Initial Environmental Examination

May 2020

TUV: Outer Island Maritime Infrastructure Project – Second Additional Financing

Nui Workboat Harbor

Prepared by Ministry of Transport, Energy and Tourism for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 26 March 2020)

Currency unit	–	Australian dollar (AU$)
AU$1.00	=	$0. 0.598
$1.00	=	AU$1.670

ABBREVIATIONS

ADB	–	Asian Development Bank
CCP	–	communication and consultation plan (for the project)
CSC	–	construction supervision consultant (supporting the PMU)
CSS	–	country safeguard system
DOE	–	Department of Environment
EHSG	–	Environment, Health and Safety Guidelines (of the World Bank Group)
EHSO	–	Environment, health and safety officer (of the contractor)
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ES	–	Environmental specialist (of the CSC)
GFP	–	Grievance focal point
GPS	–	global positioning system
GRM	–	grievance redress mechanism
HIV/AIDS	–	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HSP	–	health and safety plan (of the contractor)
IEE	–	initial environmental examination
IUCN	–	International Union for Conservation of Nature
MTET	–	Ministry of Transport, Energy and Tourism
NEMS	–	National Environmental Management Strategy
OHS	–	occupational health and safety
PAM	–	Project Administration Manual
PEAR	–	preliminary environmental assessment report (under Tuvalu country system)
PMU	–	Project Management Unit
PPE	–	personal protective equipment
SPREP	–	Secretariat of the Pacific Regional Environmental Program
SPS	–	Safeguard Policy Statement 2009 (of ADB)
STI	–	sexually transmitted infection
TKIII	–	Te Kakeega III National Strategy for Sustainable Development 2016 to 2020
TFD	–	Tuvalu Fisheries Department

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EXECUTIVE SUMMARY

1. **The project**. The Outer Island Maritime Infrastructure Project – Additional Financing (the project) will continue the efforts of the Government of Tuvalu (the government) with support from Asian Development Bank (ADB) to rehabilitate and improve maritime infrastructure on the outer islands. The ongoing Outer Islands Maritime Infrastructure Project is improving infrastructure on Nukulaelae, Nanumaga and Niutao which was damaged by Tropical Cyclone Pam in March 2015. The government has requested ADB to provide additional financing for: (i) cost overruns resulting from contract variations and foreign exchange fluctuations; and (ii) provision of passenger facilities at Nukulaelae and construction of a small boat harbor at Nui.

2. There are no docking facilities on Nui suitable for any of the three government-owned ships or the small workboats used to transfer people and cargo from the ships to the shore. Passenger transfers between vessels are often dangerous while movement of cargo is very labor intensive and carried in manageable pieces though the water to the shore. The project will provide a small workboat harbor by dredging a new channel and maneuvering basin for the workboats. The breakwater, wharf and access bridge will be constructed using precast concrete elements. There will be a passenger terminal and cargo handling buildings near the access bridge to assist in the safe movement of passengers and cargo from the land to workboats to the ship. The project also includes a number of navigational aids that will mark the access channel and maneuvering basin.

3. **Institutional responsibilities**. The Ministry of Transport, Energy and Tourism (MTET) is the executing agency for this project. The Director of Marine and Port Service was appointed as Project Director. A project management unit (PMU) has been established under the ongoing project and will deliver the new project. The PMU reports to the MTET. The PMU will be supported by a construction supervision consultant (CSC) which will include an environmental specialist (ES). Prior to recruitment of the CSC, an individual environmental specialist will be recruited to undertake tasks associated with updating the initial environmental examination (IEE) and environmental management plan (EMP) and inputs to the tender documentation and bid evaluation. Terms of reference have been prepared for the environmental specialists (for the individual and the ES included in the CSC) and are included in the project administration manual. The submission, review and acceptance of construction EMP (CEMP) is a condition of no objection to commencement of physical works and this is included in the grant agreement and will be included in the bid documents and contract.

4. **Screening, categorization and assessment.** The project has been screened, and based on existing conditions and proposed works, classified as Category B for environment following the ADB's Safeguard Policy Statement 2009 (SPS). A category B project requires an environmental assessment commensurate with its level of impact, and this IEE including an EMP has been prepared.

5. Overall, few of the impacts are irreversible. Potential impacts can be managed and reduced to acceptable levels through the implementation of the measures identified in the EMP which will be developed into a detailed CEMP by the civil works contractor, and effective monitoring of the same by the CSC, who will support the PMU on behalf of the MTET.

6. The IEE will be re-formatted as required to comply with the Tuvalu country safeguard system requirements and an application for clearance will be made under the Environment Protection (Environment Impact Assessment) Regulations 2014.

7. **Anticipated impacts**. There is no critical habitat on this island directly affected by the project. The main potential negative environmental impacts relate to the construction phase and the dredging and excavation of 15,000m^3 of reef material for the widening and extending of the existing channel through the reef platform and the small workboat harbor, and the subsequent disposal of the spoil on to the land. The spoil will be disposed of such that it does not result in damage to the reef environment, the remaining natural vegetation on land at the disposal sites, subsurface water resources and any areas of agriculture or cultural significance. The protection of the foreshore and vegetation against further deterioration, will be a priority during the construction phase. Overall, few of the impacts are irreversible. Potential impacts can be managed and reduced to acceptable levels through the implementation of the measures identified in the EMP.

8. **Environmental management plan**. The EMP requirements and provisions for environmental protection and management will be incorporated into the bid documents for the civil works and construction contract. Given the sensitivity of the marine environment, the contractor will be required to recruit an experienced marine environmental specialist to develop the construction EMP (CEMP) and help the contractor implement the CEMP, including the site-specific plans and construction methodologies (working platforms, dredging plan and methods, and spoil disposal locations and methods) most suited to the environmental conditions of Nui. The CSC will work with the supervision engineer to review and approve the CEMP and to monitor the contractor's implementation of the approved CEMP.

9. **Consultation, participation and disclosure**. The project is a continuation of support to the maritime sector which commenced in 2015. Consultations are guided by the project's communication and consultation plan (CCP) which has been updated to reflect the requirements of the two additional financing. It also provided the opportunity for the community representatives to express their concerns and provide some feedback in relation to the project design. Further consultations with the Kaupule and Falekaupule were carried out in December 2019 and March 2020 to review different harbor and access bridge options and suitable locations for the construction laydown, camp area and disposal of any surplus spoil. The contractor will identify how they will implement the relevant elements of the CCP in their CEMP.

10. **Grievance redress mechanism**. A grievance redress mechanism (GRM) has been established for the project, based on acceptable methods of conflict resolution in Tuvalu and the GRM that is currently being implemented for the ongoing project. The GRM will be implemented through all stages of the project including design, construction and operation. The community will be informed of the GRM, which has been developed in conjunction with the PMU, through a public awareness campaign and discussion with the Kaupule. The process of lodging a concern or complaint and contact details of the contractor and CSC will be posted on a public notice board. There will be full and free access to the site-based CSC.

11. The community is encouraged to voice any concerns or complaints, and during construction these will be investigated and reported by the contractor who will maintain a complaints register. The contractor will identify how they will implement the relevant elements of the GRM in their CEMP.

12. **Inspections, monitoring and reporting**. Monitoring of environmental impacts will be carried out during the construction and post-construction period based on baseline environmental conditions recorded prior to commencement of any works. Monitoring will provide information to determine whether critical factors are within acceptable levels or being exceeded. It also helps to determine if mitigation measures are effective or should be altered or improved to address the observed and measured change in impacts.

13. During the pre-construction, monitoring will ensure that (i) bidding documents contain environmental requirements and any design measures specified for sensitive areas, and (ii) criteria for the selection of qualified contractors are clearly defined and followed. When construction commences, inspections and audits will be undertaken by the CSC and supervision engineer to ensure mitigation measures are protecting environmental conditions as anticipated (based on benchmarked conditions recorded prior to works commencing for parameters identified in the EMP) and overall that the contractor is working in compliance with the approved CEMP.

14. Reporting will include contractor's monthly reports to the PMU, quarterly progress reports (including summary of contractor's reports and safeguards matters) prepared by the PMU and CSC for submission to the executing agency and ADB, and semi-annual safeguards monitoring reports prepared by the PMU and CSC and submitted to the executing agency and ADB. ADB will disclose the monitoring reports.

