliance report and/or corrective action report or other relevant documentation filed in relation to the original complaint.

285. When construction starts, a sign will be erected at all sites providing the public with updated project information and summarizing the grievance redress mechanism process including contact person details at OPM, or the PC hired by the OPM. All corrective actions and complaint responses carried out on site will be reported back to the OPM/PC. OPM/PC will include the complaints register and reporting on corrective actions/responses in its semi-annual progress reports to the ADB. Throughout this process, OPM/PC and NES will always be available to hear public complaints and provide advice if the complainant feels that OPM responses are not satisfactory. The Project Steering Committee (PSC) will make sure that this cooperation is available.

Table 8.1: Grievance Redress Process

Step	Process	Duration
1	Affected Person (AP)/village elected or traditional chief takes grievance to OPM/PC or contractor	Any time
2	OPM or contractor reviews issue, and in consultation with village chief, relevant agencies and contractor (if appropriate), agrees to a solution and records the results.	2 weeks
3	OPM/PC through PMU reports back to chief and AP and gets clearance the complaint has been resolved.	1 week
If unresolved		
4	Chief or AP take grievance to PSC for resolution	Decision within 2 weeks
5	If not resolved PSC must take matter to relevant national agency for decision.	2 weeks
6	Relevant agency can deliberate for ≤ four weeks and resolve the case	4 weeks
If unresolved or if at any stage and AP is not satisfied with progress		
AP or chief can take the matter to appropriate state or national court.		

E. Reporting and Monitoring Requirements

286. In addition to submitting hydrographic mapping and marine survey details[20], the PC working with the contractor will submit a filled-in compliance monitoring checklist to the OPM, once at the end of the preconstruction period, twice during the construction period and once during the operating period. This material will be forwarded to the OPM and made available for submission to MFEM and ADB.

287. Any non-compliance items will be dealt with immediately by the government's PMU and the contractor will be required to take immediate corrective action or face a 'stop work order' or payment delay until corrective actions have been completed.

288. The PC, overseen by MFEM and the OPM, will provide full safeguard documentation (e.g., the IEE its ESMP and alignment information) to the two villages and will, with local authorities, conduct at least one consultation once the draft of the final alignments is ready, inviting the villages to help with final locations, particularly inside the reef boundary. The government recognizes that the specific alignment of the cable and its deployment has not been

[20] Alignment details are rarely revealed due to international security concerns and it is the practice as advised by the International Submarine Cable Protection Committee.

finalized and as such there may be a need to revise and update this IEE. If this occurs the PC will adjust the ESMP and discuss these changes with OPM/MFEM as well as local Ministry of Marine Resources (MMR) and NES officers to be sure that protection of the environment is robust. The contractor will implement any new measures.

F. Environmental Management Costs

289. **Environmental**. During the construction period field monitoring, will be required daily, [21] when the cable placement is ongoing inside the barrier reef. This will be done by the PC's monitor(s) working on each island. The deep ocean work is expected to take about 300 days in total (rough estimate) with the oceanographic survey being completed earlier. The work in the intertidal zone at the two locations will take a total of say 8-12 days. It is during these periods that inspection of vessel operations will need to be conducted.

290. The total cost for the environmental mitigation and monitoring is estimated to be around US$75,000.00. MMR experts will provide any marine ecological advice. This work would include all reporting and contractor briefing. Monitoring of the contractor's vessels and any equipment needs will be provided by the MMR and or NES and/ or the villages affected (within the PIAs); and paid for by the OPM as an internal cost.

291. The indicative cost for the capacity building if New Zealand or SPREP deliver such a program during two to three day sessions over 10 days, would cost approximately US$10,000.00.

292. **Social**. Social mitigation and monitoring measures are detailed in the ESMP and will be delivered by OPM and the project PMU. During construction, the PMU's PC will field any concerns/comments expressed by stakeholders and will act to address any negative issues (in close consultation with the OPM and MFEM). Cost of community awareness activities at each project stage are expected to be approximately US$10,000.00, including both landing sites.

293. If one includes the training costs, with the ESMP implementation for both the environmental and social sector actions, the total estimated cost will likely be around US$95,000.00 ($10,000 training, $50,000 mitigation and $35,000 for monitoring functions).

[21] The cable deployment period is uncertain but based on past information provided by cable contractors, it can be just a few days to more than a week depending on site-specific complications.

Table 8.2: Environmental and Social Management Plan Matrix

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
DESIGN AND PRE-CONSTRUCTION PERIOD								
Physical Environment								
Hydrothermal Vents	Physical damage to vents by cable or cable- laying equipment.	Avoid hydrothermal vents through design and environ. sensitive placement of the alignment	Deep sea areas/ *Design period*	OPM with MMR and PMU's PC with Contractor/*OPM*	Approve alignment plan that avoids any hydrothermal vent detected	Contract terms prep. period/ once/Prior to mobilization	record of detection of hydrothermal vent	OPM and PC
Sea mounts.	Physical damage to habitat	Avoid sea mounts through design and environ. sensitive placement of the alignment	Oceanic deep-sea areas. /*Design Period*	OPM with MMR and PC/*OPM*	Approve alignment plan that avoids any seamounts detected	Contract terms prep. period/ once/Prior to mobilization	record of detection of hydrothermal vent	OPM and PC
Fish aggregation devices (FAD)	Damage from survey or cable laying vessels	MMR and MAF need to provide the contractor with GPS coordinates of the FADs	NA/ *After the contractor has been selected, but before field mobilization*	PMU's PC and MMR plus contractor /*OPM*	Approve alignment plan that avoids any FADs	Contract terms prep. period/ once/ Prior to mobilization	record of detection of hydrothermal vent	PC in cooperation with MMR and MOA/OPM
Ra'ui	Degradation of Ra'ui fishing grounds cable placement	Stay clear of Ra'ui areas, by knowing their location and planning the intertidal alignment to pass around these protected areas	NA/ *Prior to start of construction*	PMU's PC working with MAF & contractor using IEE boundaries/OPM	Confirm contract specification in place as indicated in ESMP	During pre-construction period	Written and signed DD inspection note-to file	PC/OPM
Ecological Environment								

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
Coral communities	Destruction of coral assemblages	In contract specifications instruct cable survey team to survey cable alignment for coral outcrops, and design alignment to avoid. Coral assemblages to be marked on design drawings.	NA/ *PMU's PC working with MAF & contractor using IEE boundaries/*	PMU's PRC working with MMR and Contractor/OPM	Confirm that appropriate specification contained bid documentation	During pre-construction period	Written and signed DD inspection note-to file	PC/OPM
Cetaceans, turtles, corals, seagrass, benthos species potentially at risk	Ocean sonar survey affecting cetaceans; Entanglement in cable by deep diving cetaceans such as the sperm whale.	Contract specifications to include reference to best practices for operating vessels in proximity to marine mammals; Prepare guiding work plan for contractor that avoids using sonar while whale migration and movement is taking place (July-October); Post a watch for whales and suspend activities when whales are within 1 Km of vessel; Multi-beam and/or side-scan sonar only – No air guns.	NA/ Include *when Preparing bid and construction contract documentation*	PMU's PC and Whale Research Institute and any advice from MMR/OPM	Confirm inclusion of sonar restrictions in contract specifications; Obtain visuals evidence from cable deployment vessel that cable is indeed on seafloor	When specifications are, being written	Record to file Visual record to file	PC and Contractor/ OPM

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
Cyclone damage	Failure of cable engineers to account for severe cyclone damage	Cable deployment and securing to seafloor must account for a possible category 5 cyclone and sea conditions and currents	Cable landing areas at Rutaki and Arrange / When finalizing preparation of construction contract documents	PC, MOT and Contractor/OPM	Confirm that design has accounted for severe cyclone impact	During design period/once/ -	Record on monitoring checklist	PC and contractor/OPM
Socio-Economic Environment								
ESMP implementation monitor	ESMP will not be implemented or implemented incorrectly	OPM to retain a coordinator who understands or is sensitive to environmental and social safeguard actions defined in the ESMP	NA/ At loan implementation	PC/OPM and ADB	Confirm that the technician is on staff since the start of the project	At start of the detailed design stage/throughout the project	Note to file	OPM/ADB
Land acquisition and resettlement	Minor land acquisition needs not implemented properly	Due Diligence report on land acquisition prepared for use by project	PMU office/ *Prior to field mobilization of contractor*	PC/ OPM	Examine copy of guideline and confirm that contractor has copy	Prior to mobilization/ once/NA	Compliance monitoring checklist completed	PC/OPM
Access during landside trenching	Failure of contractors to do trenching work with minimal damage and quick complete rehabilitation or roadside damage	Contract specifications to include timing concerning full rehabilitation immediately after trenching completed in one area—no lag time	NA/ *before civil work begins*	PC/OPM	Confirm that specifications are in contractor documents	During contract preparation period	Note to file that check was completed	PC and technicians on Rarotonga and Aitutaki/ OPM

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
Information disclosure	PC and contractor fail to include villages in final alignment planning and decision making	PC and Contractor, prior to start of work, present the draft plan to villages and seek input and agreement on final alignment plan, etc.	At community centres on both islands/ *Prior to start of construction*	PC and Contractor/OPM	Consult with local community members to confirm that proper consultation was initiated	Prior to start of field constructio n	Compliance Monitoring checklist completed	PC and Contractor / OPM
CONSTRUCTION PERIOD								
Physical Environment								
Hydrothermal Vents	Physical damage to vents by cable or cable- laying equipment.	Contractor to follow design boundaries as defined in ESMP	Any hydrothermal vent areas detected/ at start of construction period	Contractor, PC/OPM	Confirm that contractor has any relevant information concerning vent locations (if existing)	At start of constructio n period/onc e/ NA	Compliance monitoring checklist filled in	PC/OPM
Sea mounts.	Physical damage to habitat	Contractor to follow design boundaries as defined in ESMP	Any seamount areas detected/ at start of construction period	Contractor, PC/OPM	Confirm that contractor has any relevant information concerning vent locations (if existing)	At start of constructio n period/onc e/ NA	Compliance monitoring checklist filled in	PC/OPM
Fish Aggregation Devices (FAD)	Damage from survey or cable laying vessels	Contractor to follow design boundaries as defined in ESMP	Any FADs / at start of construction period	Contractor, PC/OPM	Confirm that contractor has FAD location data	At start of constructio n period	Compliance monitoring checklist filled in	PC/OPM
Ra'ui	Disturbance of marine organisms and habitats in Ra'ui.	Per contract specs., the contractor(s) will ensure that they: Lay cable along surveyed route providing for a safe distance (≥ 75m) from Ra'ui as per cable laying specifications Keep all survey and	Inshore coastal areas/ *When work is underway*	Contractor and PC/OPM	Inspect cable laying operation in coastal waters and confirm avoidance	As soon as work takes place inside the barrier reef— inside the passage into nearshore waters	Record of inspection and findings—written and photos	PC and Contractor/ OPM

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
		support vessels at safe (≥ 75m) distances from Ra'ui areas.						
Ecological Environment								
Coral Communities	Destruction of coral communities	Contractor(s) to adhere to avoidance rule and lay cable along surveyed route, as per cable-laying specification, thus avoiding coral reefs and outcrops; Cable placement in Retake and Autauga to be diver-assisted to avoid coral heads and damage to benthos	Offshore, inshore and coastal area; *When work is under taken. Before work in coastal areas begins*	PC Contractor, and MMR /*OPM*	Inspect cable laying operations in vicinity of coral formations for both Rarotonga and Aitutaki and confirm compliance	When work is going on in vicinity of coral areas; Defined during the detailed design work	Written compliance report (can be bullet format, with photos. Confirm that contractor has coral community location map	PC / OPM
Cetaceans: focus on whales	Disorientation of cetaceans due to sea floor mapping using standard sonar gear; Entanglement in cable risk for deep diving cetaceans	Control cable tension so that laid cable conforms to undulations of seabed as per cable laying specification and-or provide anchors if needed.	Oceanic and deep-sea areas/*Through out construction period*	PC, Contractor and Centre for Cetacean Research and Conservation/*OPM*	Discussion with person in charge of cable placement to confirm understanding re cetacean sensitivity	At start of survey and start of cable placement	Due diligence note to file with OPM	PC with input from Cetacean Research office input /OPM
Ocean water pollution due to sewage, garbage and bilge discharge from contractors' vessel	Hydrographic and cable laying vessels discharge waste into the sea, contravening MARPOL conventions contributing to the ongoing degradation of	Vessels conducting work as part of this project will be required to pump out sewage at treatment facilities, dispose of garbage at approved landside locations and treat all bilge water to reduce chances of introducing exotics in the bilge	Anywhere at sea/ *Prior to start of hydrographic survey and cable deployment*	PC, contractor, MOT and NES/ *OPM*	PC to discuss requirements for adherence to MARPOL conventions/protocols with contractor and obtain written assurance. Secondly, remind	At start of survey and start of cable placement At end of each ocean survey by vessel	Copy of written assurance on file with OPM Record of vessel waste management as prescribed by MARPOL	PC and Contractor, with advice from OPM

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
	the pelagic seas	water waste; Oily bilge most be skimmed before discharge; Each vessel will be required to submit sewage and waste management record books (as indicated in MARPOL conventions) as well as submit a bilge treatment and disposal record as specified in the relevant MARPOL Convention; as the work is completed. Prior to the start of work, contractors will be informed of these requirements.			contractor that records of on-board sewage, bilge and waste management will be collected			
Water pollution from suspended sediment coming from poorly completed trenching operations	In nearshore waters, trenching activity produces excessive suspended sediment over a large area due to poor construction method and/or unnecessarily large equipment, producing a large construction footprint. On land trenching clean up slow, work during rain	Trenching equipment to be used in water to require minimum work area, such as hydraulic trencher, with narrow channel preparation and immediate covering. Trenching on land to be completed with 'Ditchwitch' type equipment preparing a trench less than 0.5m wide. The trench and all earth excavation needs to be backfilled immediately after the work is done and	Anywhere that landside trenching is going on/ *At any time that trenching is taking place on land*	Contractor and PC, with guidance from NES if requested/*OPM*	Check that post trenching is complete and that local roadside residents are satisfied-and if not initiate immediate repairs and restoration by the contractor	Immediatel y after trenching completed in any one area	Compliance checklist showing where check was done and how many residents were interviewed and what the satisfaction level was	PC and Contractor /OPM

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
	events leading to runoff of sediment laden water into the sea.	before any significant rainfall. Therefore, the trenching and backfilling may have to be repeated daily						
Cyclone Damage	Destruction of cable by high winds and storm surges.	Protect cable against category 5 cyclone by armor, concrete matts and burial in shallower waters	At both landing sites—at reef crest and landfall locations/ *Construction Period*	PC and contractor/*OPM*	Inspect the cable treatment and confirm it is secure to a category 5 cyclone	Immediately after cable deployment	Inspection note to file for OPM	PC/OPM
Socio-Economic Environment								
Land Use	Straying of agreed to cable alignment into communal resource area. Community perception of cable encroachment to 'no-go' marine protected areas.	Conduct a series of consultations with government, private sector and non-government organizations including women and youth on progress of work and cable alignment. Consultations informing all interested people on the work and general alignment location and methods used.	Both landing areas/ *Prior to start of work at any landing site*	PC and contractor/*OPM*	Obtain review and file record/notes/ minutes of consultations completed	Within 5 days of land use issue consultation taking place	Copy of record of meeting completed	PC/OPM
Access during landside trenching	Failure of contractors to do trenching work with minimal damage and quick complete rehabilitation or roadside damage	Contract specifications to include timing concerning full rehabilitation immediately after trenching completed in one area—no lag time	Along all routes where trenching will take place/ *immediately after trenching takes place*	Contractor, PC/ *OPM*	Inspect all sites to be sure timely and complete rehab. of access to each unit impacted is undertaken	Immediately after any landside trenching is completed	Inspection checklist to OPM	PC and Contractor/OPM

Project period and environmental parameters	Project impact	MITIGATION			MONITORING			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
Information Disclosure	PC and contractor fail to include villages in final alignment planning and decision making	PC and Contractor, prior to start of work, present the draft plan to villages and seek input and agreement on final alignment plan, etc.	At community centres on both islands/ *Prior to start of construction*	PC and Contractor/OPM	Consult with local community members to confirm proper consultation was initiated	Prior to start of field constructio n	Compliance Monitoring checklist completed	PC and Contractor / OPM
OPERATING PERIOD								
Physical and Ecological Environment								
Perceived marine pollution from work	Fear of potential damages to marine life and impact to food supplies by communities	The use of the Grievance Redress Committee to address concerns needs to be established by the IA, taking immediate action to address mostly perceived concerns, before they become negative rumors. Have section of cable to show local people.	Project PMU Office/ *At start of operating "defect period'*	PC and with contractor /OPM	Confirm that availability of GRM is broadcast	Prior to start of operations/ two times/ NA	Compliance monitoring checklist filled in	PC and Service provider/ OPM
Coastal Marine water and reef zone pollution	Sediment laden runoff and erosion from poorly rehabilitated trenching sites draining into nearshore waters and reef zone	Contractor must ensure that areas where trenching occurs and where ground cover removed are completely rehabilitated to the extent that zero erosion or suspended sediment laden water from the work reaches the coastal waters.	All trenching areas on land/ *immediately after trenching is finished*	PC and Contractor/ MOT and OPM	PC's technicians on each island conduct an inspection of all trenched areas and report clean up	At start of operating period/1/2 day per island	Compliance monitoring checklist filled in	PC/ OPM
Socio-Economic Environment								
Impact assoc. with improved Internet—better	Failure to adopt measures and continue	Make population aware of 'internet site blocking features	Entire internet service area/ *at all times*	Cook Island Cable Co (service	Obtain record of action by service	Periodicall y during the first 6	Compliance monitoring checklist filled in	PC/ OPM

Project period and environmental parameters	**Project impact**	**MITIGATION**			**MONITORING**			
		Mitigation measures	**Where/ *when***	**Implementer/ *Supervisor***	**Details of monitoring action to be undertaken**	**When/ frequency / duration**	**Output to be provided**	**Implementer/ Supervisor**
access to harmful sites	mitigation actions defined in the construction environmental completion report.	available to every subscriber; possibly via a village advisory group.		provider)/ *OPM*	provider	months of operations/ conduct meeting with service provider twice		
Impacts associated with increased cost of internet/ communications cost	Failure to ensure public/customers understand available 'value for money' service package prices	Prepare timely and informative information materials for customers/public Make sure that Help Desk of service provider is well informed.	Entire internet service area / *prior to start of new service*	Cook Island Cable Co./ *OPM*	Check information materials and visit Help Desk	Two times/ during first six months of operations	Compliance monitoring checklist filled in	PC/ OPM

OPM=Office of the Prime Minister, MMR=Ministry of Marine Resources, NES=National Environment Service, MAF=Ministry of Agriculture and Fisheries, PC=Cook Island Project Coordinator, PMU= Cook Islands Project Management Unit, MFEM= Ministry of Finance and Economic Management

IX. CONCLUSIONS AND RECOMMENDATIONS

295. The Rarotonga landing site at Rutaki will not require any land acquisition, while on Aitutaki, the Arutanga site will require the temporary lease of a narrow strip (1-1.5m x 50m) of land from the high-water mark to the road ROW and a manhole. MFEM is securing an easement across the land between the high-water mark to the road ROW boundary. The Arutanga alignment will also involve the replacement of an aging septic tank, in the way of the cable to be buried in an approximately 1m deep trench to the road.