15. **Conclusion**. This IEE has identified as far as practicable the potential environmental impacts associated with the design, construction and operation of the small workboat harbor at Nui and identifies the measures required to mitigate or minimize the impacts. The impacts and required measures to mitigate them are summarized in the EMP which will be updated based on detailed design following geotechnical investigations. Overall, impacts are site-specific and few, if any, of the impacts are irreversible. The potential impacts can be managed and reduced to acceptable levels provided the EMP is properly developed into a site-specific CEMP to be prepared and implemented by the contractor. The contractor's implementation of the CEMP will be monitored and reported.

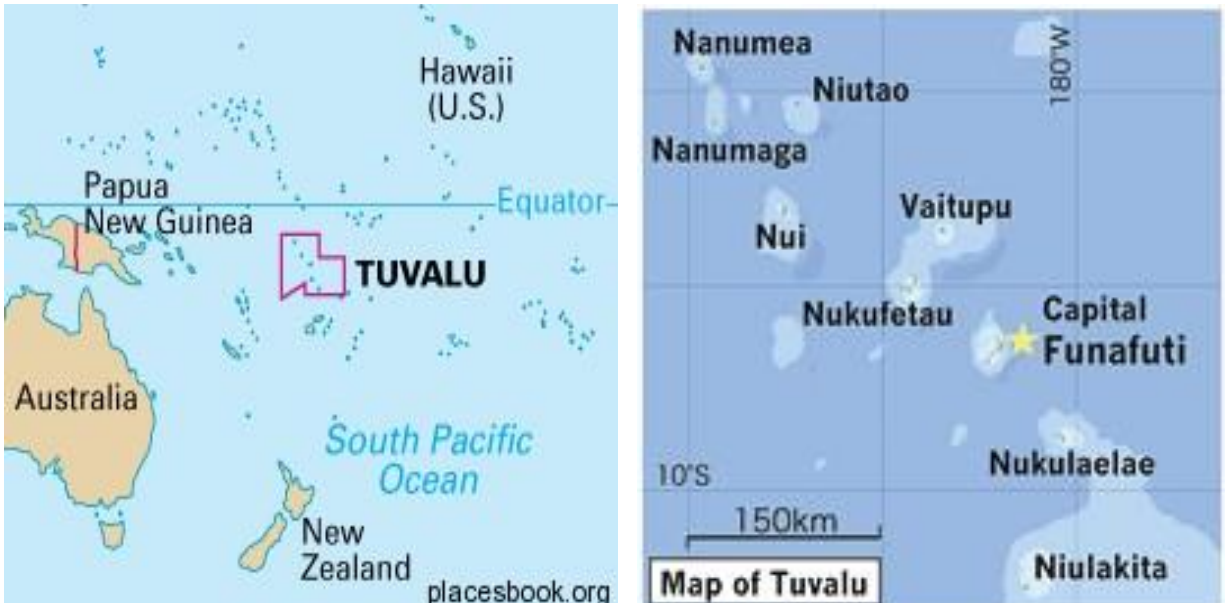
I. INTRODUCTION

A. Project Background

1. **Location**. Tuvalu is a Polynesian country located in the west Pacific, situated 4,000 kilometers (km) northeast of Australia, south of Hawaii and east of Papua New Guinea, as shown in Figure 1.1. Tuvalu is one of the smallest and most remote member countries of ADB; it has a total land area of 26 square kilometers (km^2) and an oceanic area of 900,000 km^2. Its challenges in the transport sector and economic development come from its dispersed geography:

- the country comprises nine atoll islands, stretching over 680 kilometers (km) in the southwest Pacific;
- it has a small and dispersed population of 10,640 (2012 census) with over half the population in Funafuti, the capital, and the rest spread in the outer islands; and
- the population of the outer islands is decreasing due to limited economic opportunities and people seeking better employment, social and health opportunities in Funafuti or abroad. These features pose challenges for the provision of cost effective and efficient transportation infrastructure and services in the outer islands.

Figure 1.1: Map showing location of Tuvalu and Tuvalu's islands



2. A key constraint preventing the safe, efficient, and reliable transfer of passengers and freight from Funafuti to Tuvalu's remote outer islands is the lack of adequate domestic maritime infrastructure, including docking facilities that can accommodate the government ships. Passengers and cargo need to be transferred between the ship and the shore by small workboats, posing serious safety risks when they are overloaded and when the sea is rough. The workboats are required to pass through narrow channels where swells break, posing further safety risks. Only Vaitupu, Nanumea, and Nukufetau have docking facilities for the workboats, and the ongoing project is providing a small harbor for work boats on Nukulaelae and Niutao.

3. Serious accidents have occurred during transferring, resulting in loss of economic value, injury and potentially life. All outer island people have safety concerns during transfer operations particularly for sick or vulnerable people including children, elderly, men and women and people with disabilities.

4. The Outer Islands Maritime Infrastructure Project[1] is improving infrastructure on Nukulaelae, Nanumaga and Niutao which was damaged by Tropical Cyclone Pam in March 2015. The ongoing project is financing (i) a small boat harbor construction in Nukulaelae and rehabilitating boat ramps in Nanumaga and Niutao and building a workboat harbor in Niutao, (ii) institutional strengthening for government's asset management focusing on the sustainability of project deliveries, and (iii) the preparation of transport master planning. The ongoing project is being successfully implemented with the project management unit (PMU) established an function with support from consultants and all works contracts awarded.

5. This project will continue the efforts of the Government of Tuvalu (the government) with support from Asian Development Bank (ADB) to rehabilitate and improve maritime infrastructure on outer islands. The government has requested ADB to provide further finance to build a workboat harbor in Nui.

6. **Implementation arrangements**. The Ministry of Transport, Energy and Tourism (MTET) is the executing agency for this project. The Director of Marine and Port Service was appointed as Project Director. A PMU, established under the ongoing project, will be supplemented by additional consulting resources and deliver the new project. The PMU reports to the MTET. The PMU will be supported by a construction supervision consultant (CSC) which will include an environmental specialist (ES). Prior to recruitment of the CSC, an individual environmental specialist will be recruited to undertake tasks associated with updating the IEE and EMP and inputs to the tender documentation and bid evaluation. Terms of reference have been prepared for the environmental specialists (for the individual and the ES included in the CSC) and are included in the project administration manual (PAM).

B. Objectives and Scope of the IEE

7. This document provides an initial environmental examination (IEE) of the project. The IEE has been prepared with the MTET following the requirements of the Environmental Protection Act of Tuvalu and the Safeguard Policy Statement 2009 (SPS) of the ADB.

8. The overall objective of the assessment process is to identify impacts and measures to avoid, minimize/mitigate or compensate for them. The objectives of the IEE are to:

[1] ADB. 2016. Tuvalu Outer Island Maritime Infrastructure Project approved by the Board on 16 November 2016 for three grants in the total amount of $11.8 million.

- Identify and describe the existing environmental conditions—physical, biological and socio-economic—in the subproject area including the identification of environmentally sensitive areas;
- Assess the proposed location, design, construction, and operation activities to identify and evaluate their potential impacts, and determine their significance;
- Consult with stakeholders on the potential impacts and understand the issues and concerns about the impacts and how they might be affected; and
- Propose appropriate mitigation and monitoring measures that are incorporated into an environmental management plan (EMP) that will avoid or minimize adverse impacts so that residual impacts are reduced to acceptable levels.

9. The scope of the IEE includes the footprint of the project which is relatively small and the zone or area of influence of the project to ensure that secondary or indirect impacts can be identified and subsequently managed.

10. The IEE is based on primary sources of information derived through field studies (including marine and terrestrial ecological baseline surveys) and consultations during site visits and secondary sources of information available in relevant reports.

II. LEGAL AND POLICY FRAMEWORK

A. Country Safeguard System

11. **Institutional arrangements for environmental protection**. The Department of Environment (DOE), which is based in Funafuti, is overseen by the Director. It has a staff of four, including an EIA specialist, two environmental officers, and a librarian. It does not have offices or personnel in the outer islands. There will be limited capacity to provide environmental compliance monitoring of the projects on the outer islands during the construction phase. Coordination with Secretariat for Pacific Regional Environmental Program (SPREP), which currently provides capacity building in EIA review and implementation throughout the Pacific.

12. **Policy framework**. Government policy on environmental protection is expressed in the National Environmental Management Strategy (NEMS)[2] which presents a long-term approach to dealing with environmental management issues to assist in efforts to achieve sustainable development. The key objectives of NEMS are to ensure sustainability of development by i) integrating environmental considerations into economic development, ii) improving environmental awareness and education, iii) balanced development and planned urbanization, iv) improving waste management and pollution control, v) protecting natural resources and vi) environmental monitoring. This sets the framework for the requirement of projects to undergo an environmental assessment process prior to approval and to commencement of any development.