296. The project will impact a corridor of not more than 3-4 m wide (including the footprint of the submarine trenching machine on the sea floor in the inner reef zone, and to a depth of 0.75 m beneath the sediment. The cable, about 4 cm in diameter (maximum) in the nearshore zone[22], will be buried as it passes through the natural channel (ava) through the barrier reef into the Rarotonga and Aitutaki nearshore zone. Burial of the cable will be done to reduce interference with coastal fishing gear and reduce the risk injury to corals and people during storm events.

297. The cable route will avoid sensitive habitats such as corals and areas designated Ra'ui, with placement guided by experienced divers who will place the cable according to instructions from a marine ecologist. These measures will limit any chance that the work will negatively impact the marine environment.

298. All land to be traversed by the cable and associated infrastructure is government owned, including the seafloor (according to Cook Islands law).

299. The ESMP defines a full set of working area boundaries, work restrictions and timing limits, which will be included in the construction contract specifications and which the contractor will have to comply with. The PC through the OPM/MFEM managers and trained support staff will monitor compliance.

300. Given the small-scale impact of the work, and the fact that nearly all of it will take on board a vessel at sea with a specially trained crew, no negative social impacts are predicted during any stage of the project.

301. An important potential impact will be the trenching of the cable on land and roadsides resulting in access restrictions and the need to rapidly repair the damaged as specified in the ESMP. Further the trenching will have to be completed using a trenching machine, not a backhoe which makes an unnecessarily wide trench, given that the cable inside a case hardened conduit will be less than 6cm in diameter.

302. The PC overseen by MFEM and the OPM will provide full safeguard documentation to the two villages and will conduct consultations once the draft of the final alignments is ready, inviting the villages to help with final locations, particularly inside the reef boundary.

303. With this IEE the Government of Cook Islands concludes that all safeguard requirements have been met and the project can proceed to be fully implemented. In the event

[22] The cable diameter varies depending on depth, thus for deep sea locations it will average 1.7 cm in diameter and near shore about 3.5 cm in diameter.

that, based on the final alignment information and bathymetric/hydrographic survey results, ESMP updates are needed, MFEM's PC (with guidance from MMR and NES as needed) will make these changes and submit to ADB for clearance.

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ANNEXES

Annex 1: Marine Ecology Detailed Findings

Annex 2: International and Regional Treaties, Conventions and Agreements

Annex 3: Cetacean Literature Review

Annex 4: Consultation Session Record and Presentation

Annex 5: Environment Significance Declaration Form

Marine Ecology Detailed Findings

Marine Ecology, Rarotonga And Aitutaki Nearshore Submarine Cable Alignments

This Annex included the detailed survey results both for the Rarotonga and Aitutaki Island landing sites in the Cook Islands as specified in the Terms of Reference and also provided supporting evidence for the results and discussion in the body of the IEE.

Methods

The marine assessment utilized standard and acceptable international marine biological methods (English et al., 1997) and was performed by the project team's marine ecologist with assistance from staff from the Ministry of Marine Resources (MMR) at both island sites. Free diving (snorkeling) scientific visual survey method was employed to assess and provide a general description of the reef systems and benthic habitats/sea floor in close proximity to the proposed cable alignment.

Data collected included water depth, percent live coral cover, reef condition, dominant benthic forms, dominant hard coral genus and morphological forms, marine algae (turf, macro), sediment types and physical description including water movements/currents. Digital photos were taken of key biological features (biotic and abiotic) and a global positioning system (GPS) coordinates recorded for all assessments sites.

Sampling sites for 3 Rarotonga Alignments and 4 Aitutaki Alignments

In total, seven (7) cable alignment sites were assessed, three (3) and four (4) respectively for Rarotonga (Figure 1) and Aitutaki (Figure 2). In total, 24 and 28 individual marine survey sites were assessed during the field work for Rarotonga (Figure 3) and Aitutaki (Figure 4 a and b) cable options, respectively.

The Rarotonga marine cable option assessments were undertaken on Friday the 02nd of September. The marine assessments for the Aitutaki cable alignment options 1, 3 and 4 were undertaken on Aug. 30th Option No. 3 was surveyed on Aug. 31st, 2016 Each cable option site was assessed individual and is described for Rarotonga (4.2) and Aitutaki (4.2) sections of Annex 4 in Annex 4.2.1 and 4.2.2, respectively.

The proposed cable alignment site for Rarotonga and Aitutaki are both described in the main report and are not elaborated here, except for site photos of the marine areas.

Figure A1.1: The location of the three cable alignment options sites for Rarotonga

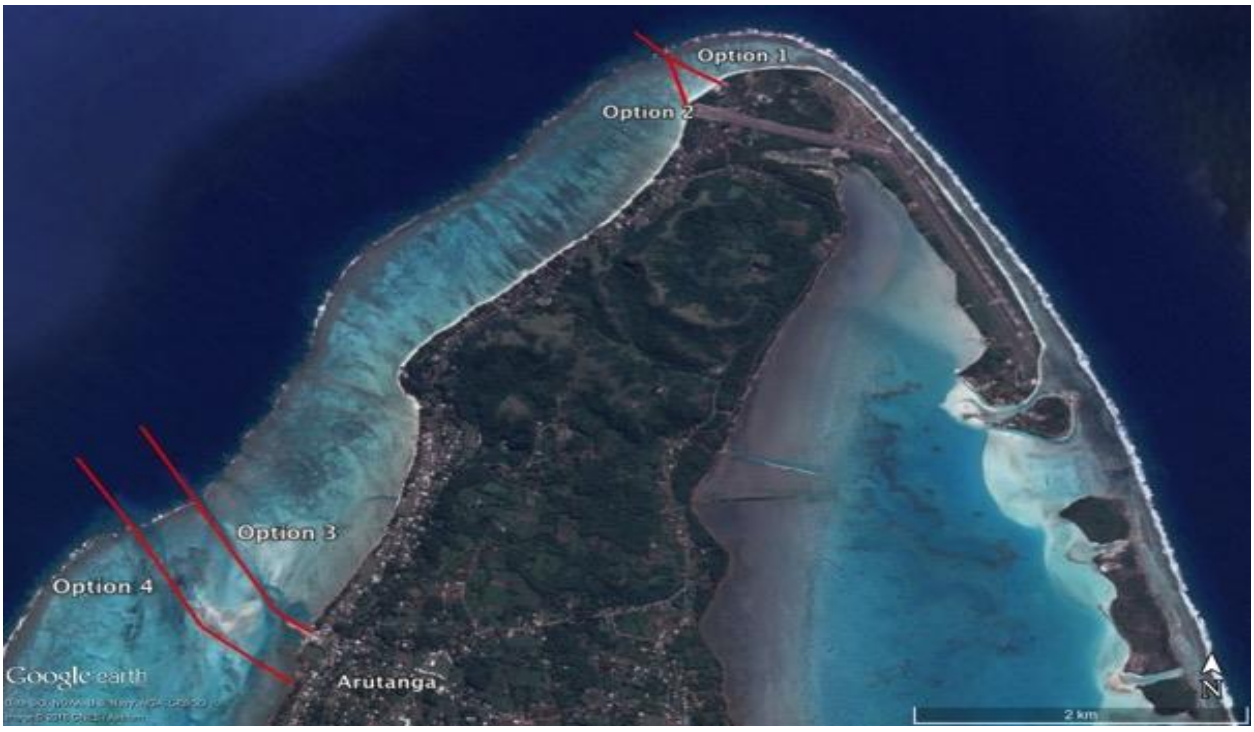


Figure A1.2: The locations of the four cable alignment options sites for Aitutaki

Figure A1.3: Location of Field Sites (Cable Alignments) - Rarotonga

Figure A1.4a: Location of Field Site (Cable Alignment) - Aitutaki

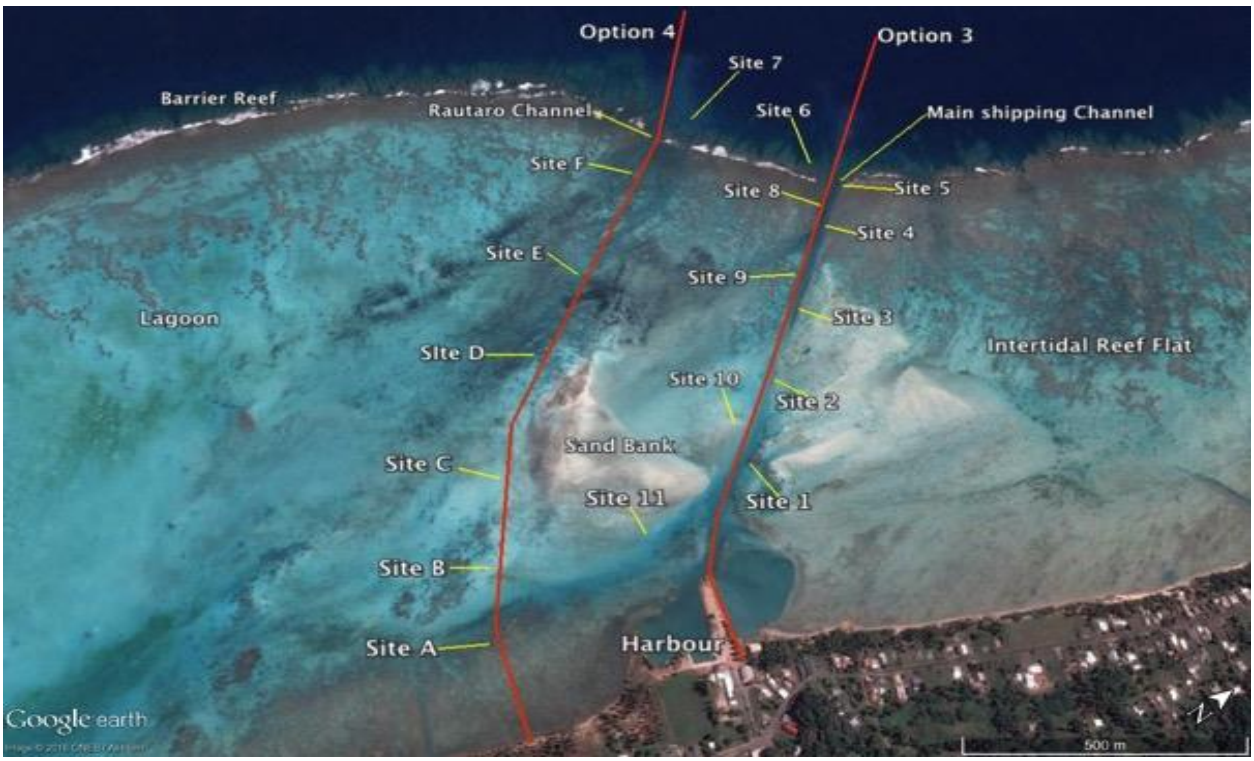


Figure A1.4b: Location of Field Sites (Cable Alignment – Aitutaki)

Coastal Zone: Nearshore Baseline Conditions Reef Assessment Findings

Rarotanga Alignments

All assessment sites were undertaken within the shallow water marine environment for Options 1, 2 and 3. Figure 3 provides the location of each assessment site and they are described below. Inclement weather was present during the field assessment producing high wave along the barrier reef, including the entrance to the channel and as such access to these locations was not practical.

Rarotonga Cable Alignment Site Description

All three cable options are located on the south coast of the island approximately 12.5 km by road to the west of Avarua, the capital of the Cook Islands.

All three option sites can be easily accessed by the islands main circumference road and includes a Ra'ui to the west of the sites, adjacent to the Rarotongan Beach Resort and Spa (Plate 1a). Ra'ui function as local marine reserve and includes the intertidal and sub tidal reef flat within the lagoon. Cook island marine protected areas are described in section IV-B-4 of this report. The proposed cable alignment options do not impact this Ra'ui as the cable lies some 300 meters to the east of the reserve boundaries and therefore are outside the area of influence of the cable.

This reef section of Rarotonga is characterised by year around oceanic swells from the southern ocean resulting in a high-energy wave (Figure 1b) dominated barrier reef comprised of considerable spur and groove formations, breached by several small natural open water reef channels that are directly linked to a shallow flat intertidal lagoon strongly influenced by tidal currents.

The inshore marine area of all three sites is characterised by a distinctive reef system that remains similar throughout the area and is dominated by a relatively narrow shallow water intertidal reef flat that is close to shore which in part is exposed during low tide consisting of beach rock and a small sand beach close to shore (refer Plate 1 e & f), and a sub tidal reef flat that extend out to the barrier reef which terminates seaward to a wave dominated reef crest, reef edge and slope which then descends rather steeply to the outer reef slope and beyond.

The sub tidal reef flat is roughly horizontal throughout its entirety averaging between 1-3 meters water depth (it is tidally influenced) and is composed of reef derived sand (calcareous origins) interspersed with significant patches and coverage of hard coral (predominantly massive forms) and marcoalgae, with some areas recording live percent coverage above 95%. Sea grass and mangroves are not present at this site location. The site has a natural seawater reef channel (termed an “Ava” in Cook Islands) that opens directly to the open sea (Figure 3). This Ava is used by the local fishers to gain access to the open sea, however usage is totally dependent on weather conditions with frequent access impossible due to oceanic swell and wave action.

The site has an ephemeral stream that during seasonal rainfall peak periods discharge considerable freshwater into the area and resulting sediment/rock plume (Plate 2). In addition, during periods of high rainfall natural springs discharge freshwater directly into the shallow waters in close proximity to the shoreline along the coastline of this site. These are a natural event on Rarotonga and will have no impact on the cable deployment or operation.

The marine environment assessment determined two potential options (1 and 2) for the delivery of the cable to the shoreline. Both options have the cable entering and trenched through the barrier reef via the natural channel “Ava” - Ritaki pass.

The preferred Option (Option 2) identified by the environment team is to deliver the cable adjacent to the school (government land) (Plate 1 b & c) by running the trenched (1 m depth) cable through the Ritaki pass and entering west close to shore (within 30 meters of the beach) and along the intertidal reef and entering a beach man hole adjacent to the main road. This alignment will have little impact on the live coral and macroalgae as it passes through the sub tidal and intertidal reef areas. Consideration for cable to be inserted within a conduit along the shore line to provide additional protection, especially in the area where a shoreline concrete boat ramp has been proposed See Figure 3 site O).

The alternative option (Option 1) is to deliver the cable directly through the Ritaki pass directly to the shoreline. This option has the least potential environmental impact and is the shortest route however the landing site is private land.

Option 3 is not recommended because of the high hard coral and macroalgae percentage coverage throughout the cable alignment and the structural difficulties to bring the cable over the reef edge through constant heavy wave action.

All three options are discussed below.

Plate 1 a, b, c, d, e & f: Location of the proposed cable alignment for Rarotongan sites.

Plate 2 a & b: The ephemeral stream located roughly in the center of the proposed cable alignment sites.

RAROTONGA CABLE ALIGNMENT OPTION 1 AND 2

Subtidal and Intertidal Reef Site Descriptions (Site A- P)

Option 1. This description includes the cable alignment entering the coastline through the Rutaki Channel and onwards through the natural channel exiting the channel through the sand/rubble bed directly to the shore (refer Figure 3). The cable is to be trenched to a minimum depth of 1 meter.

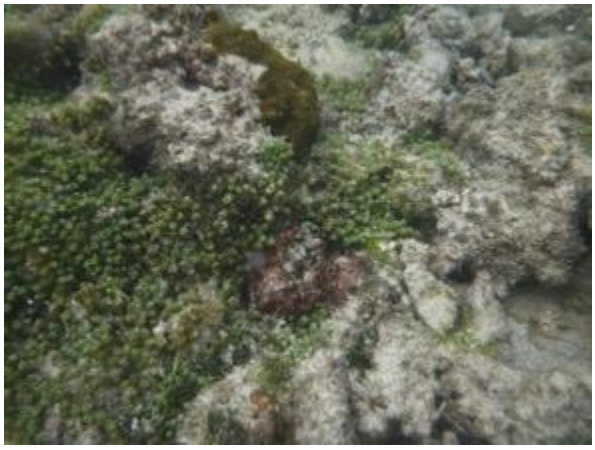
The intertidal shallow water originating from the entry point of the channel through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to fine size coral rubble and sand dispersed over the entire sea floor associated with this site. The channel and associated ecosystem has considerable oceanic swells, waves and tidal water movement (strong currents) and as such sand and rubble are constantly moved throughout this zone. The channel floor is absent of live coral however the channels vertical edges have healthy populations of hard coral and macroalgae.

Invertebrate and finfish population's numbers were low during the low tide assessment.

Option 2. Includes the cable alignment entering the coastline through the Rutaki Channel and onwards through the natural channel exiting the channel through the sand/rubble bed and following the shoreline along the coast, west of the channel to enter the land adjacent to the school. The cable is to be trenched to a minimum depth of 1 meter with consideration of the inclusion of a running the cable through a conduit along the shoreline to provide additional protection. The intertidal shallow water originating from the entry point of the channel through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to medium size coral rubble and boulders dispersed over the substrate interspersed with smaller coral rubble and reef derived sand.
The channel and associated ecosystem has considerable oceanic swells, waves and tidal water movement (strong currents) and as such sand and rubble are constantly moved throughout this zone. The channel floor is absent of live coral however the channels vertical edges have healthy populations of hard coral and macroalgae.
The intertidal reef flat adjacent to the shoreline has healthy populations of hard coral (significant small to medium size Porities sp. colonies) and a diverse and healthy marcoalgae. It is imperative that the cable alignment does not impact the inshore hard coral populations.
Invertebrate and finfish population's numbers were low during the low tide assessment.
This is the recommended preferred option.

Site A: (21026’00.1”S 159080’96.2”W). This site is located directly mid-way across the intertidal reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand with a diverse marcoalgae coverage and low number of small to medium size massive corals (Plate 3).
The area experiences strong tidal currents.

Plate 3: Substrate and live coral and macroalgae associated with site A.

Site B: (21025’96.8”S 159080’94.4”W) This site is located directly mid-way across the intertidal reef flat with a water depth between (1-3 meters). The substrate is dominated by a hard baseline platform of coral rock covered with sand with a small number of small to medium size massive corals. Macroalgae diversity and populations number lower that Site A (Plate 4).
The area experiences strong tidal currents.

Plate 4: Substrate and live coral and macroalgae associated with site B.


Site C: (21025’97.2”S 159080’85.6”W).
This site is located roughly in the center of the reef flat slightly to the west of the small coastal stream with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with a diverse marcoalgae coverage and healthy number of small to medium size massive corals (Plate 5). Coral percentage cover at this site is significant.

The area experiences strong tidal currents.

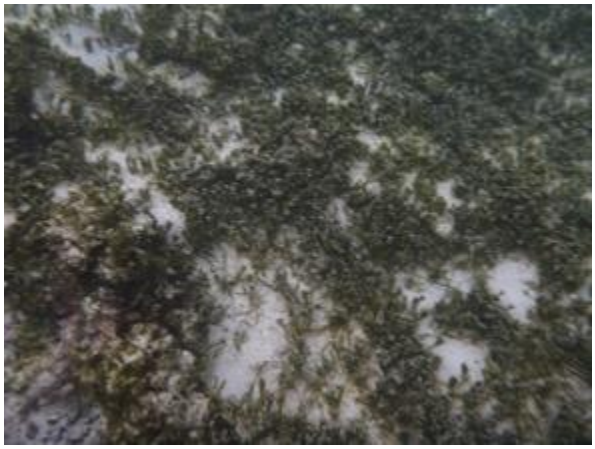
Plate 5: Substrate and live coral and macroalgae associated with site C.


Site D: (21025’98.4”S 159080’76.9”W).

This site is located roughly in the center of the reef flat directly adjacent to the small coastal stream with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with a diverse marcoalgae coverage and healthy number of small to medium size massive corals (Plate 6). Proportion of coral cover at this site is significant.

The area experiences strong tidal currents.

Plate 6: Substrate and live coral and macroalgae associated with site D.

Site E: (21025’93.7”S 159080’72.2”W).
This site is located close to the shoreline (40m) within the reef flat slightly to the east of the small coastal stream with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with a diverse marcoalgae coverage and low live population of hard coral and associated low percentage live coverage. (Plate 7). Remnants of hard coral colonies are high in this area.

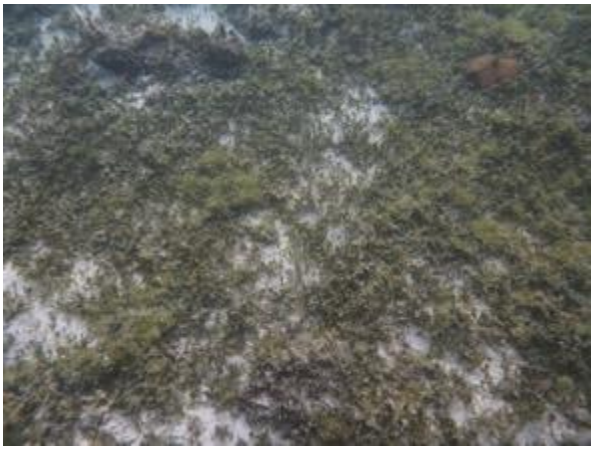
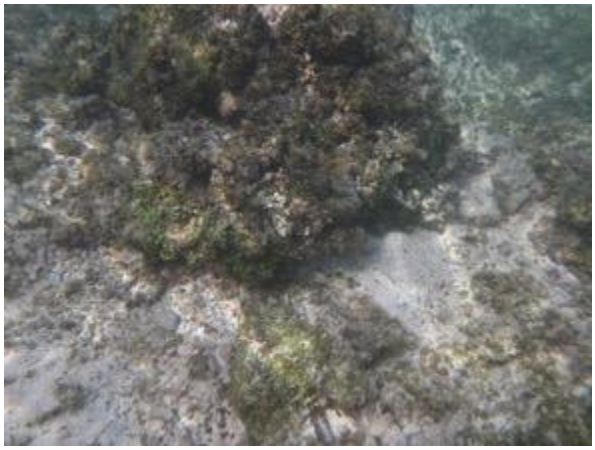
The area experiences strong tidal currents.

Plate 7: Substrate and live coral and macroalgae associated with site E.


Site F: (21025’91.2”S 159080’66.0”W).
This site is located close to the shoreline (25 m) within the reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse marcoalgae coverage. No live hard coral was located at this site (Plate 8). Remnants of hard coral colonies were present in this area.

The area experiences strong tidal currents.

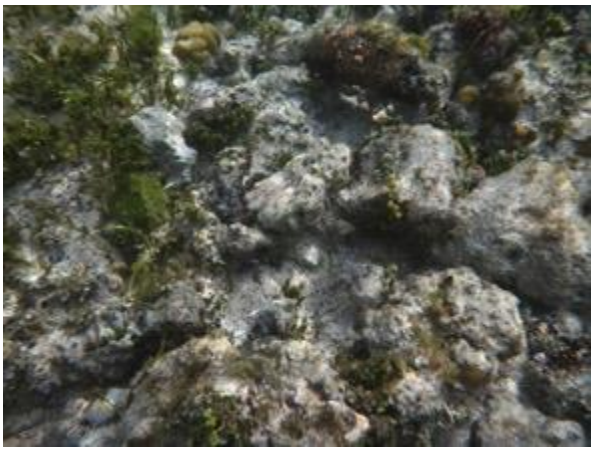
Plate 8: Substrate and live coral and macroalgae associated with site F.

Site G: (21025’93.7”S 159080’47.5”W).
This site is located close to the shoreline (20 m) within the reef flat with a water depth between (1-2 meters). This site is marked with a float that identifies the shoreward location of the proposed community cement boat ramp. The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse marcoalgae coverage. No live hard coral was located at this site (Plate 9). Remnants of hard coral colonies were present in this area.

The area experiences strong tidal currents.

Plate 9: Substrate and live coral and macroalgae associated with site G.




Site H: (21026’01.1”S 159080’49.2”W).

This site is located approximately 100 meters from shoreline within the reef flat with a water depth between (1-3 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse marcoalgae coverage. Low numbers of hard coral colonies are located at this site with a low percentage coral coverage (Plate 10).

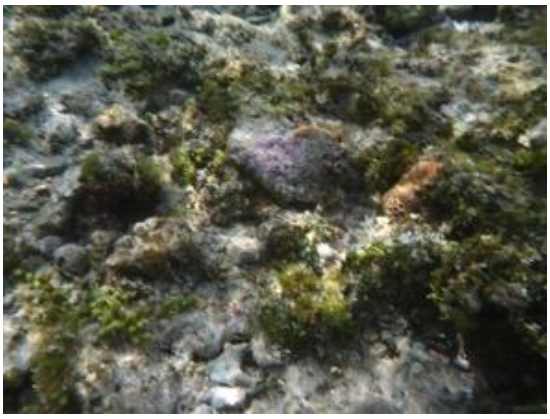
The area experiences strong tidal currents.

Plate 10: Substrate and live coral and macroalgae associated with site H.


Site I: (21026’09.9”S 159080’48.9”W).

This site is located approximately 200 meters from shoreline and 60 meters from the Ritaki channel within the reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse marcoalgae coverage. Low numbers of hard coral colonies are located at this site with a low percentage coral coverage (Plate 11). The intertidal reef flat to the south towards the barrier reef is partially exposed during periods of low water. The area experiences strong tidal currents.

Plate 11: Substrate and live coral and macroalgae associated with site I.



Site J: (21026’14.7”S 159080’42.8”W).

This site is located roughly in the center of the reef flat and about 40 metres to the west of the Ritaki channel within the reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with a diverse marcoalgae coverage and healthy number of small to medium size massive corals (Plate 12). Coral percentage cover at this site is significant. The intertidal reef flat to the south towards the barrier reef is partially exposed during periods of low water.

The area experiences strong tidal currents.

Plate 12: Substrate and live coral and macroalgae associated with site J.

Site K: (21026’15.9”S 159080’38.8”W).

This site is located roughly in the center of the reef flat and on the reef edge of the Ritaki channel with a water depth of 2-3 meters on the reef crest and a channel water depth of 4-5 meters. The substrate is dominated by a hard baseline platform of coral rock interspersed with significant deposits sand and small coral rubble.

Remnant hard coral heads are located throughout this area with limited live colonies. Massive colonies dominate what is alive and macroalgae coverage is very low (Plate 13).

The area experiences strong tidal currents associated with the natural reef channel and experiences sea swells and waves during periods of inclement weather.

Plate 13: Substrate and live coral and macroalgae associated with site K.

Site L: (21026’11.9”S 159080’37.4”W).

This site is located roughly in the center of the reef flat, adjacent to the reef edge of the Ritaki channel with a water depth of 2-3 meters. The substrate is dominated by a hard baseline platform of coral rock interspersed with significant deposits sand and small coral rubble. Remnant hard coral heads are located throughout this area with limited live colonies. Massive colonies dominate what is alive and macroalgae coverage is very low (Plate 14). The area experiences strong tidal currents associated with the natural reef channel and experiences sea swells and waves during periods of inclement weather.

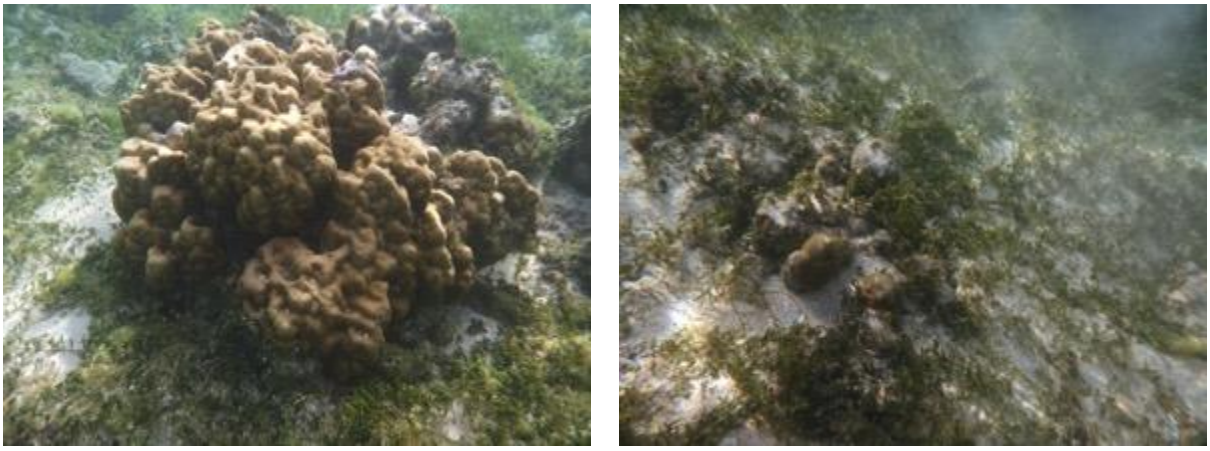
Plate 14: Substrate and live coral and macroalgae associated with site L.

Site M: (21026’06.1”S 159080’38.4”W).

This site is located roughly 100 meters from the shoreline slightly to the west of the Rutaki channel on the reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with a diverse macroalgae coverage and healthy number of small to medium size massive corals (Plate 15). Coral percentage cover at this site good.

The area experiences strong tidal currents.

Plate 15: Substrate and live coral and macroalgae associated with site M.



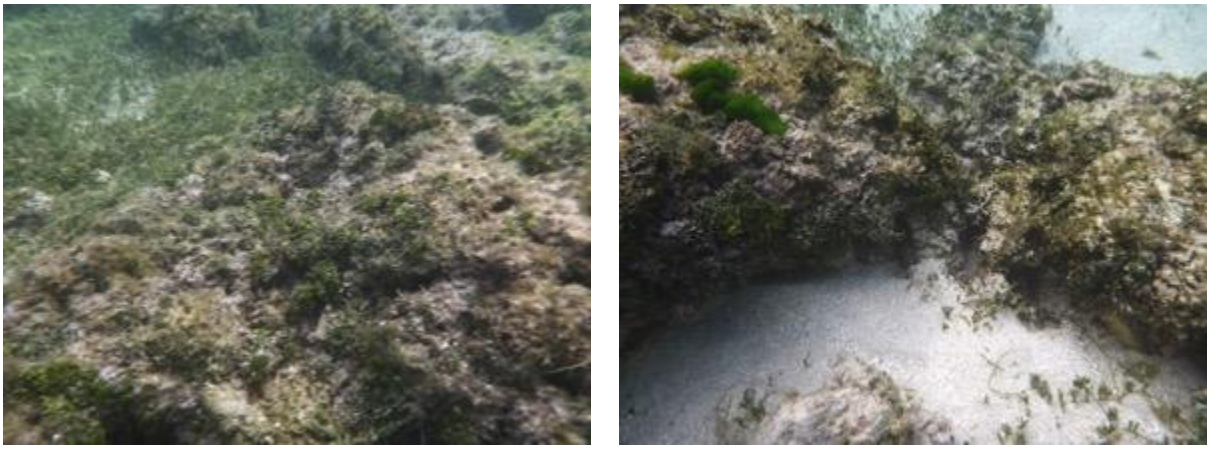
Site N: (21026’00.0”S 159080’38.8”W).

This site is located approximately 30 meters from shoreline within the reef flat with a water depth between (1-1.5 meters).

The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse and healthy marcoalgae coverage. Very low numbers of hard coral colonies are located at this site with a low percentage coral coverage (Plate 16).

The area experiences strong tidal currents.

Plate 16: Substrate and live coral and macroalgae associated with site N.



Site O: (21025’32.8”S 159080’15.6”W).

This site is located shoreward of site G and in close proximity to the location the proposed boat ramp is to be constructed. The site is exposed during low water and as such is the interface between the intertidal reef flat and shoreline. The site is dominated by sand derived from the marine environment and volcanic rocks and sand discharged into the area through the stream located to the west.

It is this region that the cable alignment should be trenched.

Plate 17: Low water and interface at site O

Site P: (21025’30.8”S 159080’26.7”W).

This site is located shoreward of site D and in close proximity to the discharge location of ephemeral stream. The site is exposed during low water and as such is the interface between the intertidal reef flat and shoreline. The site is dominated by sand derived from the marine environment and volcanic rocks and sand discharged into the area through the stream.

It is this region that the cable alignment should be trenched.

Plate 18: Substrate and live coral and macroalgae associated with site P.

RAROTONGA CABLE ALIGNMENT OPTION 3

Subtidal and Intertidal Reef Site Descriptions (Site 1- 8)

Option 3. Includes the cable alignment entering the coastline through one of the small natural reef spur and groove formations located on the reef crest of the barrier reef, crossing the back reef into the sub tidal and intertidal reef flat and entering the shoreline directly adjacent to the proposed cable alignment landing site opposite the school (Figure 3). The cable would be required to be trenched throughout the shallow water and possible placed within an external conduit and fastened to the reef when entering the shallow reef slope, crest and back reef to ensure protection and trenched to a minimum depth of 1 meter when the cable is run through the lagoon.

The intertidal shallow water originating from the reef crest entry point through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform consisting of a very hard crustose coralline algae in the wave zone and small to medium size coral rubble and boulders dispersed over the substrate interspersed with smaller coral rubble and reef derived sand. The shoreline is composed of both sand derived from the reef and volcanic origins. The barrier reef and associated ecosystem is impacted constantly by oceanic swells resulting in significant waves resulting in considerable water movement (strong currents) and as such sand and rubble is constantly moved throughout this zone. The presence of constant wave action is a major constraint in laying a cable through this zone and subsequent constant environmental forces during its use. The back reef and lagoon (subtidal and intertidal regions) have healthy populations and a high percent coverage of hard coral (significant small to medium size Porities sp. colonies) and a diverse, healthy and high percent coverage of marcoalgae.

It is imperative that the cable alignment does not impact the inshore hard coral populations. Invertebrate and finfish population's numbers were low during the low tide assessment. This Option is not recommended due to the high hard coral and macroalgae percentage coverage throughout the cable alignment and the structural difficulties to bring the cable over the reef edge through constant heavy wave action.

Site 1: (21025'77.9"S 159080'98.7"W).

This site is located shoreward of the proposed cable alignment landing site adjacent to the school (Plate 19). The site is exposed during low water and as such is the interface between the intertidal reef flat and shoreline. The shoreline has been supported by the placement of a small rock retaining wall, principally to prevent further erosion from waves and undercutting the road.