13. **Legal framework**. The principal law governing the protection and management of the environment in the country safeguard system (CSS) is the Environmental Protection Act 2008, and specifically, Part V – Environmental Impact Assessment, outlines the requirements and provisions for an Environmental Impact Assessment and monitoring of environmental impacts. This legislation was further strengthened with the Environment Protection (Environment Impact Assessment) Regulation 2012 made under Section 39 of the Environment Protection Act 2008, which sets out the process for undertaking environmental impact assessments.

14. The DOE is responsible for the administration and enforcement of the Environmental Protection Act 2008 and the Environment Protection (Environment Impact Assessment) Regulation 2012. The DOE is a department under the Ministry of Foreign Affairs, Trade, Tourism, Environment and Labor. Prior to 2011, it was part of the Ministry of Natural Resources. The DOE has the responsibility under the legislation for reviewing, assessing and monitoring of projects.

15. The procedures for undertaking environment impact assessment under the Environment Protection (Environment Impact Assessment) Regulation 2012 include a preliminary environmental assessment report (PEAR) be prepared for all development projects in accordance with Regulation 8, and a full environment impact assessment (EIA) be prepared for activities with significant impacts as identified in the PEAR.

16. If DOE confirms that a project will not cause any significant adverse impact to the environment and has complied with the requirements of Regulation 8, the Minister may give written approval to the project based on the preliminary report. Environment Protection (EIA) Regulations 2014 Sec 3 (6) states that the Director of DOE and a proponent can also agree that an EIA is required for a major project at any time prior to or during the preparation of a preliminary report.

[2] SPREP. 1997. Tuvalu: National Environmental Management Strategy (Apia, Samoa)

17. It is noted that the IEE is comparable in content and detail to the DOE's EIA thus a separate EIA will not be required. Consequently, the PMU and the Director of DOE have formally agreed in December 2019 that this IEE can be submitted in lieu of a PEAR for review by DOE.

18. Under the CSS, all EIA reports are submitted to the Director of DOE who arranges for a review of the report to be undertaken by DOE, or by an external review in accordance with Regulation 1 should DOE not have the necessary specialist skills to appropriately review a full EIA or any specific parts of an EIA. All EIA together with the report of the review by the DOE and a report of public consultations (if any) shall be referred to the Environmental Assessment Task Force for consideration.

19. The Minister may give written approval to any project based upon a full EIA which has complied with the requirements of Part IV, and which the Task Force has reviewed in accordance with Part V. The Task Force may also recommend to the Minister that a proposed major project be refused permission to commence or continue due to the unacceptable environmental impacts of the potential or existing project.

20. **Other relevant legislation**. Under the Foreshore and Land Reclamation Act the State owns the foreshore and seabed. This is subject to public rights of navigation, fishing and passing over the foreshore, as well as any private rights which may exist. Section 3 (2) of the Act also gives authority to the Kaupule (council of elders) on each island specifically for licensing people who wish to remove anything from the foreshore. No person shall remove from the foreshore of any part of Tuvalu any sand, gravel, reef mud, coral or other like substances without having first obtained from the Kaupule in whose area of authority such foreshore lies, a license for that purpose.

21. The Conservation Areas Act 2008 makes provision for the declaration and management of conservation areas. The Minister may declare any part of the territory of Tuvalu as a conservation area upon the request of a Kaupule and after due consultation with the Kaupule recommending the establishment of a conservation area. The objective of the conservation area is to protect the coastal, marine and terrestrial environment and preserve the biodiversity.

22. The Marine Resources Act 2006 is the main law dealing with fisheries in Tuvalu and makes provisions for the promotion and regulation to ensure the long-term conservation and sustainable use of the living marine resources for the benefit of the people of Tuvalu. The Marine Resources Amendment Act 2012 implements changes to the principal act which are intended to ensure that Tuvalu's international, regional and national rights and responsibilities in relation to fisheries conservation, management and development are accommodated. The Amendment significantly increased the level of penalties for various types of offence under the Act.

23. Each inhabited island has a council of elders, or falekaupule, who are responsible for running the affairs of the island. The falekaupule cooperates with the national government on matters relating to the island and on matters of custom. The Falekaupule Act 1997 (revised 2000) empowers Kaupule to provide for the improvement and control of fishing and related industries in accordance with the Fisheries Act and to prohibit, restrict or regulate the hunting, capture, killing or sale of animals, reptiles, birds or fish in accordance with the Wildlife Conservation Act.

24. The Biosecurity Act 2017 is the legislation establishing the biosecurity administration for the safe importation and monitoring of animals, plants and their products into Tuvalu.

25. **International agreements and conventions.** Tuvalu has ratified numerous environment-related international and regional commitments and remains in general compliance with the spirit of such commitments (Table 2.1).

Table 2.1: International Conventions and Treaties

Year	Convention or Treaty
1972	Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)
1973	All IMO conventions and protocols relating to the prevention of pollution from ships
1982	United Nations Convention on the Law of the Sea (UNCLOS)
1982	Cooperation in the Management of Fisheries of Common Interest (Nauru Agreement)
1985	South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty)
1985	Vienna Convention for the Protection of the Ozone Layer
1986	Protection of Natural Resources and Environment of the South Pacific Region and Related Protocols
1987	United States Multilateral Fisheries Treaty (as amended)
1987	Montreal Protocol for the Vienna Convention
1989	Basel Convention - Control of Transboundary Movements of Hazardous Wastes and Their Disposal
1989	Convention on the Prohibition of Fishing with Long Drift Nets in the South Pacific
1990	London Amendment to the Vienna Convention
1992	Rio Declaration on Environment and Development
1992	United Nations Framework Convention on Climate Change (UNFCCC)
1992	United Nations Convention on Biological Diversity (CBD)
1992	Copenhagen Amendment to the Vienna Convention
1993	Niue Treaty in Fisheries Surveillance and Law Enforcement
1993	United Nations Chemical Weapons Convention
1994	United Nations Convention to Combat Desertification
1995	Waigani Convention – banning importation, controlling and managing hazardous and radioactive waste within the South Pacific Region
1995	Amendment to the Basel Convention
1997	Kyoto Protocol to the UNFCCC
1999	Basel Protocol on Liability and Compensation for Damage to the Basel Convention
2000	Cartagena Protocol on Biosafety to the CBD
2001	Stockholm Convention on Persistent Organic Pollutants (POPs)
2004	Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Tuna Convention)
2016	Paris Agreement to the UNFCCC

B. Safeguard Policy Statement

26. The goal of the ADB's SPS[3] is to promote the sustainability of project outcomes by protecting the environment and people from any potential adverse impacts of the project.

27. The objectives of the SPS 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; (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

28. The SPS contains three safeguard requirements; SR1: environment, SR2: involuntary resettlement, and, SR3: indigenous peoples. Each of the safeguard requirements comprises an objective, scope and triggers, and a set of policy principles that must be met. Each of the safeguard requirements follows a due diligence process of screening, categorization, scoping, consultation, impact assessment, management, and monitoring and reporting. Documentation of the due diligence is subject to disclosure as per the requirements of the Access to Information Policy 2018.

29. ADB will not finance projects that do not comply with the SPS and the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law. The SPS also contains a prohibited activities list identifying specific activities that ADB will not finance.

30. As per SR1, the project has been screened as category B i.e. its potential adverse environmental impacts are less adverse than those of category A projects. These 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. This IEE identifies as far as practicable the various components of the project and assesses the potential adverse environmental impacts and identifies the measures required to mitigate or minimize them and includes these in the EMP.

31. ADB's SPS applies pollution prevention and control technologies and practices consistent with good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines (EHSG). The EHSG provide the context of international best practice and contribute to establishing targets for environmental performance. Standards incorporated into the EHSG will be used in parallel with Tuvalu environmental standards (where they exist) throughout this document with the principals of due diligence and a precautionary approach adopted. Application of occupational and community health and safety measures, as laid out in the EHSG is required under the SPS.

[3] ADB. 2009. Safeguard Policy Statement (Manila, Philippines)

III. PROJECT DESCRIPTION

A. Rationale

32. Tuvalu has inadequate transportation infrastructure and services. There are three Government owned ships that provide a service every two to three weeks from Funafuti. There are no docking facilities for these ships and passengers and cargo are transferred by small workboats to and from the ship floating off-shore. Nui has no docking facilities even for the workboats, and passengers must transfer to and from the workboats directly from the beach.