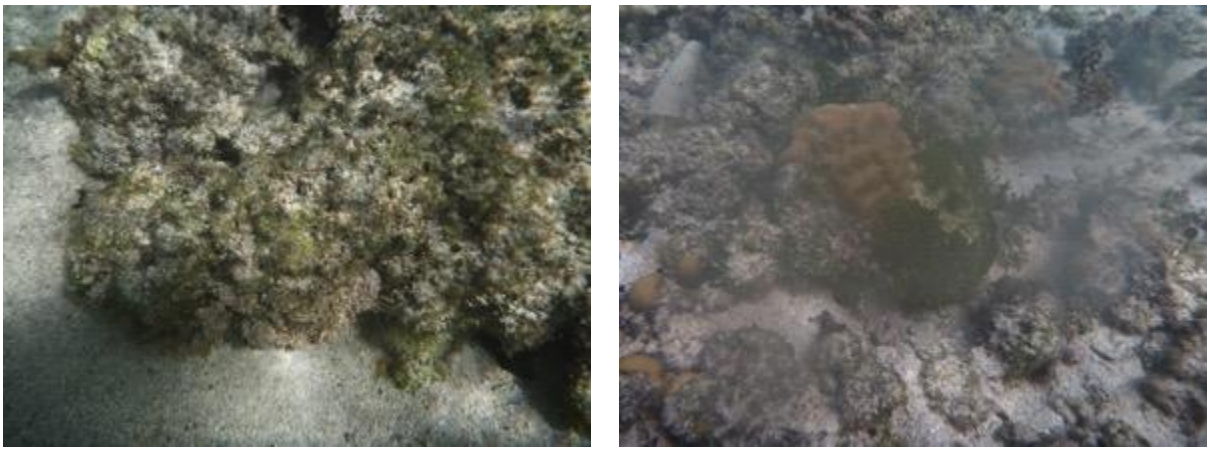
The site is dominated by sand derived from the marine environment and volcanic rocks and sand discharged into the area through the stream located to the east. It is this region that the cable alignment should be trenched.

Plate 19: Substrate and live coral and macroalgae associated with site 1.

Site 2: (21025’82.8”S 159080’99.1”W).

This site is located close to the shoreline (25 m) within the reef flat with a water depth between (1-1.5 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse marcoalgae coverage. A small number of small massive coral colonies were located at this site (Plate 20). Remnants of hard coral colonies were present in this area. The area experiences tidal currents.

Plate 20: Substrate and live coral and macroalgae associated with site 2.



Site 3: (21025’87.9”S 159080’99.1”W).

This site is located about 80 meters from the shoreline within the reef flat with a water depth between (1-2 meters).

The substrate is dominated by a hard baseline platform of coral rock interspersed with sand and small coral rubble with diverse marcoalgae coverage. A small number of small massive coral colonies were located at this site (Plate 21). Remnants of hard coral colonies were present in this area.

The area experiences tidal currents.

Plate 21: Substrate and live coral and macroalgae associated with site 3.


Site 4: (21025’90.8”S 159080’99.3”W).

This site is located directly mid way across the intertidal reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand with a diverse marcoalgae coverage and low number of small to medium size massive corals (Plate 22). The area experiences strong tidal currents.

Plate 22: Substrate and live coral and macroalgae associated with site 4.


Site 5: (21025’98.3”S 159081’01.6”W).

This site is located approximately two-thirds the way across the intertidal reef flat with a water depth between (1-2 meters).

The substrate is dominated by a hard baseline platform of coral rock interspersed with sand with a diverse marcoalgae coverage (over 95% in many areas) and healthy but low number of small to medium size massive corals (Plate 23).

The area experiences strong tidal currents and is influenced by wave actives especially during period of high tide and inclement weather.

Plate 23: Substrate and live coral and macroalgae associated with site 5.


Site 6: (21026’05.8”S 159081’05.4”W).

This site is located approximately 50 meters behind the back reef proper on the intertidal reef flat with a water depth between (1-2 meters). The substrate is dominated by a hard baseline platform of coral rock interspersed with sand with a diverse and healthy macroalgae coverage (over 95% in many areas) and a healthy number of small to medium size massive corals (Plate 24) with some areas showing coral coverage above 20%. The area experiences strong tidal currents and is influenced by wave actives especially during period of high tide and inclement weather.

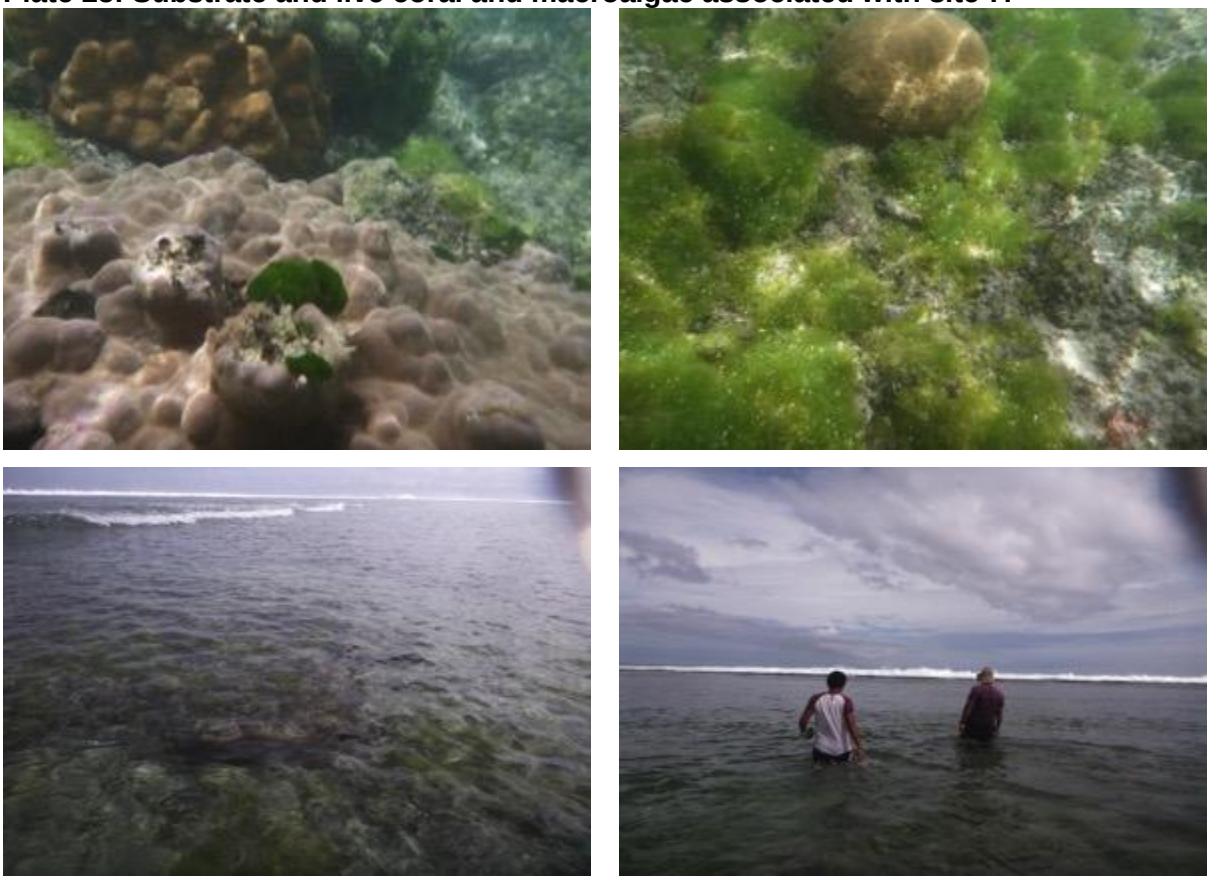
Plate 24: Substrate and live coral and macroalgae associated with site 6.


Site 7: (21026’11.1”S 159081’07.4”W).

This site is located at the shore end of the back reef proper approximately 60 meters behind the reef crest on the intertidal reef flat with a water depth between (1-1.5 meters).

The substrate is dominated by a hard baseline platform of coral rock (constantly scoured by wave action) possessing a diverse and healthy macroalgae coverage (over 95% in many areas) and a healthy number of small to medium size massive corals (Plate 25) with some areas showing coral coverage above 70%. The area experiences strong tidal currents and is influenced by wave actives especially during period of high tide and inclement weather.

Plate 25: Substrate and live coral and macroalgae associated with site 7.



Site 8: (21026’16.0”S 159081’09.7”W).

This site is located mid-way along the back reef proper approximately 30 meters behind the reef crest on the intertidal reef flat with a water depth between (1-2 meters).

The substrate is dominated by a hard baseline platform of coral rock (constantly scoured by wave action) possessing a diverse and healthy marcoalgae coverage (over 95% in many areas) and a healthy number of small to medium size massive and digitate branching corals (Plate 26) with some areas showing coral coverage above 60%.

The area experiences strong tidal currents and is influenced by wave actives especially during period of high tide and inclement weather.

Plate 26: Substrate and live coral and macroalgae associated with site 8.

Aitutaki Alignments

Assessment Findings for proposed cable options for Aitutaki

All assessment sites were undertaken within the shallow water marine environment for Options 1, 2, 3 and 4. Figure 4a and 4b provides the location of each assessment site respectively for options 1 and 2 and Options 3 and 4 and they are described below.

All four cable options are located on the western side (sheltered) of the island. Option 1 and 2 are located in the north western corner of the main island adjacent to the Ministries of Marine Resources National Aquaculture Center (Figure 4a) whilst Options 3 and 4 are located directly adjacent to the main township Arutanga (Figure 3 ad 4), approximately mid-way along the coast line of the main island. Option 3 utilizes the island only commercial and recreational shipping channel. All four option sites can be easily accessed by the islands main circumference road Options 1 and 2 are approximately 5.5 km by road to the east of Arutanga, the capital of the Cook Islands.

The western reef sections of Aitutaki is characterised by an outer barrier reef which is subjected to oceanic swells resulting in seasonal high energy resulting in a wave dominated reef comprised of considerable spur and groove formations, breached by a number of small natural open water reef channels that are directly linked to a shallow flat intertidal lagoon and in the north western corner of the island is strongly influenced by tidal currents.

The inshore marine area of all four sites is characterised by a distinctive reef system that remains similar throughout the area and is dominated by a relatively narrow shallow water

intertidal reef flat that is close to shore which in part is exposed during low tide consisting of beach rock and a small sand beach close to shore and a sub tidal reef flat that extend out to the barrier reef which terminates seaward to a wave dominated reef crest, reef edge and slope which then descends rather steeply to the outer reef slope and beyond.

The sub tidal reef flat is roughly horizontal throughout its entirety averaging between 1-3 meters water depth (it is tidally influenced) and is composed of reef derived sand (calcareous origins) interspersed with significant patches and coverage of hard coral (predominantly massive forms) and macroalgae, with some areas recording live percent coverage above 70%. Sea grass and mangroves are not present at these site locations.

Each site option has a natural seawater reef channel (termed an “ava” in Cook Islands) that opens directly to the open sea (Figure 4 a & b) and have been recommended as a natural pathway for the cable to enter the reef. Ava’s are used by the local fishers to gain access to the open sea, however usage is totally dependent on weather conditions with frequent access impossible due to oceanic swell and wave action. The islands main shipping channel is the largest Ava on the island.

There are no freshwater streams present along the western coast however during seasonal rainfall peak periods natural springs discharge freshwater directly into the shallow waters along the shoreline in close proximity to each of the proposed option landing sites. These are a natural event and will have no impact on the cable deployment or operation.

There are no marine or terrestrial Ra’ui sites associated with any of the proposed cable alignment sites.

The marine environment assessment determined two potential options (1 and/or 2 and 4) for the delivery of the cable to the shoreline. Both options have the cable entering and trenched through the barrier reef via the natural channel.

Option 4 is the preferred cable alignment identified by the environment team. The option is to deliver the cable by running cable through the Rautaro Channel (anchored in a conduit to the reef floor) and across the subtidal and intertidal reef flat to the west of the sand bank, trenched to a depth of 1 meter and landing on a parcel of land to the south of the main shipping harbor and trenched to the road.

The alternative option is Option 1 or Option 2. Both options would utilise the natural sea water channel to deliver the cable directly into the reef (anchored in a conduit to the reef floor) and across the subtidal and intertidal reef flat, trenched to a depth of 1 meter and either landing to the north on the land parcel associated with the MRD Aquaculture Centre or to the south landing adjacent to the old airport runway.

Option 3 is not recommended because its alignment is associated with the island only main commercial shipping channel. The channel requires periodical dredging and major shoreline infrastructure is planned. Both preclude long term justification of this site for the cable location.

All four options are discussed below.

Plate 27 a, b, c, d, e, f, g & h: Landing site locations for 4 Aitutaki options

Option 1 (a & b), Option 2 (c & d), Option 3 (e & f) and Option 4 (g & h)








Subtidal and Intertidal Reef Site Descriptions (Site 1- 7)

Option 1. Includes the cable alignment entering the coastline through the natural barrier reef pass adjacent to the site and onwards through the natural channel exiting the channel through the sand/rubble bed directly to the shore (refer Figure 4a) within the MRD Aquaculture Centers land. The cable is to be trenched to a minimum depth of 1 meter through the lagoon and anchored to the substrate entering the outer and inner ref slope and channel. Consideration for the use of a conduit to provide further protection when traversing these zones should be considered.

The intertidal shallow water originating from the entry point of the channel through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to fine size coral rubble and sand dispersed over the entire sea floor associated with this site. The channel and associated ecosystem has considerable oceanic swells, waves and tidal water movement (strong currents) and as such sand and rubble are constantly moved throughout this zone. The channel floor has limited live coral however the channels vertical edges have healthy populations of hard coral and macroalgae. The intertidal reef flat adjacent to the shoreline has healthy populations of hard coral (significant small to medium size Porities sp. and fire coral Millepora sp. colonies) and a diverse and healthy macroalgae fauna towards the barrier reef. It is imperative that the cable alignment does not impact the inshore hard coral populations.

Invertebrate and finfish population's numbers were low during the low tide assessment, except for the sea cucumber populations of the black lolly fish (Holothuria atra) inshore and the red surf fish (Actinopyga mauritiana) towards the barrier reef.

Site 1: (18049'50.0"S 159046'53.4"W).

This site is located seaward of the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 28) roughly 20 meters from the shoreline. The site is not exposed during low water however holds less than 0.5 meters of water and as such is the interface between the intertidal reef flat and shoreline. The site is dominated by a hard baseline platform of coral rock covered with sand and small size coral rubble derived from the marine environment interspersed with small to medium size massive hard coral heads (Porities sp.) and branching colonies of Millepora sp. with a hard coral coverage in the areas of less than 5 percent. The site has a high stock population of the small black sea cucumber (H. atra) and recorded a very low stock abundance of macroalgae.

The area experiences strong tidal currents associated with tidal movements.

Plate 28: Substrate, live coral and macroalgae associated with site 1.

Site 2: (18049’48.4”S 159046’55.5”W).

This site is located approximately 80 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 29) with water depth between 1-2 meters. The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies of Millepora sp. with a hard coral coverage in the areas of less than 10 percent. The site has a high stock population of the small black sea cucumber (H. atra) and recorded a very low stock abundance of macroalgae. The area experiences strong tidal currents associated with tidal movements.

Plate 29: Substrate, live coral and macroalgae associated with site 2.

Site 3: (18049’47.4”S 159046’59.1”W). This site is located approximately 130 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 30) with water depth between 1-2 meters. The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies of Millepora sp. with a hard coral coverage in the areas of less than 10 percent. The percent coverage of rubble increases as distance from the shoreline increases. The stock population of the small black sea cucumber (H. atra) is considerable lower than sites closer to shore however the red surf fish sea cucumber (A. mauritiana) was located and is associated with the large coral heads located in this area. Macroalgae diversity and population density remains very low. The area experiences strong tidal currents associated with tidal movements.

Plate 30: Substrate, live coral and macroalgae associated with site 3.

Site 4: (18049’46.0”S 159046’61.2”W).

This site is located approximately 200 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 31) with water depth between 1-2 meters. The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies (Millepora sp. and Acropora sp.) with a hard coral coverage in the areas of less than 10 percent. The percent coverage of rubble increases as distance from the shoreline increases.

The stock population of the small black sea cucumber (H. atra) was located rarely however the red surf fish sea cucumber (A. mauritiana) was located and is associated with the large coral heads located in this area. Macroalgae diversity and population density remains very low.

The area experiences strong tidal currents associated with tidal movements.

Plate 31: Substrate, live coral and macroalgae associated with site 4.

Site 5: (18049’45.7”S 159046’63.6”W).

This site is located approximately 240 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 32) with water depth between 1-3 meters. The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies (Millepora sp. and Acropora sp.) with a hard coral coverage in the areas of less than 10 percent. The percent coverage of rubble increases as distance from the shoreline increases. Stock populations of all sea cucumbers and macroalgae remained low.

The area experiences strong tidal currents associated with tidal movements.

Plate 32: Substrate, live coral and macroalgae associated with site 5.

Site 6: (18049’42.9”S 159046’68.0”W).

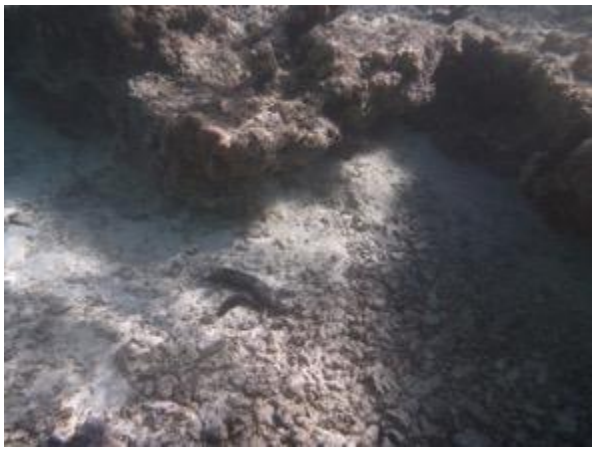
This site is located at the shoreward start of the natural reef channel approximately 270 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 33) with water depth between 1-3 meters. The site is dominated by a hard baseline platform of coral rock covered by predominantly by small to medium size coral rubble with some sand derived from the marine environment in the channel and a hard reef platform on the reef flat proper (back reef).

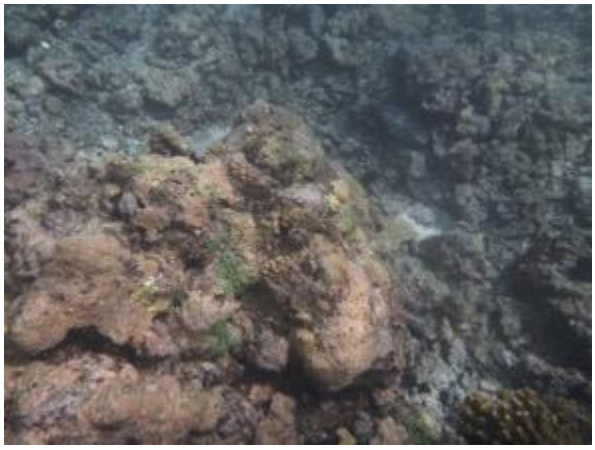
Low coral colony numbers were located within the channel however the channel edges and reef flat had small to medium size massive hard coral heads (Porities sp.) and branching colonies (Millepora sp. and Acropora sp.) with a hard coral coverage in the areas of about 30 percent. The stock populations of all sea cucumbers were low within the channel however the red surf fish sea cucumber (A. mauritiana) showed reasonable population numbers on the reef flat adjacent to the channel.

Macroalgae diversity and population density remained low.

The area experiences strong tidal currents associated with tidal movements, especially associated with the channel.

Plate 33: Substrate, live coral and macroalgae associated with site 6.



Site 7: (18049’39.6”S 159046’73.2”W).

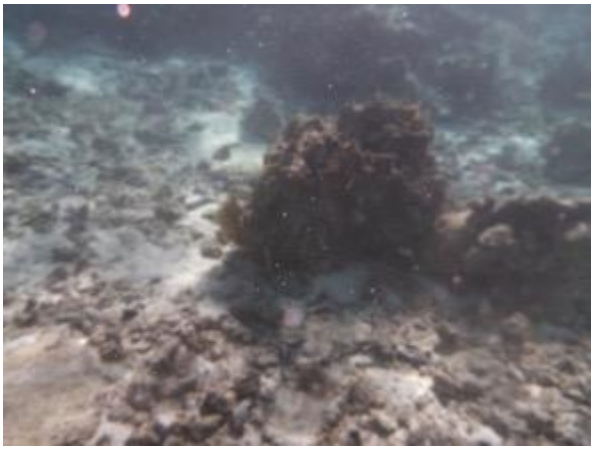
This site is located at the entrance of the natural reef channel approximately 300 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the MRD aquaculture center (Plate 34) with water depth between 1-3 meters on the reef flat and 2-4 meters within the natural channel.

The channel at this site is dominated by a hard baseline platform of coral rock covered by predominantly by small to medium size coral rubble and sand derived from the marine environment. Low coral colony numbers were located within the channel however the channel edges and reef flat had small to medium size massive hard coral heads (Porities sp.) and branching colonies (Millepora sp. and Acropora sp.) with a hard-coral coverage of less than 5 percent.

The reef flat either side of the channel is a hard-horizontal rock reef dominated by crustose coralline algae in the surf zone (and spur and groove formations) with a low numbers of small encrusting branching and massive hard corals. This site is dominated by oceanic swells and waves and strong currents are associated with tidal movement of water through the channel. The stock population of the red surf fish sea cucumber (A. mauritiana) showed reasonable population numbers on the reef flat adjacent to the channel.

Macroalgae diversity and population density remained low.

Plate 34: Substrate, live coral and macroalgae associated with site 7.




Subtidal and Intertidal Reef site Descriptions (Site 8- 11)

Option 2. Includes the cable alignment entering the coastline through the natural barrier reef pass adjacent to the site and onwards through the natural channel exiting the channel through the sand/rubble bed directly to the shore (refer Figure 4a) to the western end of the old airport runway. The cable is to be trenched to a minimum depth of 1 meter through the lagoon and anchored to the substrate entering the outer and inner reef slope and channel. Consideration for the use of a conduit to provide further protection when traversing these zones should be considered. The intertidal shallow water originating from the entry point of the channel through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to fine size coral rubble and sand dispersed over the entire sea floor associated with this site.

The channel and associated ecosystem has considerable oceanic swells, waves and tidal water movement (strong currents) and as such sand and rubble are constantly moved throughout this zone. The channel floor has limited live coral however the channels vertical edges have healthy populations of hard coral and some macroalgae.

The intertidal reef flat adjacent to the shoreline has healthy populations of hard coral (significant small to medium size Porities sp. and fire coral Millepora sp. colonies) and a diverse and healthy macroalgae fauna towards the barrier reef. It is imperative that the cable alignment does not impact the inshore hard coral populations.

Invertebrate and finfish population's numbers were low during the low tide assessment, except for the sea cucumber populations of the black lolly fish (Holothuria atra) inshore and the red surf fish (Actinopyga mauritiana) towards the barrier reef.

Sites 7, 6 and 5 described in Option 1 should be referred to for a description of the channel entering the reef flat.

Site 8: (18049'44.7"S 159046'68.5"W).

This site is located approximately 200 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the old airport runway (Plate 35) with water depth between 1-2 meters.

The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies (Millepora sp. and Acropora sp.) with a hard-coral coverage in the areas of less than 10 percent. The percent coverage of rubble increases as distance from the shoreline increases.

The stock population of the small black sea cucumber (H. atra) and the red surf fish sea cucumber (A. mauritiana) were located in reasonable numbers throughout this area in their preferred habitats.

Macroalgae diversity and population density remains very low.

The area experiences strong tidal currents associated with tidal movements.

Plate 35: Substrate, live coral and macroalgae associated with site 8.


Site 9: (18049’47.8”S 159046’64.4”W).

This site is located approximately 150 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the old airport runway (Plate 36) with water depth between 1-2 meters. The site is dominated by a hard baseline platform of coral rock covered and dominated by sand and small size coral rubble derived from the marine environment interspersed with a small number of medium to large size massive hard coral heads (Porities sp.) and branching colonies (Millepora sp. and Acropora sp.) with a hard coral coverage in the areas of less than 5 percent.

The stock populations of the small black sea cucumber (H. atra) and the red surf fish sea cucumber (A. mauritiana) were located in reasonable numbers throughout this area in their preferred habitats. Macroalgae diversity and population density remains very low.

The area experiences tidal currents associated with tidal movements.

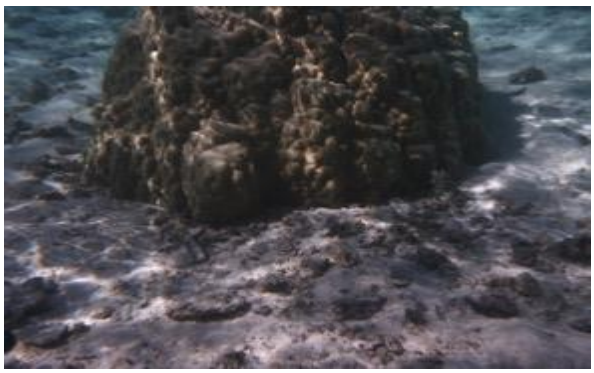
Plate 36: Substrate, live coral and macroalgae associated with site 9.


Site 10: (18049’52.0”S 159046’62.4”W). This site is located approximately 110 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the to the old airport runway (Plate 37) with water depth between 1-2 meters. The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies of Millepora sp. with a hard coral coverage in the areas of less than 5 percent.

The stock population of the small black sea cucumber (H. atra) is considerable lower than sites closer to shore however the red surf fish sea cucumber (A. mauritiana) was located and is associated with the large coral heads located in this area. Macroalgae diversity and population density remains very low.

The area experiences strong tidal currents associated with tidal movements.

Plate 37: Substrate, live coral and macroalgae associated with site 10.



Site 11: (18049’55.0”S 159046’59.6”W). This site is located approximately 50 meters from the shoreline within the intertidal reef flat adjacent to the proposed cable alignment landing site adjacent to the to the old airport runway (Plate 38) with water depth between 1-1.5 meters. The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed with medium to large size massive hard coral heads (Porities sp.) and branching colonies of Millepora sp. with a hard coral coverage in the areas of less than 5 percent. The site has a high stock population of the small black sea cucumber (H. atra) and recorded a very low stock abundance of macroalgae.

The area experiences tidal currents associated with tidal movements.

Plate 38: Substrate, live coral and macroalgae associated with site 11.

Subtidal and Intertidal Reef site Descriptions (Site 1- 11)

Option 3. Includes the cable alignment entering the coastline through the Aitutaki main pass and onwards through the natural channel exiting into the manmade harbor and landing onshore within the harbor facilities (figure 4b).

The cable is to be trenched to a minimum depth of 1 meter within the channel and harbor and should be run through an additional protective conduit when the cable is brought from the deep ocean to the lower and upper reef slope to aid in securing the cable to the hard reef. Consideration for running the cable through a conduit to provide additional protection for all marine sections is recommended.

The intertidal shallow waters associated with the channel originating from the barrier reef entry point through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to medium size coral rubble dispersed over the substrate and significant reef derived sand deposits (especially landward).

The channel, especially the entrance and associated ecosystem is impacted by oceanic swells, waves and tidal water movement (strong currents) and as such sand and rubble are constantly moved throughout this zone. The channel floor is absent of live coral however the channels vertical edges have healthy populations of hard coral and macroalgae. The intertidal reef flat adjacent to the channel has healthy populations of hard coral (significant small to medium size Porities sp. colonies) and a diverse and healthy marcoalgae. Of interest reef systems to the south of the channel have considerably higher hard coral and macroalgae coverage than the northern reef flats.

Invertebrate and finfish population's numbers were low during the low tide assessment, however the red surf fish sea cucumber (A. mauritiana) were located in high densities on the western reef flats adjacent to the channel and populations of the Lolly fish (H. atra) were high in inshore reef flat areas.

Option 3 is not recommended due to its alignment passing directly through the island only main commercial shipping channel. The channel requires periodical dredging (which has been undertaken before) and major shoreline infrastructure is planned. Both preclude long term justification of this site for the cable location.

Site 1: (18051'74.4"S 159048'12.3"W).

This site is located approximately 350 meters from the shoreline within the intertidal reef flat adjacent to the Aitutaki harbor on the northern side of the main channel (Plate 40) with water depth between 1-2 m on the reef flat and 2-4 m within the channel.

The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment. The channel floor was almost devoid of large coral rocks, and no hard coral were present. Hard coral coverage was very low (Porities sp., Pocillopora sp.) on the channels reef edge, however significant coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate was recorded at this site.

Stock populations of the black sea cucumber (H. atra) were present.

The area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 40: Substrate, live coral and macroalgae associated with site 1.

Site 2: (18051'64.3"S 159048'17.9"W). This site is located approximately 550 meters from the shoreline (half way along the channel) within the intertidal reef flat adjacent to the Aitutaki harbor on the northern side of the main channel (Plate 41) with water depth between 1-2 m on the reef flat and 2-4 m within the channel.

The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment. The channel floor was almost devoid of large coral rocks, and no hard coral were present. Hard coral coverage was very low (Porities sp., Pocillopora sp.) on the channels reef edge, however significant coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate was recorded at this site.

The area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 41: Substrate, live coral and macroalgae associated with site 2.

Site 3: (18051’55.8”S 159048’24.5”W).

This site is located approximately 750 meters from the shoreline within the intertidal reef flat adjacent to the Aitutaki harbor on the northern side of the main channel (Plate 42) with water depth between 1-2 m on the reef flat and 2-3 m within the channel. This site has recorded the shallowest section of the channel.

The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment.

The channel floor was completely devoid of coral rocks and dominated by sand. No hard corals were present.

Hard coral coverage was very low (Porities sp., Pocillopora sp.) on the channels reef edge, however significant coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate was recorded at this site.

The area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 42: Substrate, live coral and macroalgae associated with site 3.

Site 4: (18051’42.2”S 159048’33.3”W).

This site is located approximately 70 meters from the entrance of the channel within the intertidal reef flat adjacent to the Aitutaki harbor on the northern side of the main channel (Plate 43) with water depth between 1-2 m on the reef flat and 2-5 m within the channel.

The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment.

The channel floor was devoid of coral rocks and dominated by sand interspersed with small to medium size coral rubble.

Hard coral coverage was significant (Porities sp., Pocillopora sp., Acropora sp.) on the channels reef edge and slope, dominated by massive forms interspersed with significant coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate.

The area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 43: Substrate, live coral and macroalgae associated with site 4.


Site 5: (18051’30.3”S 159048’39.9”W).

This site is located at the entrance of the channel, adjacent to the intertidal reef flat and the Aitutaki harbor on the northern side of the main channel (Plate 44) with water depth between 1-2 m on the reef flat and 2-10 m directly outside the channel associated with the outer reef edge and upper slope. The reef slope drops steeply to the ocean floor within 80 meters of the reef crest.

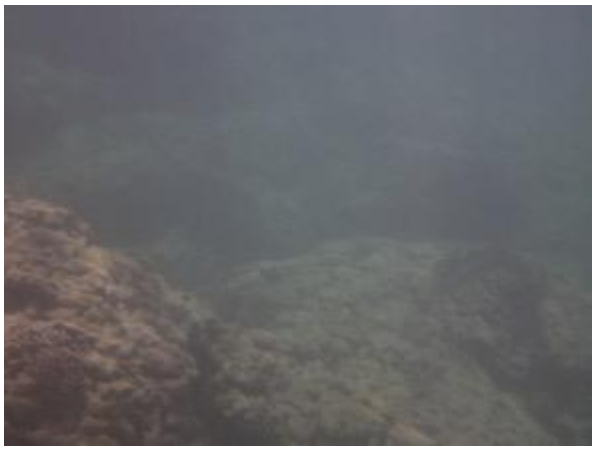
The site is dominated by a hard baseline platform of coral rock covered by coralline algae in the surf zone (reef crest), whilst small spur and grove formations dominate the outer reef edge and upper slope. Significant large massive hard coral colonies (Porities sp.) dominate the upper reef slope and the entrance to channel with smaller colonies of branching Acropora species present. The hard coral coverage in this area is 30 percent.

The channel floor is dominated by a hard substrate which includes, especially along the channel edges hard corals dominated by small to medium size massive hard corals (Porities sp.) interspersed with coral sand small to medium size coral rubble.

Macroalgae coverage remains high on the intertidal reef flat behind the reef crest, shoreward of the wave zone and is dominated by a range of species and growth forms.

The area is dominated by oceanic swell, waves and experiences significant tidal currents during incoming and outgoing tidal phases.

Plate 44: Substrate, live coral and macroalgae associated with site 5.

Site 6: (18051’34.6”S 159048’45.8”W).

This site is located to the south of the entrance of the channel, adjacent to the intertidal reef flat and the Aitutaki harbor on the southern side of the main channel (Plate 45) with water depth between 2-15 m directly outside the channel associated with the outer reef edge and upper slope. The reef slope drops steeply to the ocean floor within 80 meters of the reef crest.

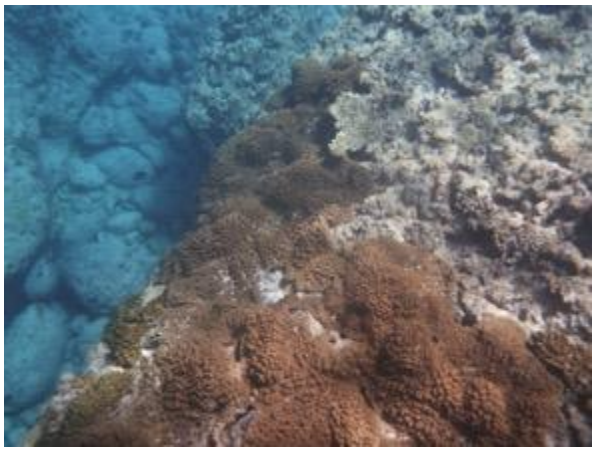
The site is dominated by a hard baseline platform of coral rock covered by coralline algae in the surf zone (reef crest), whilst medium to large size spur and grove formations dominate the outer reef edge and upper slope. Small to medium size coral rubble/rocks are present in the bottom of the spur and groove formations.

Significant massive and encrusting hard coral colonies (Porities sp., Acropora sp.) dominate the upper reef slope. The hard coral coverage in this area is 30 percent.

Macroalgae coverage is very low and the area is dominated by oceanic swell, waves and is influenced by the tidal currents associated with the main reef channel.

The southern reef section adjacent to the reef channel is significantly different biologically than the northern side – this is part is associated with the direction the discharge water exiting the channel, which moves to the north. Resulting in the water directly south of the channel remaining feed by oceanic waters.

Plate 45: Substrate, live coral and macroalgae associated with site 6.



Site 7: (18051’43.1”S 159048’58.1”W).

This site is located approximately 300 metres to the south of the entrance of the channel, adjacent to the intertidal reef flat (Plate 46) with water depth between 2-15 m.

The site is adjacent to the “Rautaro” (southernmost) and Arani small barrier reef channels and is associated with the outer reef edge and upper slope. The reef slope drops steeply to the ocean floor within 150 meters of the reef crest and includes a large coral pinnacle that extents about 120 meters from the reef crest and includes deep furrows that contain little live hard coral and align with the small reef channels. The southern channel “Rautaro” is the preferred cable alignment pathway entering the reef.

The site is dominated by a hard baseline platform of coral rock covered by coralline algae in the surf zone (reef crest), whilst medium to large size spur and grove formations dominate the outer reef edge and upper slope. Small to medium size coral rubble/rocks are present in the bottom of the spur and groove formations.

Significant massive and encrusting hard coral colonies (Porities sp., Acropora sp.) dominate the upper reef slope The hard coral coverage in this area is 25 percent.

The channel floor is dominated by a hard substrate which includes, especially along the channel edges hard corals dominated by small to medium size massive hard corals (Porities sp.) interspersed with coral sand small to medium size coral rubble.

Macroalgae coverage is very low and the area is dominated by oceanic swell, waves and is influenced by the tidal currents associated with the main reef channel. It increases on the reef flat past the surf zone.

The southern reef section adjacent to the reef channel is significantly different biologically than the northern side – this is part is associated with the direction the discharge water exiting the channel, which moves to the north. Resulting in the water directly south of the channel remaining feed by oceanic waters.

Plate 46: Substrate, live coral and macroalgae associated with site 7.

Site 8: (18051'.43.3"S 151048'20.2"W).