33. Cargo is manually carried to and from the workboats and often while walking in the water. The workboats also need to navigate through the surf and into narrow channels to reach the shore. This is potentially dangerous depending on the sea conditions, and serious accidents do occur, resulting in loss of life and economic values. Transfer operations are not possible when the sea is rough or after dark, further reducing the efficiency of ship operations.

34. The effectiveness and efficiency of domestic maritime transport is essential for the economic development of Tuvalu. The only means of inter-island travel is through voyages by government owned ships. The government fleet currently includes three passenger/cargo ships operated by the MTET, a research boat under the Fishery Department, and a patrol boat. The passenger/cargo ships travel from Funafuti to the groups of outer islands and to Fiji, and therefore each island only has access to these ships once every 2–3 weeks as part of a four-day circuit.

35. Investment in the domestic maritime sector is articulated through the government's Te Kakeega III Strategic Priority (TKIII). TKIII's 9.7 Maritime Service states that: "The outer islands need boat harbors and related facilities. The islands most in need are: Niutao, Nanumaga, Nui and Nukulaelae. Boat harbors and facilities are needed to improve travel safety, faster and safer cargo handling (offloading and loading), handling a greater range of cargo, handling larger cargo loads, and improving shipping services overall." In October 2017, the Cabinet endorsed the prioritization of maritime infrastructure investment in the outer islands, with facilities at Nanumaga and Niutao to be constructed next. The first additional financing covers preparation and implementation of the works at Niutao, and this second additional financing is for similar scale works at Nui.

B. Proposed Works and Activities

36. **Summary**. The project's works consists of the dredging and reclamation, concrete construction of the wharf, the approach jetty, navigational aids, the boat ramp, a warehouse and passenger terminal building.

37. The scope of the proposed maritime infrastructure for the new boat harbor are as follows:

- Additional dredging/excavation of existing channel to provide the safe access to berthing areas;
- Dredging of the new basin for the safe maneuvering of design vessels (i.e. work boats)
- Construction of a concrete approach structure (precast concrete blockwork)

- Construction of a concrete wharf for the loading/unloading of work boats (precast concrete blockwork with an in-situ lean concrete mix platform)
- Construction of a concrete landing platform for passenger access (precast concrete blockwork)
- Construction of a detached breakwater located on the northern side of the channel for provision of wave protection
- Construction of a boat ramp (precast concrete flexmat system)
- Installation of appropriate navigation aids
- Services, surveys, utilities and miscellaneous items.

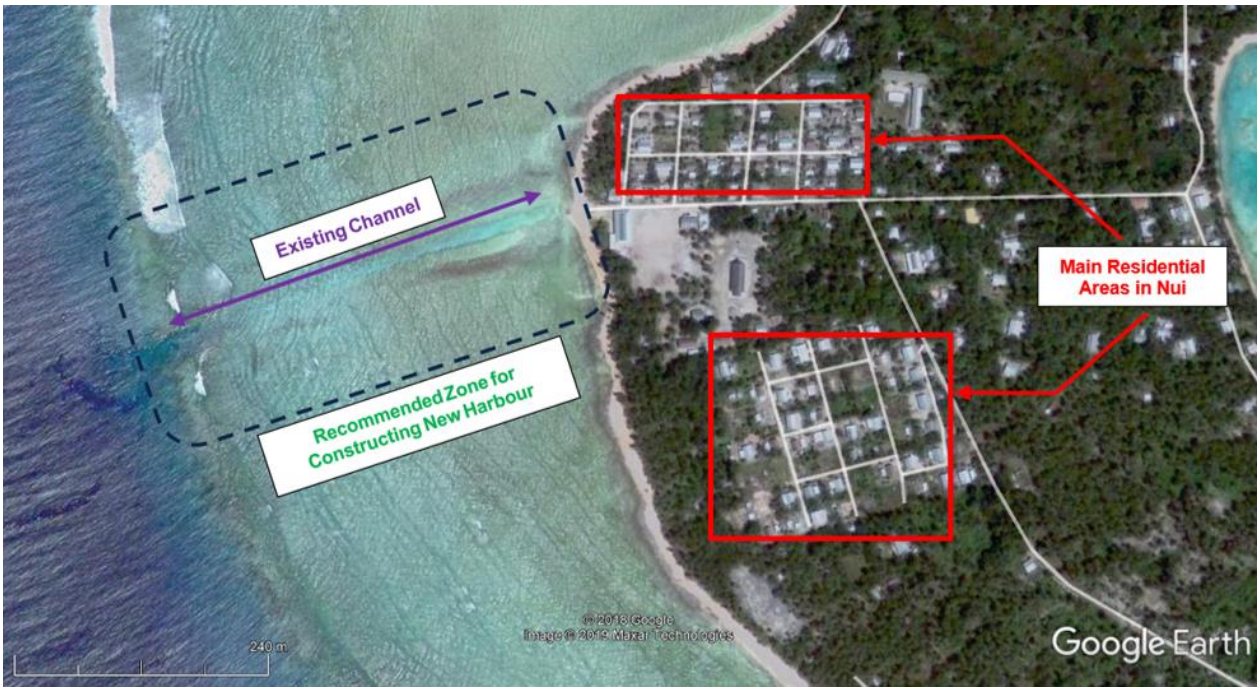
38. The scope of the proposed landside infrastructure for the new boat harbor includes:

- Foreshore reclamation
- Passenger building, cargo warehouse
- Welcome signage
- Construction of a boat ramp and hardstand for local fishing boat use
- Feature landscaping
- Proposed informal community gatherings amenities include seating, shade shelters and barbeque/fire pit; and
- Access road and pedestrian paths.

39. The construction period for the works on Nui would take approximately eighteen (18 months and timed so that no construction activity takes place during the cyclone season, being from late December to March). The construction phase will consist of several elements, being the temporary working platform, breakwater, the dredging and excavation works, the wharf and the access bridge from the land to the wharf and landside infrastructure. The construction work on the reef platform may be done in separate stages or in tandem with the dredging and excavation. This will be largely determined by the contractor who will assess the practical aspects including machine utilization and efficiency, depending on the size and complexity of the planned works on the reef platform.

40. Existing access to the island of Nui is by way of a dredged channel in the outer reef on the western side of the island. It is assumed the contractor will initially use this existing channel for the first stage mobilization onto the island (Figure 3.1).

Figure 3.1: Proposed Nui harbor site

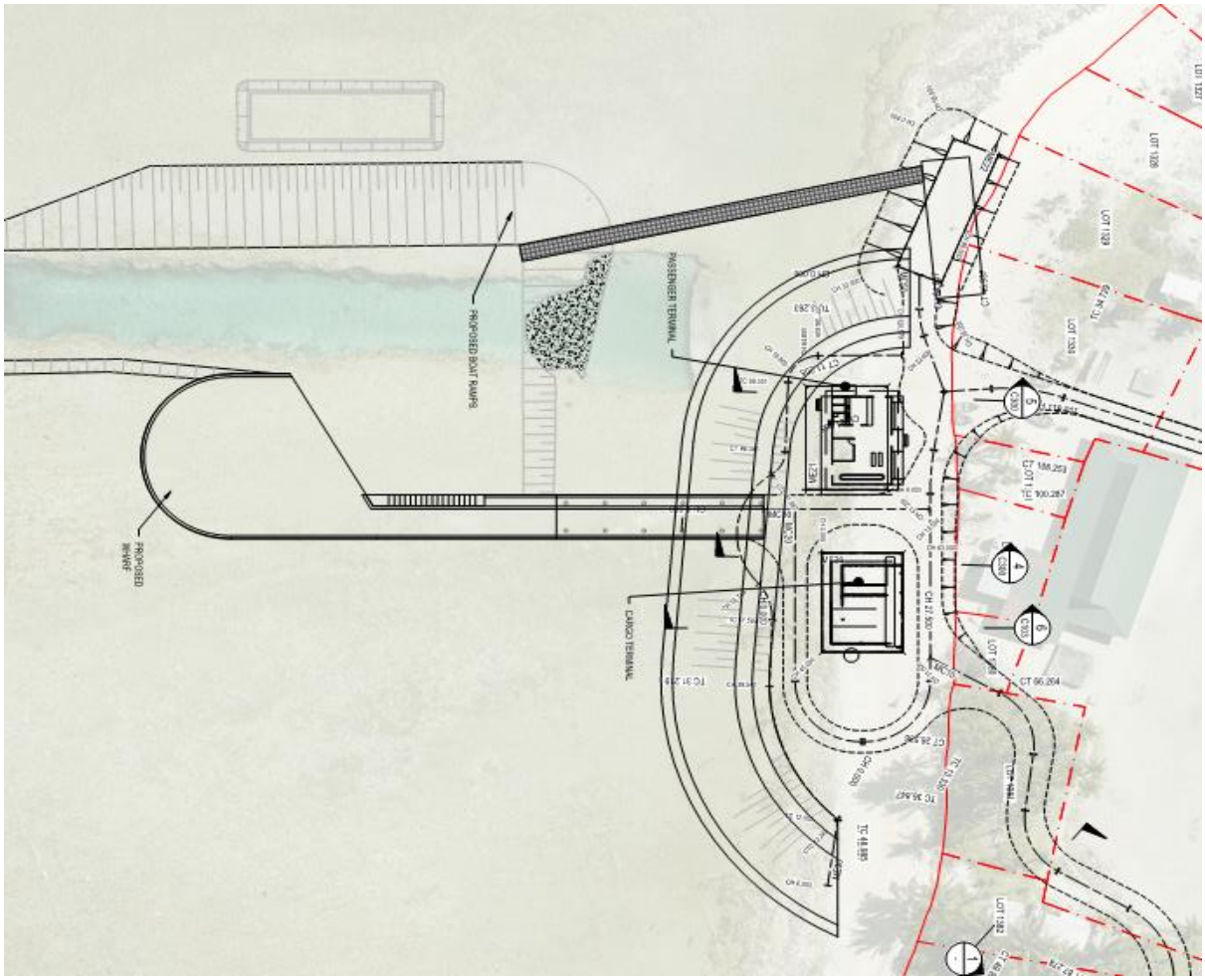


41. **Channel and swing basin dredging**. Dredging is the removal of sand and rock material from the bottom of the channel and includes removal of the solid rock material from the side walls and turning basin within the reef platform. The EMP contains recommendations for type and operation of equipment and machinery. Dredging will, unless otherwise agreed by the PMU and CSC, be restricted to tracked excavators using a hydraulically operated rock breaker attachment and bucket for removal of the coral reef material. The proposed dredge channel and swing basin shown in Figure 2.2 are aligned to maximize overlay with the existing channel to minimize the dredging requirements and reduce environmental impact.

42. The channel is approximately 400m long and 20m wide along the entire length to allow for safe passage of vessels as well as allowing vessels to pass within the channel. This width will also allow for the contractor's vessel to gain safe access to the wharf area to unload construction equipment and material for the works. The swing basin was designed to have a minimum of 20m diameter to allow for safe maneuvering of the workboats prior to transit and berthing within the harbor.

43. The main channel will be dredged to a maximum depth of -3.30 m below mean sea level (MSL) with three steps to a level of -2.2m MSL within the swing basin. These depths have been determined based on the tidal variation within the channel and ensuring there is sufficient under keel clearance for the workboats at MLWS. The harbor basin is dredged to a level of –2.2 m MSL assuming that the basin is not exposed to incoming waves.

Figure 2.2: General arrangement of the Nui boat harbor



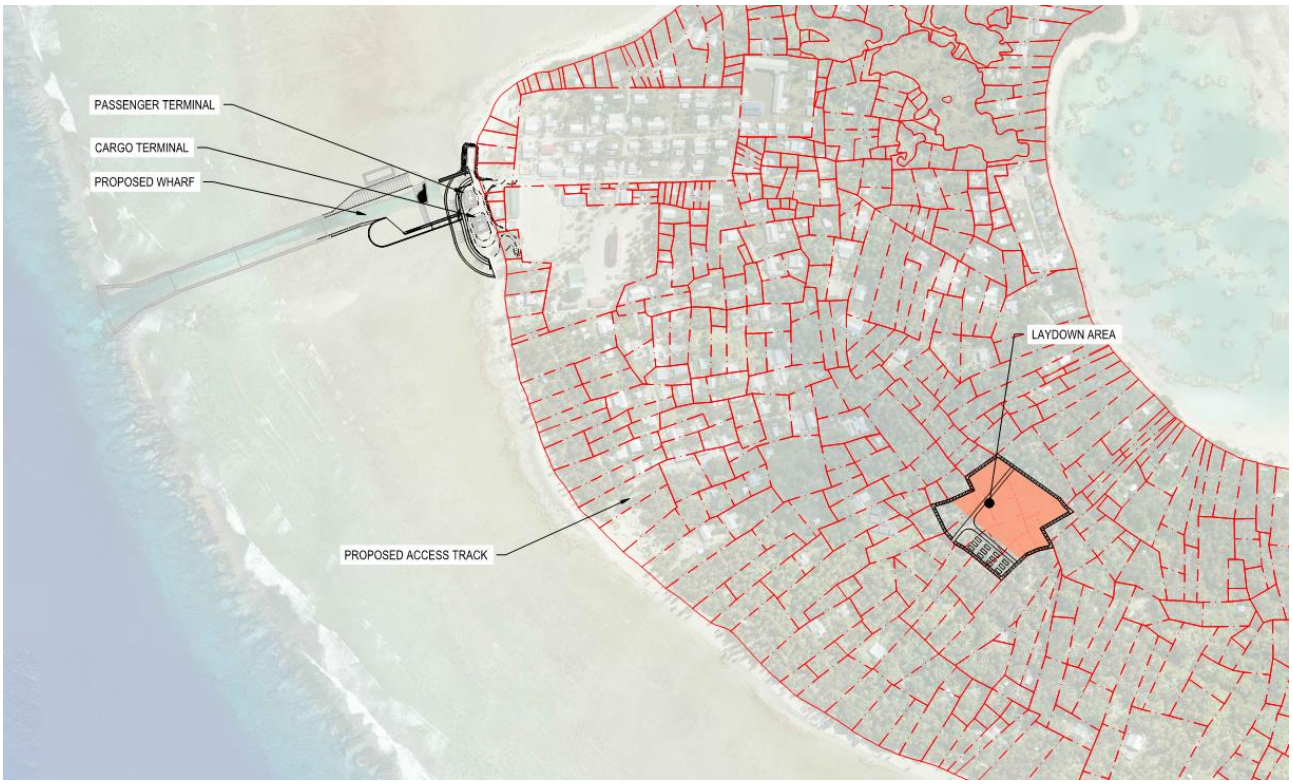
44. The dredging for the channel and the basin will be carried out by 40 or 50 tonne excavators using hydraulic rock breaker and bucket attachments rather than the use of a grinder/suction head due the marginal economics of mobilizing such equipment for one remote island. Furthermore, the volume of suspended sediment resulting from the grinder/suction method is anticipated to be more extensive than when using the excavator method as the daily period when dredging can safely take place is not limited by the tide to the same extent.[4] The receiving environment has longer periods of exposure to the sediment plume with an increase in the rate of sediment deposition on the outer reef habitat. Any sediment plume generated through the grinder/suction method would be significantly greater and occur over a longer period during daily operation than that generated by the excavator method which is limited by the tide. In total (channel and harbor/turning basin) dredging will involve removal of an estimated 15,000m^3 of coral material. The excavated material will be transported by truck from the work site and disposed of at the spoil site located on land via existing roads in the island.

[4] For the Nukulaelae subproject, the governing factor on volume of dredging per day was the tide. Dredging could only be undertaken 1-2 hours either side of high tide which resulted in a lesser volume of daily dredging than that calculated as the maximum daily limit in the dredging plan.

45. **Spoil disposal, laydown and accommodation site**. A low-lying area of 11,337m^2 near the ADB financed ground-mounted solar photovoltaic system has been set aside for use by the contractor for the access route and disposal of surplus spoil (Figure 3.3). This was agreed upon by the Kaupule during the December 2019 site visit. The site is located less than 1 km away from the village and will also be used for the laydown and accommodation camp for approximately 40 personnel. The site will not have any effects on coastal ecology or process.

46. The spoil disposal site will require the removal of a number of coconut trees to accommodate approximately 15,000m^3 of dredged material to a maximum height of 3m. The dredged spoil will be used to fill in the area behind the revetment, while any surplus spoil will be used for landscaping of the site and for road improvement. Any further surplus will be available for community use and will be left in an area to be identified by the Kaupule.