This site is located just inside the entrance of the channel (40m), adjacent to the intertidal reef flat and the Aitutaki harbor on the southern side of the main channel (Plate 47) with water depth between 1-2 m on the reef flat and 2-6 m within the channel.

The site is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment. The channel floor was devoid of coral rocks and dominated by sand interspersed with small to medium size coral rubble.

Hard coral coverage was significant (Porities sp., Pocillopora sp., Acropora sp.) on the channels reef edge (almost vertical), dominated by massive forms interspersed with medium coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate.

The reef flat (south) is dominated by a hard reef platform with significant marcoalgae coverage and diversity, hard coral encrusting, digitate and massive forms (20 % coverage) and a high population of the red surf fish sea cucumber (A. Mauritania) was recorded. Of interest significant colonies of the green alga (Caulerpa sp.) locally known as sea grapes, which are harvested both for subsistence and small scale commercial activities (food).

The area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 47: Substrate and live coral and macroalgae associated with site 8.

Site 9: (18051’46.4”S 159048’32.3”W).

This site is located approximately 220 m inside the entrance of the channel, adjacent to the intertidal reef flat and the Aitutaki harbor on the southern side of the main channel (Plate 48) with water depth between 1-2 m on the reef flat and 2-4 m within the channel.

The channel floor is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment.

Hard coral coverage is relatively high and is dominated by medium to large massive forms (predominately Porities sp., and Pocillopora sp.,) associated with the interface between the intertidal reef flat and the channel reef edge. The site has a healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate within this area.

The reef flat showed a low number of the lolly fish sea cucumber (H. atra) and the area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 48: Substrate, live coral and macroalgae associated with site 9.

Site 10: (18051’53.7”S 159048’27.1”W).

This site is located approximately 400 m from the shoreline within the intertidal reef flat adjacent to the Aitutaki harbor on the southern side of the main channel (Plate 49) with water depth between 1-2 m on the reef flat and 2-3 m within the channel.

The channel floor is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment. Hard coral coverage is relatively high and is dominated by medium to large massive forms (predominately Porities sp., and Pocillopora sp.,) associated with the interface between the intertidal reef flat and the channel reef edge. The site has a healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to any hard substrate within this area.

The reef flat showed a low number of the lolly fish sea cucumber (H. atra) and the area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 49: Substrate, live coral and macroalgae associated with site 10.

Site 11: (18051’69.9”S 159048’16.9”W).

This site is located approximately 250 meters from the shoreline within the intertidal reef flat located directly south of an exposed sand bank adjacent to the Aitutaki harbor on the southern side of the main channel (Plate 50) with water depth between 1-2 m on the reef flat and 2-4 m within the channel. The site is dominated by a hard baseline platform of coral rock covered by significant deposits of sand interspersed with small size coral rubble derived from the marine environment.

The site was almost devoid of hard corals, however a significant coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.) attached to both hard substrate and embedded in the sand.

Stock populations of the black sea cucumber (H. atra) were present.

The area experiences tidal currents associated with tidal movements with increased velocity within the channel.

Plate 50: Substrate, live coral and macroalgae associated with site 11.


Subtidal and Intertidal Reef site Descriptions (Site A- F)

Option 4. Includes the cable alignment entering the coastline through the Rautaro channel, approximately 300 meters to the south of the main Aitutaki shipping channel and onwards across the intertidal reef flat passing south of the large intertidal sand bank and exiting onto the shoreline adjacent to the community pathway through to the main road to the south (300 m) of the main harbor (Figure 4b).

The cable is to be anchored preferable in a conduit to the reef floor as it enters the outer and inner reef slope (70 m deep) and whilst it enters the channel and through onto the reef flat proper. The cable is to be trenched to a minimum depth of 1 meter across the intertidal reef flat until it lands at the shoreline. Consideration for running the cable through a conduit to provide additional protection for all marine sections is recommended.

The intertidal shallow waters associated with the Rautaro channel originating from the barrier reef entry point through to the shoreline has a consistent benthic profile that includes a base layer of hard reef platform which has small to medium size coral rubble dispersed over the substrate and significant reef derived sand deposits (especially landward).

The barrier reef, including the channel is impacted by oceanic swells, waves and tidal water movement and as such sand and rubble are constantly moved throughout this zone.

The intertidal reef flat adjacent to the barrier reef edge and close to the shoreline have healthy populations of massive hard corals (significant medium to large size Porities sp. colonies) and a diverse and healthy marcoalgae coverage is located throughout the area.

Invertebrate and finfish population’s numbers were low during the low tide assessment.

This option is the preferred cable alignment identified by the environment team. Due diligence when laying the cable is required to ensure impacts are negligible.

Site A: (18052’05.3”S 159048’16.5”W).

This site is located approximately 200 m from the shoreline within the intertidal reef flat adjacent to the landing site to the south of the Aitutaki harbor (Plate 51) with a water depth between 1-3 m.

The intertidal substrate is dominated by a hard baseline platform of coral rock covered by sand and small size coral rubble derived from the marine environment interspersed between massive hard coral colonies.

Hard coral coverage is high and is dominated by medium to large massive forms (predominately Porities sp., and Pocillopora sp.,) associated with the interface between the intertidal reef flat and the small man made channel located to the west of the site.

As hard coral coverage in this area is high, due diligence will be required when laying the cable to ensure corals are not impacted.

The site has a very healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.).

The reef flat possesses a healthy population of the lolly fish sea cucumber (H. atra).

Plate 51: Substrate, live coral and macroalgae associated with site A.

Site B: (18052’00.1”S 159048’20.0”W).

This site is located approximately 400 m from the shoreline within the intertidal reef flat to the west of the man-made channel and south of the Aitutaki harbor (Plate 52) with a water depth between 1-2 m.

The intertidal substrate is dominated by a hard baseline platform of coral rock covered by sand and some small size coral rubble derived from the marine environment interspersed between massive hard coral colonies.

Hard corals at this site are dominated by medium to large massive forms (predominately Porities sp., and Pocillopora sp.,).

The site has a very healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.).

Populations of all sea cucumbers were low.

Plate 52: Substrate, live coral and macroalgae associated with site B.


Site C: (18051’91.5”S 159048’27.9”W).

This site is located approximately 570 m from the shoreline within the intertidal reef flat adjacent to the beginning of the intertidal sand bank (parts of which are exposed during low water) to the south of the Aitutaki harbor (Plate 53) with a water depth between 1-2.5 m.

The intertidal substrate is dominated by a hard baseline platform of coral rock covered by sand and some small size coral rubble derived from the marine environment interspersed between massive hard coral colonies.

Hard corals at this site are dominated by medium to large massive forms (predominately Porities sp., and Pocillopora sp.,).

The site has a very healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.).

Plate 53: Substrate, live coral and macroalgae associated with site C.


Site D: (18051’79.9”S 159048’47.4”W).

This site is located approximately 650 m from the shoreline within the intertidal reef flat adjacent to the seaward end of the intertidal sand bank (pasts of which are exposed during low water) to the south of the Aitutaki harbor (Plate 54) with a water depth between 1-3 m. The intertidal substrate is dominated by a hard baseline platform of coral rock covered by sand and some small size coral rubble derived from the marine environment interspersed between massive hard coral colonies. Hard corals at this site are dominated by medium to large massive forms (predominately Porities sp., and Pocillopora sp.,).

The site has very healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.).

Plate 54: Substrate, live coral and macroalgae associated with site D.

Site E: (18051’72.7”S 159048’47.4”W).

This site is located approximately 370 m east of the Rautaro channel (barrier reef) within the intertidal reef flat to the south of the Aitutaki harbor (Plate 55) with a water depth between 1-3 m.

The intertidal substrate is dominated by a hard baseline platform of coral rock covered by sand and small to medium size coral rubble derived from the marine environment interspersed between massive hard coral colonies.

Hard corals diversity has increased at this site (closer to the barrier reef) and is dominated by medium to large massive and digitate forms (predominately Porities sp., Pocillopora sp., and Acropora sp.).

The site has a very healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.).

Plate 55: Substrate, live coral and macroalgae associated with site E.

Site F: (18051’60.9”S 159048’52.1”W).

This site is located approximately 70 m east of the Rautaro channel (barrier reef) within the intertidal reef flat to the south of the Aitutaki harbor (Plate 56) with a water depth between 1-3 m.

The intertidal substrate is dominated by a hard baseline platform of coral rock covered by sand and small to medium size coral rubble derived from the marine environment interspersed between massive hard coral colonies.

Hard corals diversity has increased at this site (closer to the barrier reef) and is dominated by medium to large massive and digitate forms (predominately Porities sp., Pocillopora sp., and Acropora sp.).

The site has a very healthy coverage of macroalgae (Padina sp., Dictyota sp., Turbinaria sp.).

Plate 56: Substrate, live coral and macroalgae associated with site F.

Site 7: (18051’43.1”S 159048’58.1”W).

This site is located approximately 300 metres to the south of the entrance of the channel, adjacent to the intertidal reef flat (Plate 46) with water depth between 2-15 m.

The site is adjacent to the “Rautaro” (southernmost) and Arani small barrier reef channels and is associated with the outer reef edge and upper slope. The reef slope drops steeply to the ocean floor within 150 meters of the reef crest and includes a large coral pinnacle that extents about 120 meters from the reef crest and includes deep furrows that contain little live hard coral and align with the small reef channels.

The southern channel “Rautaro” is the preferred cable alignment pathway entering the reef.

The site is dominated by a hard baseline platform of coral rock covered by coralline algae in the surf zone (reef crest), whilst medium to large size spur and grove formations dominate the outer reef edge and upper slope. Small to medium size coral rubble/rocks are present in the bottom of the spur and groove formations.

Significant massive and encrusting hard coral colonies (Porities sp., Acropora sp.) dominate the upper reef slope the hard coral coverage in this area is 25 percent.

The channel floor is dominated by a hard substrate which includes, especially along the channel edges hard corals dominated by small to medium size massive hard corals (Porities sp.) interspersed with coral sand small to medium size coral rubble.

Macroalgae coverage is very low and the area is dominated by oceanic swell, waves and is influenced by the tidal currents associated with the main reef channel. It increases on the reef flat past the surf zone.

The southern reef section adjacent to the reef channel is significantly different biologically than the northern side – this is part is associated with the direction the discharge water exiting the channel, which moves to the north. Resulting in the water directly south of the channel remaining feed by oceanic waters.

Plate 46: Substrate, live coral and macroalgae associated with site 7.

International and Regional Treaties, Conventions and Agreements

The Cook Islands are signatory to a number of international conventions and treaties that have relevance to the project. These are:

- *Agreement establishing the South Pacific Regional Environment Program (SPREP), 1993;*
- Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, 1986;
- Protocol for Prevention of Pollution of the South Pacific Region by Dumping, 1990;
- Convention on the Conservation of Nature in the South Pacific, 1976;
- United Nations Framework Convention on Climate Change, 1992;
- Kyoto Protocol to the Framework Convention on Climate Change, 2005;
- Convention on Biological Diversity, 1992;
- Vienna Convention for the Protection of the Ozone Layer, 1985;
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987;
- United Nations Convention to Combat Desertification, 1994;
- Convention on the Protection of the World Cultural and Natural Heritage, 1972;
- Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 1998;
- Basel Convention on the Control of Trans-Boundary Movements of Hazardous Wastes and their Disposal, 1989;
- Convention on Persistent Organic Pollutants, 2001;
- Convention on Wetlands of International Importance, 1971;
- Convention on International Trade in Endangered Species of Wild Fauna, 1973;
- *Convention of Migratory Species, 1979;*
- Protocol concerning Cooperation in combating Pollution Emergencies in the South Pacific Region, 1990;
- Cartagena Protocol on Biosafety to the convention of Biological Diversity, 2003;
- *International Convention for the Prevention of Marine Pollution form ships MARPOL, 2006.*
- International Plant Protection, 1951;
- International Treaty on Plant and Genetic Resources for Food & Agriculture, 2001;
- Plant Protection Agreement for the South-East Asia & Pacific Region, 1956;
- Strategic Approach to International Chemicals Management, 2007.
- Convention on the International Maritime Organisation as amended 1999.
- Convention on the International Regulation for Preventing Collisions at Sea, 1972.

Cook Islands membership list to international and regional organizations associated with the marine sector.

International Environmental Organisation Membership

- United Nations (UN)
- United Nations Development Program (UNDP)
- Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Food and Agriculture Organization of the United Nations (FAO)
- International Seabed Authority (ISA)
- International Watershed Project (IWP)
- *International Whaling Commission (IWC)*
- International Tribunal for Law of the Sea (ITLOS)
- International Maritime Organization (IMO)
- Bureau (Secretariat) of the Convention on Wetlands (RAMSAR)
- Secretariat of the United Nation Convention to Combat Desertification (UNCCD)
- Secretariat of the United Nations Convention on Biological Diversity (UNCBD)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC)

Regional Organisations Membership

- *Western and Central Pacific Fisheries Commission (WCPFC)*
- *Secretariat of the Pacific Community (SPC)*
- *Forum Fisheries Agency (FFA)*
- *Secretariat of the Pacific Islands Forum (PIF)*
- *Secretariat of the Pacific Regional Environment Programme (SPREP)*
- *Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific (SPC)*

Of these, the ones in italics are most relevant and should be accessed if issues of use of the seabed, vessel operations and fisheries are triggered by the project. Membership to the six regional organizations facilitates information exchange and allows for each member country to seek advice and resource management data when needed. For this project, it might be EIA implementation training and whale migration monitoring.

Cetacean Literature Review

Literature review of potential effects of sonar and entanglement on Cetaceans during oceanic cable deployment

Cetaceans use sound as a means of communication with each other, to locate prey and to navigate. In order for cetaceans to hear effectively, they have a highly sophisticated auditory system and a similarly developed vocalisation system to emit sound. Both systems have the ability to detect and produce sounds spanning a very wide range of frequencies. These systems are, however, prone to disruption and damage by non-natural sound for which they have not evolved.

The sound they emit is one of the many forms of natural noise that can be detected in the ocean. In addition to this natural noise there is an increasing intensity and continuity of human-produced sound emanating from shipping and boat traffic, underwater construction, and dredging, acoustic exploration, military activity and active sonar systems. Such sound is commonly referred to as noise pollution. Both natural and anthropogenic sound can travel many hundreds or even thousands of kilometres underwater.

Marine Seismic assessments employ pulses of sound to image the geological structure of the seabed. If these activities are in close spatial proximity to marine animals (e.g. cetaceans) that rely on sound for orientation, communication and foraging the resulting noise from the sonar can increase the risk of harm to these animals (Berzina & Saksina, 2013).

The response of cetaceans to noise falls into three categories: behavioral, acoustic and physiological. Behavioral responses include individuals actively avoiding sound sources, modifying feeding behaviour, and even modifying surfacing behaviour. Acoustic responses include changes to the frequency, intensity and duration of vocalisation by individuals' subject to external sound sources. Finally, and most severe, are physiological responses which include, at the lesser end of the spectrum, a change in heart rate through to physical damage of auditory systems in individuals exposed to high intensity sound (Nowacek 2007).

These responses typically deal with individuals. There is also the potential for population- level responses through, for example, altered mating behaviour affecting population fecundity. Given, however, that much of the data on cetacean population size is uncertain at best, finding changes to such metrics much less proving causative pathways to noise pollution is at present not possible (Nowacek, 2007).

The level of likely response by both individual cetacean and possibly by population is highly dependent on a number of factors. Primarily, the intensity and frequency of the sound source are of critical importance. In general, as the intensity increases the potential for negative response by cetaceans increase. The sensitivity of cetaceans also changes. During mating and migration for example, the rate of vocalisation is far greater than during periods of 'rest'. Consequently, these life history stages are more susceptible to noise pollution impacts.

Within the proposed development area there are likely two sources of sound pollution, one specific to the design phase and one originating during both the design and the construction phase.

During the marine route survey of the design phase, active sonar will be used to find the depth of water in which the cable will be laid in addition to the nature (topography and perhaps substrate) of the seabed. For this, two types of sonar will be used: a) multibeam sonar for bathymetry and b) side-scan sonar for bottom typing. Both these sonar types are at the lower end of the intensity scale, though they are generally considered high acoustic density sources and medium frequency generators.

The level of sound pressure ranges from about 200 dB re 1µPa to 240 dB re 1µPa. The frequency ranges from about 50 to 500 kHz. The nature of propagation varies depending on the nature of the survey, although it can generally be expected to conform to a conical pattern with a greater swath being covered in deeper water.

To survey deeper water, it is necessary to use lower frequency to compensate for the attenuating properties of seawater. However, the lower the frequency of source used, the lower the resolution of images collected. Therefore, it is likely that for most operations the maximum detectable frequency will be used.

There is a significant difference in the effects of seismic and multibeam/side-scan surveys on cetaceans. Higher frequency emissions utilized in normal multibeam operations tend to be dissipated to safe levels over a relatively short distance despite having similar sound levels to seismic surveys. By contrast the lower frequency (and higher intensity) emissions of seismic surveys, including air gun arrays, travel over a far greater distance and esonify a greater area at greater intensity (Department of Environment, Heritage and Local Government, Government of Ireland, 2007).

Given this difference in intensity between seismic (air gun) survey and more conventional sonar bathymetric survey, this environmental assessment is valid only for multibeam and sides can sonar. In the unlikely event that seismic surveys are required during the route survey, this would require additional assessment, mitigation and management actions.

Information resulting from the Antarctic Treaty Consultative meeting on acoustic effects on cetaceans in the Southern Ocean found the following level of responses and associated likelihoods of occurrence for multibeam sonar (Scientific Committee on Antarctic Research, 2006) and, given the similar acoustic properties of side-scan, a similar response is likely for the use of side-scan sonar.

- Individuals show no response or only a temporary (minutes) behaviour change. No change to environment or populations. Expected in almost all instances
- Individuals show short-term (hours) behaviour change. Temporary displacement of a small proportion of a population; small proportion of habitat affected; no impact on ecosystem function. Could occur in some cases
- Longer term (days) simultaneous displacement of a higher proportion of a population; disruption to behaviour; interference with feeding. May occur in exceptional circumstances.

The main concern associated is its effect on the large whale populations that utilise the waters associated with the proposed cable route area of interest. Information is not available on specific temporal scales to determine when different species and/or populations of these animal frequent the waters of Palau however during this period displacement of a proportion of the population and disruption to behaviour could result in modified migration behaviour.

Given this concern, best practice should be followed when sonar is used during the route survey. This best practice is described in Annex 6 of this report. If this best practice is followed, most of the concerns can be mitigated and the impact would be rendered insignificant.

The second source of noise pollution during both the route survey design and cable laying construction phase is the activity of survey and cable-laying vessels. Vessels have acoustic footprints generated by engines and transmitted through the hulls as well as by moving propulsion systems in water (Whale and Dolphin Conservation Society 2009). Given, however, that the vessels involved in the route survey and laying stages are likely to be in the region for only relatively short periods of time and given that the proposed cable route area is traversed regularly by other vessels, the proposed development does not constitute a significant additional ship-noise burden.

The second potential impact is entanglement or physical contact by cetaceans with the cable when it is being laid. Given that the cable laying process will take place over a very short period, however, this is considered extremely unlikely and is therefore considered an insignificant impact.

The final potential impact comes after the cable has been laid during the operational phase. Between 1877 and 1955 there were 16 records of cetaceans becoming entangled in unsupported sections of submarine cables. The most at risk group of cetaceans are the deep diving toothed species such as sperm whales (Heezen 1953), whose feeding behaviour involves swimming along the seabed with the lower jaw skimming the sediment.

However, a more recent exhaustive study of cable fault databases containing records of 5740 cable faults, between 1959 and 2006, failed to find a single record of cetacean entanglement in cables (Wood & Carter 2008). The review attributes this change in the frequency of entanglement, to change in the design of cables (coaxial to fiber optics), marine surveying resolution and availability, and cable laying techniques. In particular, the following five reasons are stated: 1) development of torque-balanced cables that were less prone to self- coiling; 2) laying armored cables under slight tension to minimize suspensions and loops, and laying low-torque, non-armored cables with minimum slack to follow the seabed topography; 3) avoidance of rough topography where suspensions may develop; 4) burial of cables below the seabed on the continental shelf and upper slope to protect against shipping and fishing activities; and 5) use of fault repair procedures that reduce cable slack. *This review concludes that entanglement by cetaceans is extremely unlikely to occur so this represents a non-significant impact.*

Consultation Session Record and Presentation

Rarotonga

Sept 1st; Meeting with House of Ariki Council-Presented proposed project to council of chiefs who seemed surprised and indicated that they had not been briefed and requested a future government briefing on this project

DATE AND VENUE: Friday 26th August, MFEM boardroom (11.30am – 1.00pm)

Meeting Minutes

Meeting Opened by Office of Prime Minister, followed by short summary of the proposed submarine cable project and the optional landing sites. Participants were informed that the marine survey was not yet completed and therefore specifics concerning the three options were not available.

For about 40 minutes the ADB consultant presented a PowerPoint presentation on the project, focusing on the optional alignments and what the sensitive conditions could be, pending the marine survey.

Land acquisition issues were also discussed since Option 1 would involve the need to acquire or at least seek an easement across private land to the road allowance. The entire presentation has been reproduced as part of Annex 2.

The meeting was attended by 18 people.

Questions and Answers (Q&A)

(Jean Media, CITV)

1-Q: If there is a break or damage to the cable from Samoa is there a back-up in plan?

A: Yes, French Polynesian is the alternative

2-Q: When does the French Polynesian cable come into play and has the current project team only come to do the Samoa line and does Aitutaki have a back-up?

A: At the moment, the current project tis from Samoa to the Cook Islands (spur to Rarotonga). Discussions are being had for the French Polynesian connection, a lot of work has been done and they team (ADB, NZ, Cook Islands) has weekly meetings.

The team in country to work on the ADB Environmental and Social Safeguards only.

3- Q: Will the seismic activity along the Tongan trench affect out cable?

A: Possibly, we are not sure. The research by this in-country team will provide us with the information we need for the cable placement

4-Q: Bluesky owns the cable network and station, do they have the capability for additional capacity?

A: The Bluesky site has capability to include additional capacity or we can look at an alternative structure.

Rod Dixion (USP)

5-Q: There is an assumption that O3B will provide service to the Outer Islands, it is rumoured that O3b will pull their service if the cable goes ahead

A: Dynamics are there for other providers if O3b pull their service

Kelvin Passfield (Te Ipukarea Society)

6-Q: How much is the loan
A: NZ is contributing a 3rd of the financing currently the figures are:
CIG-46M (ADB Loan, yet to be determined)

NZ-15M

Cook Islands Government still needs to find an additional 28M to complete the project, but these figures are not set yet. There is still work to be done. MFEM is working on the debit sustainability side of things.
With the cable option, Cook Islands debit sustainability financing works out to be less than what our current costs are now.
The French Polynesian option will also reduce the Cook Islands cost and connecting to our cable is their redundancy option.

Polly Tongia – (Cook Islands Family Welfare Association) – Did her marster's thesis on cable options and orbiting satellites.
Statement – Would like the cables to be smaller and ensure capability with current network

7-Q's Is the cable the Cook Islands Investment and would like to see public costs come down.
Also, what is the projected plan for the cable i.e. how do you set up to match the new technology?
A: A lot of work has been done and they team (ADB, NZ, Cook Islands) has weekly meetings. It's still too early in the planning to discuss, this ADB team is here to do the ADB Environmental and Social Safeguards and the Marine assessments which will then feed into the other work that is being done. Cook Islands government are looking into having a consortium and crown will be the major shareholder

8-Q: There is a need for the telecommunications Act to be looked at

A: Government are looking into this. A lot of work has and is being done prior to this team coming in country.

Maureen Hilyard- Cook Islands Internet Action Group
Statement: Rutaki options – Shorter option (option 3) is preferred.

9-Q: Will there be restrictions where the cable will be buried/ placed. There is a lot of activity in that area. What is the impact/changes that will happen over the reef and do we own the cable (Rarotonga/Aitutaki) and do we have to maintain it.
A: The marine ecology specialist will be arriving in country to do the work on the selected options. It is too early to say what impacts/changes there will be until the assessments are done. Yes, we (CIG) will need to maintain the cable.

Ben Ponia – Secretary for the Ministry of Marine Resources

10-Q: With the outer islands depopulation and the technology gap will we be creating a new imbalance?

A: Currently, we're not in a position to answer

Tuaine Marsters – Civil Society Organisation, Legal advisor

Statement: This project has her full support, please ensure when the project is being implemented (digging) you stay in confines of the road easement boundaries. If you need help with the families for the land, she is happy to assist with the talks.

Lloyd Miles – CIIC land lawyer
Clarifying the Rutaki school land ownership – It isn't Crown land, it is Native freehold land and the lease is a lease in perpetuity. The next renewal is in 2020.

Week Key messages 22 – 26 August

Civil Society should be included in project planning through all stages of project preparation, implementation and on completion – Ministry of Internal Affairs, Gender division

Critical – check land leases to ensure the land ownership and/or crowns entitlements to the leased land

Rarotonga preferred landing site option – Option 3, shortest track from the ocean to the shore

Chamber would like there to be a telecommunications regulator (Should not be a Bluesky cable, they already own the monopoly). If the cable becomes the Bluesky cable it defeats the purpose of putting it in. The infrastructure is fine, but would like to ensure separation occurs. Government should own the cable and the cable regulator should be from New Zealand.
When the cable is put in place, would like there to be a clear distinction between wholesale and commercial costs.
The telecommunications legalisation and regulations need to be looked at

The cable will help to improve:

efficiencies for business, provided economic benefits, cost effective, faster access to the international businesses, easier access to the internet

Improve access to educational tools – online training

Improvement for the vulnerable/ abused - able to seek support outside of the local community

Improve accessibility to data storage capacity

RECORD OF ATTENDANCE:

Proposed ICT cable
REGISTRATION LIST
Friday 25 August 2016
MFEM boardroom

	Full name	Business title	Signature	Email Address
1	Tuaine Marsters	Legal Advisor CICSO	[signature]	tuaine@oratrust.com
2	Nukutau Pokura	CINYC Rep	[signature]	cki.nationalyouthcouncil@gmail.com
3	Rod Dixon	Director, USP C.I.	[signature]	dixon_r@usp.ac.fj
4	Te Tuhi Kelly	Director Corp Services	[signature]	tetuhi.kelly@cookislands.gov.ck
5	Maureen Hilyard	CIIOA Rep	[signature]	hilyard@oyster.net.ck
6	Pua Hunter	ICT Director	[signature]	pua.hunter@cookislands.gov.ck
7	Maru Willie	ICT – MOH	[signature]	maru.willie@cookislands.gov.ck
8	Ikori Raumea	Director-Inshore MMR	[signature]	k.raumea@mmr.gov.ck
9	Ngere George	Senior Fisheries Officer	[signature]	n.george@mmr.gov.ck
10	Garth Henderson	Sec Finance	[signature]	garth.henderson@cookislands.gov.ck
11	Kelvin Passfield	Technical Director	[signature]	kelvin.passfield@gmail.com
12	Liam Kokaua	Project Officer TIS Te Ipukarea / CINYC	[signature]	l.kokaua@tiscookislands.org
13	Polly Torgia	CIFWA	[signature]	pollytorgia@hotmail.com
14	Lydia Sijp	CICSO (NGO's)	[signature]	lydia.sijp@cookislands.gov.ck
15	Lloyd Miles	CIIC		lloyd.miles@cookislands.gov.ck

Aitutaki

Aug. 30th meeting with all 9 Aitutaki Council members, including mayor.
Project was presented by OPM and Consultant and all members supported the proposed cable deployment

Public Consultation-DATE AND VENUE: 31st August 2016, Fishing Club Conference Room, Arutanga, Aitutaki

Meeting Minutes

Agenda:

1. Opening remarks
2. Presentation of environmental and social findings
3. Question and Answers
4. Closing remarks

Participants:

1. Government agencies
2. Non-government organizations/civil society
3. Private sector

In total 10 people attended the meeting

The consultation started with a prayer.

Geza Teleki started the presentation focusing on the Team's terms of reference, members of the team, the executing and implementing agencies for the project. Also, the route of the proposed cable from Apia, Samoa to Rarotonga and Aitutaki via Niue. He outlined the environmental requirements. Moreover, the 4 options for the Aitutaki cable landing sites were also presented. He was followed by Lulu Z. Carmine to present social areas to be covered by the social impact assessment: land, gender, and poverty reduction.

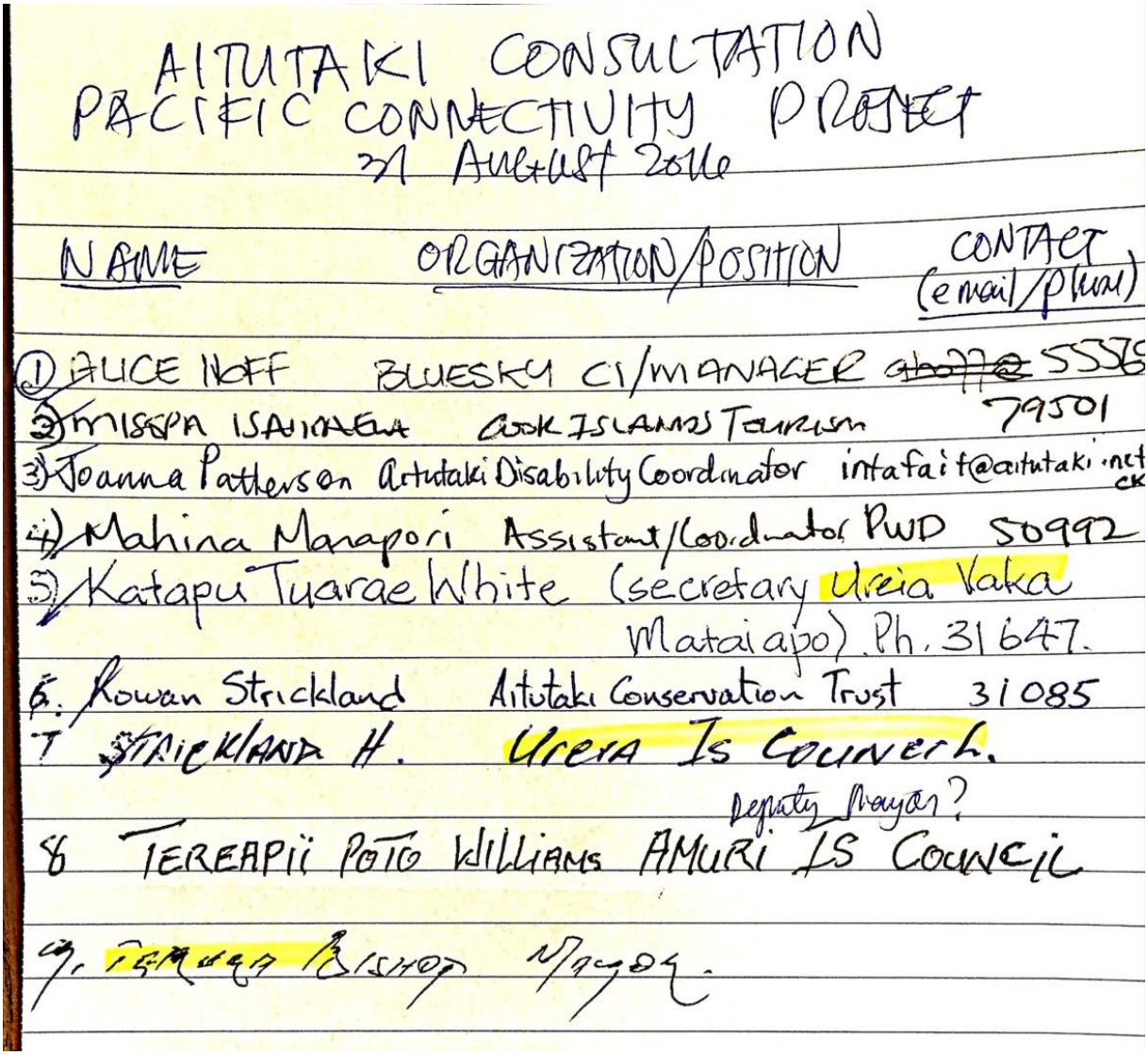
Q & A followed, chaired by the Aitutaki Mayor.

Questions and Answers:

1. Village Council rep: Island How long is the life span of the cable? 30-40 yrs (Geza).
2. Deputy Mayor: How often is maintenance work to be done on the cable? –A-GEZA- Very rarely only if there is a catastrophic break which has been recorded only at sea due to anchors and deep nets—on land it will certainly not be for the next 30-40 years.
3. Rowan/Aitutaki Conservation Trust: Supports the project. However, asked how the project will manage the laying down of the cable to minimize damage to the reefs? Geza described how cable is brought into shore and how impact is minimized
4. Also asked if business/tour operators were consulted by the Team. Recommended to meet with them. (A meeting was set up at 1pm by the Tourism Officer; only 1 attended due to short notice and time constraint- we were flying out4:30 pm)
5. Deputy Mayor: Thinks that the shorter route is Option 4 (Reureu Village). He also clarified that his village (near the old airport) is not against the cable being laid from there (option 1). Generally, in favour of Option 4.
6. Also, he asked about the timing for the tender of the cable project. He stated that the project should not be given to the Chinese contractors as their previous work on the island is "not good".

7. Female Chief: supports to land the cable in the shortest route from the reef near the main harbor (option 4).
8. Overall, all participants stated their strong support for the cable project. Also, thinks that option 4 is the best option due to shorter route thus reduced cost. They also highlighted that landowners need to be consulted.

Attendance Sheet



AITUTAKI CONSULTATION
PACIFIC CONNECTIVITY PROJECT
31 August 2016

NAME	ORGANIZATION/POSITION	CONTACT (email/phone)
① ALICE NOFF	BLUESKY CI/MANAGER	~~[illegible]~~ 5555 79501
② MISEPA ISAIAKELA	COOK ISLANDS Tourism	
3) Joanna Patterson	Aitutaki Disability Coordinator	intafait@aitutaki.net.ck
4) Mahina Manapori	Assistant/Coordinator PWD	50992
5) Katapu Tuarae White	(secretary Ureia Vaka Mataiapo)	Ph. 31647.
6. Rowan Strickland	Aitutaki Conservation Trust	31085
T STRICKLAND H.	Urera Is Council.	
8 TEREAPII POTO WILLIAMS	AMURI IS COUNCIL	Deputy Mayor?
9. TEMAKA BISHOP	Mayor.	

Table A4.1: Summary of Consultations Held and People's Concerns

Dates	People Consulted	No. of Partici-pants	Concerns	How Concerns Reflected in the Assessment
A. Rarotonga				
22 August 2016 (Monday	Meet with Women and People with Disabilities Department of Women and Youth	3	Contacting outer islands slow; cost of internet will be lower? social risk of high speed internet. Ownership of cable to ensure reduces in communication charges.	Included in the Project impacts and mitigation. Institutional arrangements
23 August (Tuesday)	Ministry of Finance and Economic Management and Office of the Prime Minister	3		
	New Zealand High Commission	1		
	Bluesky Corporation	4		
	Cook Islands Investment Corporation (CIIC)	1	Any private land requirement by project most likely to involve multiple landowners (leaving overseas) thus will take time to contact them.	Action plan in the DDR for leasing easement reflected time allocation based on mos recent project by government
24 August (Wednesday)	Independent Contract/Cook Island Infrastructure Member	1	Public may think project to blow up the lagoon; impact to marine protected areas?	Included in the impact assessment
	Ministry of Marine Resources	4	Why Rutaki passage? Lots of fishermen in the area.	Cable to be buried thus will not affect current area users.
	Infrastructure Cook Islands	1	Ensure roads are returned to original condition asap; proper works supervision; grievance mechanism; work permits and compensation for trees cut down due to road works.	Mitigation measures in th EMP.
25 August (Thursday)	Mr Bim (Tou) Nooroa, General Manager, Ports Authority	1	Damage to environment; need permits from Ports Authority; need to be provided route chart prior to construction. Need support from Paramount Chief of site even for Crown lands.	Mitigation measures in the EMP. Project communications and consultation plan to be prepared by contractor.
	Civil Society Association Executive Council	2	Cyber bullying Cyber-crime/scams as people could be gullible including elderly.	Inclusion of information awareness in existing government and NGOs programs
	Chamber of Commerce	7	Telecoms monopoly; wants to see separation of regulator and retailer in the country. Current high cost and quality of telecom service	Included in the consultation documentation of IEE for government decision
	Business Trade and Investment Board	1	Critical to have fiber optic cable in place to get more investors in the country to develop small & medium businesses. To be very concerned if new cable will not reduce communications costs; difficul	Included in the IEE impacts assessment for government decision.