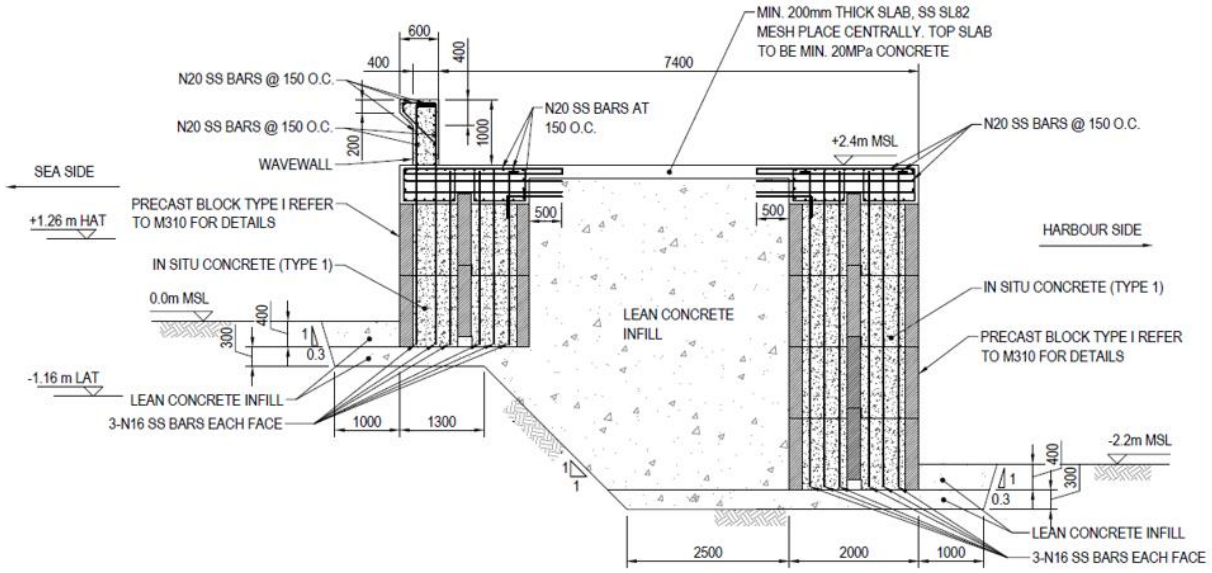
Figure 3.3: Location of spoil disposal, laydown and camp accommodation



47. **Pre-cast concrete**. A precast concrete gravity structure, with hollow blocks infilled by in-situ concrete, founded on shallow footings was selected as the most appropriate style of structure for the site. The concrete hollow blocks will be precast out of the country and delivered by ship or barge to the site. Prior to the placement of the concrete blocks, the surface of the reef flats will be cut to form a shallow trench to provide a level surface upon which to place the individual blocks. The extent of trenching will be limited to the width and length of the structures. The blocks will be placed into the prepared trench by crane. Works will be constrained by the tide and will require coordination with other associated construction activities.

48. Hollow precast concrete blocks, which are infilled by in-situ concrete, will be used for the construction of access structure, semi-circular wharf, wave wall and detached breakwater (if required). A 200 mm concrete topping slab will be formed as the finished surface of these areas. Figure 3.4 shows a typical cross section.

Figure 3.4: Wharf (harborside) typical section



49. **Storage of pre-cast concrete blocks**. About 600 individual precast concrete blocks with average dimensions of 2m x 1.1m x 1.5m, with some slightly smaller or larger in size, and weighing around 5t each will form the basis of the construction. These blocks will be unloaded from the vessel and transported across the reef flat and stored within the footprint of the wharf site for a period of a few months to proof load the site as per the design specifications. The balance of the blocks will be stored on the reef platform outside the wharf footprint, but within the designated construction zone, in an area yet to be defined; this area will be approved by the CSC. On completion of preloading, blocks will be moved in stages from the wharf area to a designated area on the reef to allow for concrete bed preparation works to be completed prior to final installation of the blocks. This will involve an area of 1,200m^2 of reef platform.

50. It is not proposed that the concrete blocks be stored on land as this will require the clearance of more coconut trees and other vegetation and also require new lease arrangements to be put in place.

51. **In-situ concrete**. In-situ lean concrete using crushed coral dredged from the channel and turning basin will be used to fill inside and in the void between the concrete hollow block elements used to form the jetty and wharf..

52. **Breakwater.** There are no sidewalls along the side of the channel to reduce the impact of wave action and allow for improved work boat operation within the channel. However, there is one (or maximum two, subject to further modelling in the detailed design stage) detached concrete block breakwater set on an angle on the north eastern side of the turning basin.

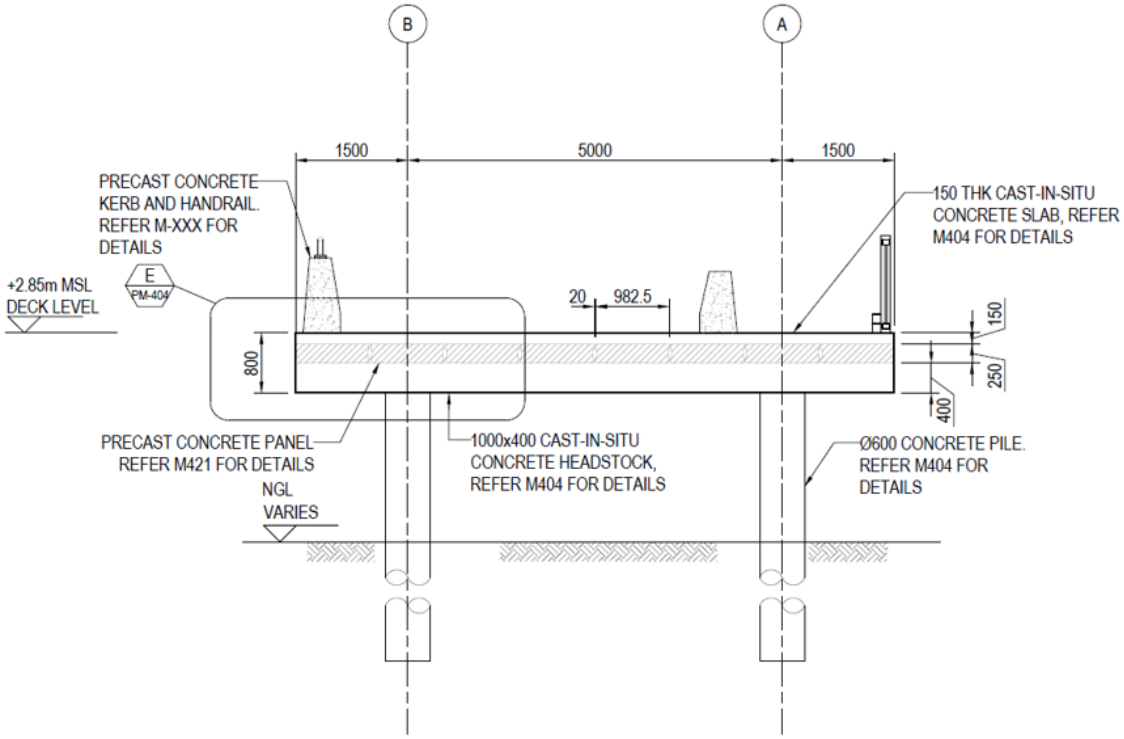
53. This breakwater is made entirely of pre-cast concrete blocks with no in-situ concrete used to fill the void between the blocks.

54. **Wharf and pedestrian loading area**. The main marine structure is the semi-circular wharf and its adjoining pedestrian landing area. It is a semi-circular precast concrete block structure with lean concrete infill with a length of 24m. The inner side of the wharf where the work boats are berthed will include rubber fenders and mooring bollards. The main wharf area has a radius of 15m to allow for the tractor with trailer to maneuver. A wave wall has been incorporated into the deck to allow the deck level to be lowered which reduces the amount of concrete needed and provides a more operable level.

55. **Approach jetty and abutment**. The approach jetty (Figure 3.5) is the structure between the shore and the wharf. It was orientated to allow for ease of continuity between the existing infrastructures on the island, i.e. roads, to provide access to the facility. The landside connection of the approach structure is at the end of the access road which previously allowed for access to the concrete ramp which was utilized for the purpose of cargo transport and boat launching.

56. The structure will be a blockwork wall with precast hollow blocks, similar section to the wharf and detached breakwaters. However, in order to avoid blocking the longshore currents and have limited impact on the critical movement of sands along the beach as the jetty, the opening areas (below the deck on pile structure) will be maximized.. The opening sizes will be finalized according to the outcomes of sediment transport modelling, the uplift pressure underside of the deck and the final layout of reclamation area.