Dates	People Consulted	No. of Partici-pants	Concerns	How Concerns Reflected in the Assessment
			to justify government loan.	
26 August (Friday)	Wider stakeholders' consultation	15	Back-up plan if Samoa to Rar cable fails? Cost of the loan (ADB)? Capacity of Bluesky to system to absorb increased capacity through fiber optic? Potential for O3B to pull out with incoming fiber optic cable Impact to the outer islands? Will there be restrictions where the cable will be buried/ placed? Lots of activities in the Rutaki passage. Need for a telecoms regulator Ensure separation of owner and retailer.	French Polynesian line is the alternative (response from government reps). Still to be determined. The Bluesky site has capability to include additional capacity or we can look at an alternative structure (government rep). Outside in the IEE but input to government decision making. Incorporated in the EMP. Input into the recommended institutional arrangement.
	National Environmental Service	1		
1 September (Thursday)	Paramount Chiefs (House of Ariki)	6	Not informed earlier about the project; previous project consulted the chiefs once and did not continue their involvement. Although project sites are on leased lands, government to still inform landowners.	Continue consultation and participation of the House of Ariki and landowners to ensure ownership and support for the project (refer to the Project communication and consultation plan)
	Sub-total	**45**		
B. Aitutaki				
29 August (Monday)	Aitutaki Island Council	6	What will be the possible damage of the cable to the environment eg corals? Who will own the cable? Increase price of communication services due to loan.	Discussed in the project impact and EMP section. Institutional section of IEE. Project impacts section.
30 August (Tuesday)	Chiefs of Aitutaki (House of Ariki)	9	Economic sense to provide cable to 2,000 people? Consumers may end up paying for the project costs thus increase in charges Ownership of cable landing site, cable station and route. Previously, when the hospital was built, the landowners did not benefit financially.	Outside IEE but indirectly covered in the benefits section. Recorded in the consultations section for government's reference. A separate social due diligence report was prepared to screen potential impacts due to land requirement of the project. As above.
	Ministry of Education	2	If 03B will leave the outer	Documented the concern in

Dates	People Consulted	No. of Partici-pants	Concerns	How Concerns Reflected in the Assessment
			islands due to cable connection as it is no longer financially viable to stay, fears the outer islands may lose telecom services affecting the education program delivery.	the consultations section for government's consideration.
	Aitutaki Religiou Advisory Council	8	None. Very supportive as they see this to benefit their members and their churches to connect better to members (locally/overseas)	
	Business leaders	3		
	Women's organizations	15	Potential damage to the environment resulting from cable connection. Will it cross the *Rauis*? Charges after cable operations?	Mitigation measures document in the EMP.
	Ministry of Internal Affairs	3		
	Aitutaki Islan Administration	3		
31 August	Aitutaki Wide Stakeholders' Consultation	9	Lifespan of the cable? How often is maintenanc done? How to manage environmenta impact of laying the cable under the sea and on land? Hopes Chinese contractors are chosen in the tender; 2 contracts in Aitutaki poor quality.	About 50-60 years. Mitigation measures documented in the EMP. In the procurement bidding document.
	Meet with Tour Operator	1	Environmental impacts resulting from the project? Landownership issues	A separate DDR was prepared and to be monitored.
	Meet with environmental organization	1	Parents not ICT technolog aware.	In the EMP section.
	Sub total	**52**		

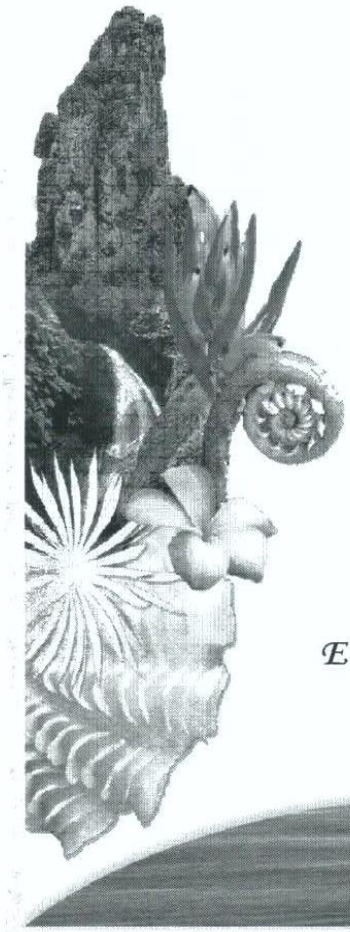
Cook Islands Environment Significance Declaration Form

ENVIRONMENT SIGNIFICANCE DECLARATION FORM (PARTIALLY FILLED IN)

ANNEX 8

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

ENVIRONMENT SIGNIFICANCE DECLARATION AND PERMIT



KIA ORANA

Any person, group or organisation that intends to carry out any activity that may impact the environment must fill out this declaration.

The checklist is used to identify physical, biological, social and economic factors, which might be changed by the proposal. Normally a background study will show those factors or issues that the proposal will or will not impact. A "YES" answer indicates further consideration to obtaining more information may be necessary. A "NO" answer in the second column indicates that the activity has no or low impact to the environment.

E Kura Mana to tatou Aorangi

1

Under the Environment Act 2003 – Part 5, it is a requirement that all activities be assessed as to its potential impact upon the environment. Your cooperation in filling out this form will assist the National Environment Service in protecting our environment. Meitaki Maata.

Section A: General Information

A 1. Name of Applicant:			
A 2. Is the application on behalf of a business or organisation? State here			
A 3. Name of the Project or Activity:			
A 4. Project Address:			
Vaka		Land Title	
District		Part Section	
Tapere		Lot	
A 5. Nature of ownership of land (tick appropriate box)			
Occupation Right:	☐	Lease:	☐
Vesting Order:	☐	Other:	
A 6. Contact Details:			
Phone Number		Mobile Number	
Email Address			
A 7. Person or persons who have vested interests in this activity			

A 8. Environment Significance Checklist (tick appropriate box)

Will this development -	Yes	No	Unsure	Comments
i. cause erosion on site and neighbouring properties due to rain, surface water, surface water, wind or wave action?	☐	☒	☐	
ii. take place within 30 metres of the defined foreshore area?	☒	☐	☐	
iii. take place between the defined foreshore and the reef	☒	☐	☐	
iv. take place within 5 metres of a bank of a stream, river or lake?	☐	☒	☐	
v. take place on a site with a slope greater than 1:10 (slope of 15 degrees)	☐	☒	☐	
vi. take place on or affect the top of a hill or mountain	☐	☒	☐	
vii. take place above or affect any water intakes /catchments	☐	☒	☐	
viii. take place in or affect any wetlands areas e.g. taro swamps	☐	☒	☐	
ix. take place on or affect any motu or makatea areas	☐	☒	☐	
x. take place in or affect public and recreation areas or access to these areas	☐	☒	☐	
xi. take place within or affect any reserve, parks or protected area	☐	☒	☐	
xii. impact on any species or species habitats	☒	☐	☐	
xiii. generate waste or pollution of any type	☐	☒	☐	Vessels at sea only

Section B: Proposal

B 1. Describe your project or activity?

Deployment of subwarine fibre Optic cable within Cook Islands' EEZ to shore on Rarotonga and Aitutaki and from there to cable stations

B 2. Does your project or activity take place on or relate to any of these areas of concern?

Foreshore and Cook Islands Waters	☑	Inland Waters	☐
Wetlands	☐	Sloping Land	☐
Low lying area or depression	☐	Makatea	☐
Disposal of Chemicals or Waste	☐	Protection of Species	☐
Protected Area e.g. ra'ui	☐	None of the above	☐

B 3. Do any of these activity types fit the description of your proposal?
Tick all that apply

Foreshore Clearance	☐	Foreshore Development	☐	Foreshore Protection - Gabions	☐
Foreshore Protection - Rock Revetments	☐	Foreshore Protection - Groynes	☐	Foreshore Protection - Coastal Protection Units (CPUs)	☐
Development/clearance within the lagoon and Cook Islands Waters			☐	Coastal Reclamation	☐
Stream Clearance	☐	Stream Development - Rock Revetments	☐	Stream Development - Gabions	☐
Stream Diversion	☐	Stream dredging	☐	Filling of wetlands	☐
Vegetation clearance	☐	Earthworks*	☐	Excavation on sloping land	☐
Mining of sand	☐	Residential Development	☐	Extension to residential development	☐
Commercial Development	☐	Commercial Extension /Reconstruction	☐	Tourism Accommodation	☐
Tourism Accommodation - Extension/Reconstruction	☑	None of the above	☑	Other _____	☐

B 4. Describe any features that are unique about your project or activity?
e.g. it is the only of it's kind

Installation of 2-3cm diameter fibre optic cable through inter-tidal zone to shore & cable station

B 5. Are there any significant features of the present ecosystem? Describe
e.g. site for the protection of endangered species from extinction, heritage site

Intertidal coral stone flats

Foreshore:	Means all that area from the Mean High Water Mark (The line of mean high tide between the ordinary high-water spring and ordinary high-water neap tides. It is the average of all high tides), moving towards inland, to a distance of 30 metres or to where vegetation begins as well as those areas defined in the Environment Act 2003 (see last page)
Cook Islands waters:	Means the internal waters of the Cook Islands as defined by section 4 of the Territorial Sea and Exclusive Economic Zone Act 1977, the territorial sea, and the exclusive economic zone
Inland waters:	Means the waters, banks (5 metres landward from edge) and beds (whether dry or not) of any stream, river or lake.
Wetlands:	Means areas of marsh, swamp or water whether - natural or artificial; permanent seasonally flooded or temporary; with water that is static or flowing, or fresh, brackish or salty, and; includes water storage reservoirs, taro swamps and fish farms.
Sloping Land:	Means any area of land that has a slope greater than a gradient of 1:10 (slope of at least 15 degrees)
Earthworks:	e.g. levelling of land, backfilling, replacing sand with red soil materials etc

B 6. Brief description of what the land is currently being used for:
-Road allowance -Tidal flats - unused

B 7. Which of these apply to the current use of the land?	Yes	No	Unsure	Comments
Agriculture crops (commercial)	☐	☐	☐	
Agriculture crops (subsistence)	☐	☐	☐	
Live stock	☐	☐	☐	
Residential	☐	☐	☐	
Retail or Commercial Purposes	☐	☐	☐	
Tourism	☐	☐	☐	
Industrial	☐	☐	☐	
Native Forest	☐	☐	☐	
Bush or scrubland	☐	☐	☐	
Developed shoreline	☐	☐	☐	
Wetlands	☐	☐	☐	
Reclaimed land (coastal or wetlands)	☐	☐	☐	
Low lying or natural depression areas	☐	☐	☐	
Aquaculture	☐	☐	☐	
Recreational or public area	☐	☐	☐	
Natural & cultural heritage	☐	☐	☐	
Other	☒	☐	☐	

Section C: Environment Significance Details (Please tick appropriately)

This checklist is used to identify physical, biological, social and economic factors which might be changed by your proposed project or activity. Usually a background study will show those factors or areas that an activity will or will not impact. A **"YES"** answer indicates that further consideration is necessary. A **"NO"** answer indicates that the activity will not impact those areas or factors.

NON LIVING THINGS

Will your project or activity directly or indirectly:				
C 1. Earth	**Yes**	**No**	**Unsure**	**Comments**
i. Require the use of earth moving equipment that could change the shape and natural layout of the land or destabilize the area causing land slips?	☐	☒	☐	
ii. Destroy, cover or change any landform or natural feature unique to the area?	☐	☒	☐	
iii. Will materials* for back filling be brought in from another site? - If yes, what type and from where?	☐	☒	☐	
iv. Will any materials* be removed from the site? - If yes, what types?	☐	☒	☐	
v. Involve the construction or erection of any wall or structure within the foreshore or Cook Islands waters?	☐	☒	☐	
vi. Will a new road or access way be required?	☐	☒	☐	
C 2. Water	**Yes**	**No**	**Unsure**	**Comments**
i. Change the present water flow direction of a lagoon, stream, estuary or natural drainage causeway?	☐	☒	☐	
ii. Will the project alter the existing surface water flows?	☐	☒	☐	
iii. Be located in an area where flooding occurs often because of a nearby stream; or the area is likely to be affected by flood waters or sea surge and tropical cyclones?	☐	☒	☐	
iv. Cause an increase or decrease in the amount and quality of water on the ground, underground or to the supply of drinking water?	☐	☒	☐	

***Materials:** Includes materials such as silt, sand, soil, cobble, gravel, boulder, hard rock, coral, trees, vegetation

Will your project or activity directly or indirectly:				
C 3. Pollution	**Yes**	**No**	**Unsure**	**Comments**
i. Would it produce poisonous gases that could result in the air becoming less clean and dangerous to people?	☐	☒	☐	
ii. Would it cause the production of excessive waste?	☐	☒	☐	
iii. Would it cause the discharge of any chemical or its waste?	☐	☒	☐	
iv. Would it cause noticeable bad smell?	☐	☒	☐	
v. Cause more noise than usual or make the ground to tremble disturbing neighbours?	☐	☒	☐	

LIVING THINGS

Will your project or activity directly or indirectly:				
C 4. Plants:	**Yes**	**No**	**Unsure**	**Comments**
i. Change the number of different plant species on the area?	☐	☒	☐	
ii. Cause the numbers of special plants, or plants already low in numbers to be further decreased; or disturb the places these plants live in. These special plants include those that are not found anywhere else, or that are in danger of dying out completely?	☐	☒	☐	
iii. Bring a new kind of plant into the area? If the new plant does not exist in the area naturally, then it might compete with the present plants resulting in other plants dying out?	☐	☒	☐	
iv. Reduce the amount of land that could be used for agriculture, business, or other uses that might be important to the community?	☐	☒	☐	
C 5. Animals:	**Yes**	**No**	**Unsure**	**Comments**
i. Destroy or ruin the places that animals live in? (i.e. birds, land animals including reptiles, fish and shellfish, benthic organisms, insects or microfauna)?	☐	☒	☐	
ii. Change the population numbers of different kinds of animals?	☐	☒	☐	
iii. Bring in a new kind of animal that does not already exist in the place, or that will cause other resident animals to move away from their usual living places?	☐	☒	☐	

3. SOCIAL AND ECONOMIC FACTORS

Will your project or activity directly or indirectly:				
C 6. General:	**Yes**	**No**	**Unsure**	**Comments**
i. Cause you to break any law in the Cook Islands?	☐	☒	☐	
ii. Support any existing plans, policies or goals made by the village, communities or by Government?	☒	☐	☐	
iii. Contradicts any existing plans, policies or goals made by the village, communities or by Government	☐	☒	☐	
iv. Alter or impact on any important scenic areas or natural land marks?	☐	☒	☐	
v. Affect or destroy historical and significant sites such as marae, old buildings or artefacts?	☐	☒	☐	
vi. Alter the aesthetics (natural and visual scenery) of the surrounding areas?	☐	☒	☐	
C 7. Social:	**Yes**	**No**	**Unsure**	**Comments**
i. Disrupt households and existing businesses in the area?	☐	☒	☐	
ii. Potentially disturb people's lifestyles or usual practices in the community or neighbourhood?	☐	☒	☐	

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iii. Involve the risk of an explosion or an accident happening thereby endangering people?	☐	☒	☐	
iv. Create traffic detours, temporarily restrict access, etc?	☒	☐	☐	roadside trenching will temporarily restrict access
v. Use places commonly used by people such as parks, recreation areas, or wildlife sanctuaries or water flow areas which are protected for public purposes?	☐	☒	☐	
vi. Produce more light, glare or shadows, e.g. glaring lights, overshadowing a planter's crop, etc?	☐	☒	☐	
C 8. Economic:	**Yes**	**No**	**Unsure**	**Comments**
i. Cause fewer jobs or fewer businesses?	☐	☒	☐	
ii. Cause other businesses or growers to move?	☐	☒	☐	
iii. Cause the worth of the property to decrease?	☐	☒	☐	
iv. Cause any changes to the inter-island movement of traffic either by air or sea?	☐	☒	☐	

Section D: Operational Activities

Following the completion of this project or activity there may be additional impacts that need to be considered.

Will the ongoing operation of the proposed activity;				
D 1. Generate waste or pollution?	**Yes**	**No**	**Unsure**	**Comments**
i. Liquid waste (include the wash down of machinery, paint, oils, sewage)	☐	☒	☐	
ii. Solid waste	☐	☒	☐	
iii. Hazardous waste	☐	☒	☐	
iv. Increase the level of noise	☐	☒	☐	
v. Chemical pollutants	☐	☒	☐	
vi. Gaseous wastes	☐	☒	☐	
vii. Storm water runoff	☐	☒	☐	
viii. *If YES {to the above} can the amount of waste be managed within the site or will it be removed*				
D 2. Biodiversity	**Yes**	**No**	**Unsure**	**Comments**
i. Impact on any bird, animal, plant or marine species or habitats?	☒	☐	☐	Very minor in cable alignment.
D 3. Social	**Yes**	**No**	**Unsure**	**Comments**
i. Disrupt households and existing businesses in the area?	☐	☒	☐	
ii. Potentially disturb people's lifestyles or usual practices in the community or neighbourhood?	☐	☒	☐	
iii. Involve the risk of an explosion or an accident happening thereby endangering people?	☐	☒	☐	
iv. Create traffic detours, temporarily restrict access, etc?	☒	☐	☐	Yes - see above
v. Use places commonly used by people such as parks, recreation areas, or wildlife sanctuaries or water flow areas which are protected for public purposes?	☐	☒	☐	
vi. Produce more light, glare or shadows, e.g. glaring lights, overshadowing a planter's crop, etc.	☐	☒	☐	