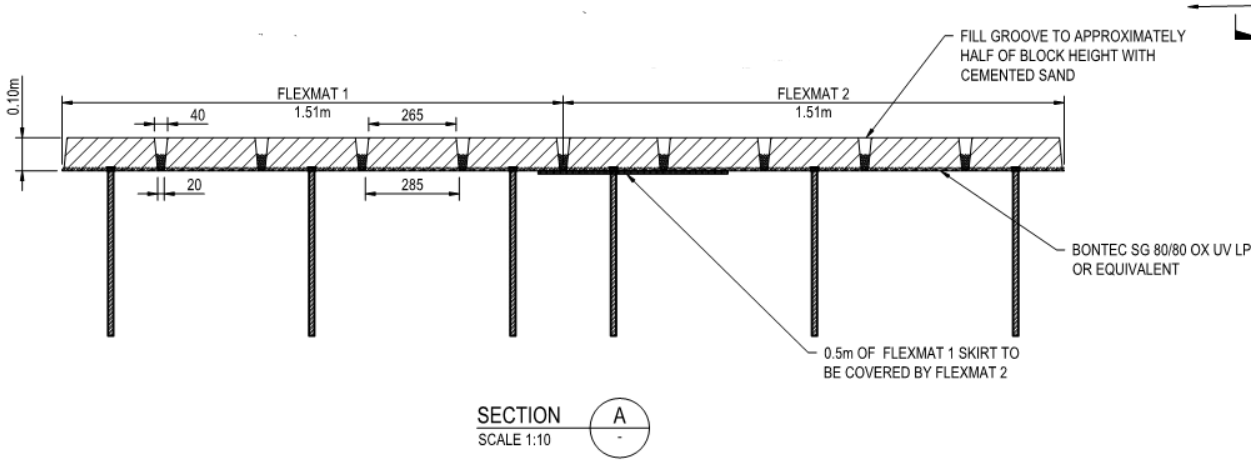
Figure 3.5: Typical section of approach structure



57. **Boat ramp**. A proprietary type flexmat will be used to provide a 20ft dinghy from the dredged turning basin to the land. The flexmat consists of a 3m wide uniform rectangular pattern of square concrete blocks pre-cast onto a durable woven polypropylene fabric which is then laid by a mobile crane onto the prepared site and anchored to the reef platform using anchor pins to prevent creep or slippage caused by vehicle movement and wave dynamics. The flexmat will be precast out of the country and delivered by ship or barge to the site. Minimal surface levelling of the reef platform and beach will be required to allow for the placement of the flexmats which can be undertaken by mobile cranes.

58. A flexmat system has been chosen for the ramp instead of a solid concrete slab and beam as they are lightweight, can be precast to minimize costs and have a flexibility that can follow the changing shape of the beach profile as it moves seasonally with the prevailing conditions. A cross section of the flexmat ramp is shown in Figure 3.6.

Figure 3.6: Cross-section of flexmat ramp



Source: TA 8674-REG: Trade and Transport Facilitation in the Pacific – Feasibility Study (April 2018)

59. **Coastal protection.** The coastal protection option was identified as the preferred method for the placement of the passenger terminal and cargo shed. This was the preferred option for the community. It should be highlighted that location of the reclamation area being next to the dredged channel will be helpful during the construction stage. This would allow a more efficient transfer and placement of the dredged material during construction activities. During the operation stage, the short distance between the terminal building and the berthing areas will allow more convenience and efficiency for the passengers and cargo handling vehicles. The layout of the revetment will be designed in such a way that the need for reclaiming land would be minimised and would be in harmony with the existing coastline as much as possible. A curved revetment in the southern part of the reclamation area will be included in the design to allow this. This layout requires the construction of a seawall comprised of rock armor along the foreshore to minimize the effects of cyclonic waves. This rock will typically be of basalt or granite material to satisfy technical specification. The rock will be sourced from the quarries nominated by the contractor subject to the Engineer approval and will need to be sourced outside of the country. The protection structure of the reclamation area (i.e. rock armour revetment) will be designed for 200 ARI waves as well as extreme cyclonic condition. Therefore, this increases the resilience of this part of the island against cyclonic waves.

60. **Navigational aids**. The channel will be properly marked to ensure the safe passage of boats entering and departing from the harbor. A number of navigational lights (nav-aids) will be proposed considering the alignment and plan of access channel and harbor basin; It has been evaluated that two nav-aids should be located in deeper water on either side of the entrance to the harbor at the outer edge of the reef platform. They will be subject to extreme wave forces during a cyclonic event.

61. **Road works**. A road access from the wharf to the laydown area will be used to transport dredged material to the laydown area for processing and stockpiling. The proposed road will consist of a single 4m carriageway and will use approximately 1,800m^3 of dredged material to form the road. An access to the laydown area will be upgraded and may involve the removal of coconut trees. This will be done in consultation with the Kaupule as a number of properties will be affected.

62. The fill material shall be deposited in layers of a thickness appropriate to the compaction method to be used. The roadworks will be graded to ensure that there is no major ponding as a result of heavy rain events. Otherwise, drainage is achieved by sheet flow onto the surrounding un-cleared land without the need to construct any specific drainage infrastructure.

63. **Cargo warehouse**. The proposed warehouse is a standard building shell that is best designed and built as a performance-based specification combined with the concept building layout drawings to achieve the best possible outcome and price of the structure. The warehouse is a single-story structure with one section partitioned off for food storage. The walls of the warehouse are partially exposed to allow good ventilation of the structure. The warehouse lighting is by solar powered LED lights.

64. **Passenger terminal**. The passenger terminal is a one-story building with no main walls and an aluminium sheet roof that will mirror the traditional Tuvaluan building. The entire shoreside of the building will be open to the harbor, allowing for the best views to be captured as well as for a wind cross flow throughout the building. A water tank is included for water supply of the terminal and nearby areas. The septic tank is shown nearby and is based on a standard Tuvalu PWD type tank.

IV. BASELINE INFORMATION

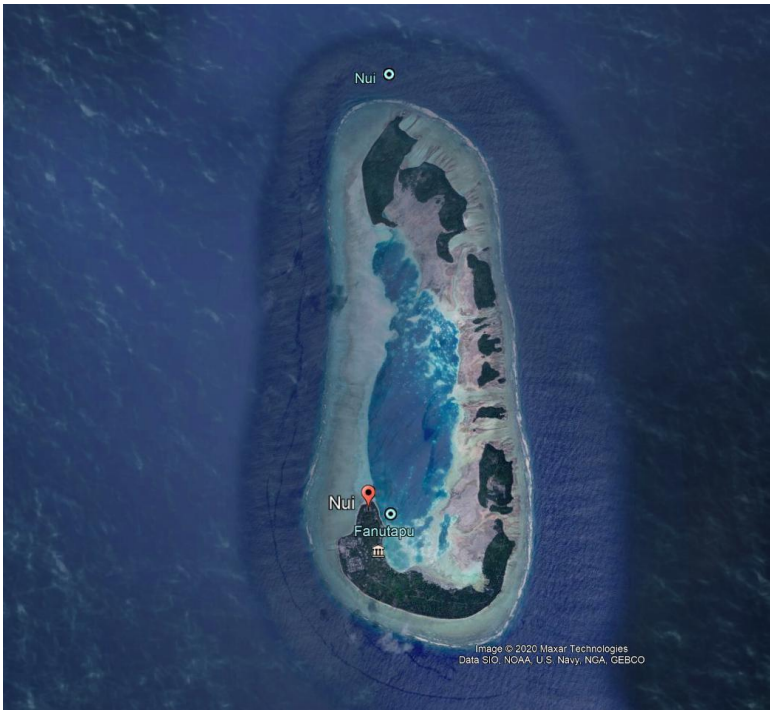
A. Physical Resources

65. Tuvalu consists of six coralline atolls (Nanumea, Nui, Nukufetau, Funafuti, Nukulaelae, Vaitupu), and three table reef islands (Nanumaga, Niutao, Niulakita) with a total land mass of some 26 km^2 spread across an economic zone of 757,000 km^2.

66. **Topography and geology**. The islands of Tuvalu are very low-lying with an average height of 2m above sea level. Like other coral atolls and islands, the soil is derived from limestone which results from coral formation over thousands of years. Tuvalu is geologically very young, with most of its islands having poorly developed sandy or gravel coralline soils.

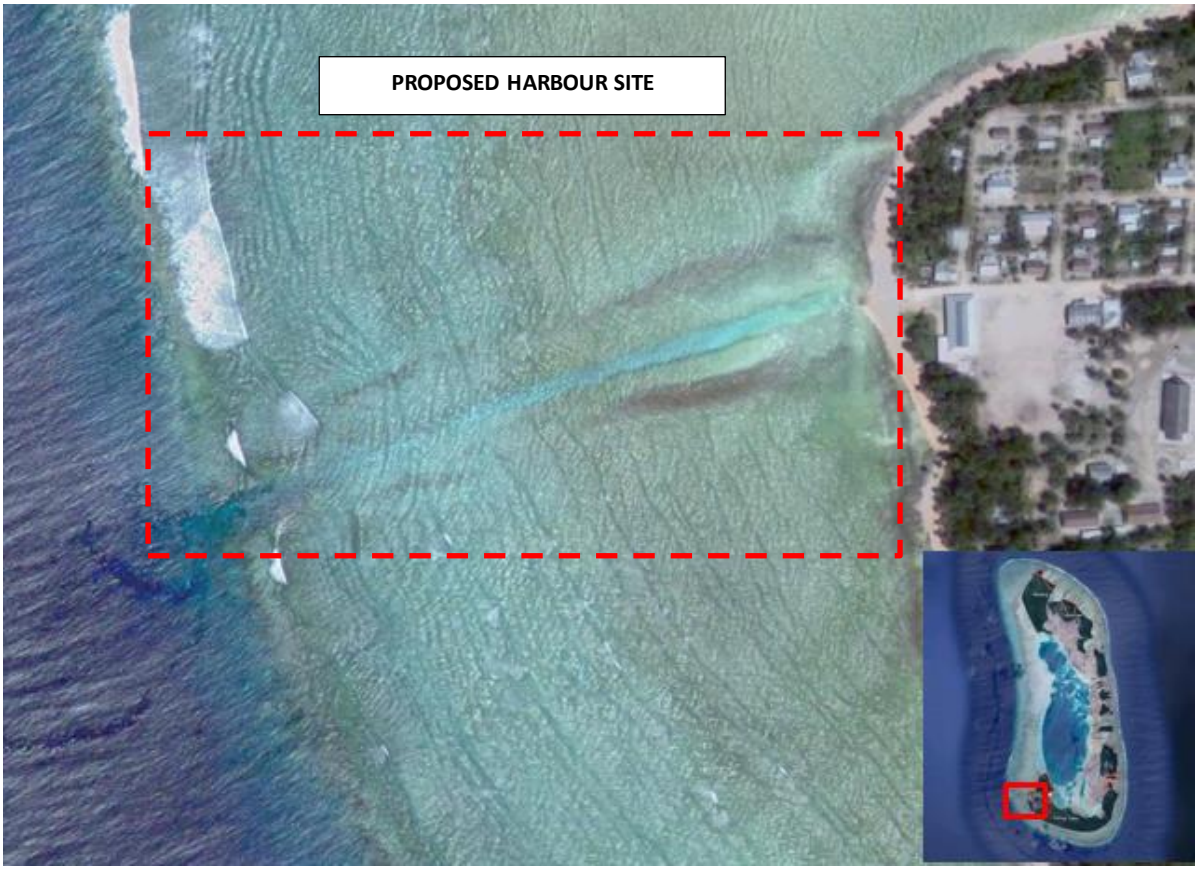
67. Nui Island, located at 7°13' south and 177°9' east, is an elongated 'ringed atoll' with the longest section trending north-south, shown in Figure 4.1. Most of the land above sea level is located along the eastern margin. Nui consists of at least 21 islets, with the two biggest atolls in the group located at the northern and southern tip of the island. The western margin of the island comprises submerged reef platform.

Figure 4.1: Satellite image of Nui



68. The southernmost islet of the atoll, Fenua Tapu, is residence to the majority of the island population. There are two villages, Alamoni and Manutalake. The project site is located towards the western side of this islet, where an existing channel has been formed in the shore platform (Figure 4.2). The existing channel serves as the main embarking point for cargo and passengers travelling by boat to/from Nui. An access way from the mainland connects to a concrete ramp leading to the existing channel.

Figure 4.2: Satellite Image of proposed harbor site at Nui



69. The project site comprises of flat land above the high-water mark with gently sloping beached zone connecting to a reef limestone platform that extends some 500m into the ocean. The surface of the island is covered in weathered, cemented derivatives of reef limestone. The island is vulnerable to coastal erosion due to human activity and the effects of tropical cyclones

70. There are remnant building structures comprising concrete columns and slabs near the project site. The original buildings were destroyed by Tropical Cyclone Pam. There are also a number of buildings along the shoreline, most notably the local council meeting house.

71. In 2016, a hydrographical and topographic survey was undertaken of the project site area. The hydrographic survey covered the marine area footprint of the facility and topographic survey was undertaken extensive topographic survey of the landside areas.

72. **Soils.** The calcareous soils found on all three island are shallow, coarse-textured and poorly developed overlying a limestone formation. Soils range from 250-1000mm in depth, generally low in fertility and have limited potential for agriculture production being typically deficient in most of the important nutrients needed for plant growth (e.g. nitrogen, potassium and micronutrients such as iron, manganese, copper and zinc). The island landscape is inherently dynamic, with erosion and accretion of sands along the coastal margin being common features on all the islands, especially during tropical cyclones associated with high seas and storm surges.

73. **Reef platform.** The formation of reef platforms is a complex phenomenon with the following phenomenon occurring throughout geological times:

- Coral reef can die and result in soil-like deposits sandwiched in between medium to high strength limestone "slabs"
- Tides can transport loose deposits which translates in presence of voided cavities within the rock mass

74. Human activities such as the construction of the existing harbor channel can contribute to degradation of the reef platform. In particular, it is believed that the channel has had adverse impacts in terms of accelerated transportation of loose deposits 0.3m to 0.5m below the reef platform level. This is believed to be the cause of the observed large voidaceous horizon 0.3m to 0.5m below the reef platform level, as shown in Plate 4.1.

Plate 4.1: Large voids below the reef platform

75. **Seismicity.** Tuvalu is situated in a relatively quiet seismic area but is surrounded by the Pacific "ring of fire," which aligns with the boundaries of the tectonic plates. These tectonic plate boundaries are extremely active seismic zones capable of generating large earthquakes and, in some cases, major tsunamis that can travel great distances. No significant earthquakes have been observed in recent history. However, in 1899, a large earthquake off the eastern coast of New Ireland, Papua New Guinea generated a large tsunami that resulted in destructive waves at Nukufetau atoll and a significant historic seismic event was a magnitude 7.0 earthquake recorded in 1907.[5] The World Bank Country Risk Profile concludes that Tuvalu has a 40% chance in the next 50 years of experiencing, at least once, weak levels of ground shaking.[6]

76. **Coastal processes.** Hindcast modelled wave data offshore of Tuvalu (deep ocean waves) indicates that the offshore non-cyclonic wave climate is predominantly driven by the south-east trade winds and long period south-westerly swell waves from the Southern Ocean. The wave climate information shows that waves predominantly come from the east to the south-east (~25% occurrence) and can exceed 3m significant wave height (Hs) at times. There is also a significant occurrence of long-distance swells coming from the south-west which typically have higher periods.

77. **Tides.** Tidal variations in the area are generally small, with a mean spring tidal range (MLWS to MHWS) of 1.6 m. Due to the small tides, tidal currents are expected to be small. The governing currents on the reefs are expected to be driven by waves. The island has a fringing reef. The larger waves plunge on the edge of the reef due to the steep drop-off and abrupt change in depth at this location. The tidal range for Funafuti – Tuvalu is set out in Table 4.1; Nui's tides are expected to be similar to Funafuti's tides.

Table 4.1: Tidal range for Tuvalu (used for Nui harbor)

Tidal Plane	Water Level (m to LAT)	Water Level (m to MSL)
Highest Astronomical Tide (HAT)	2.422	1.263
Mean High Water Spring (MHWS)	1.980	0.821
Mean High Water Neap (MHWN)	1.492	0.333
Mean Sea Level (MSL)	1.159	0
Mean Low Water Neap (MLWN)	0.827	-0.332
Mean Low Water Spring (MLWS)	0.338	-0.821
Lowest Astronomical Tide	0.000	-1.159

Source: Pacific Catastrophe Risk Financing Initiative - Country Risk Profile Tuvalu (2008)

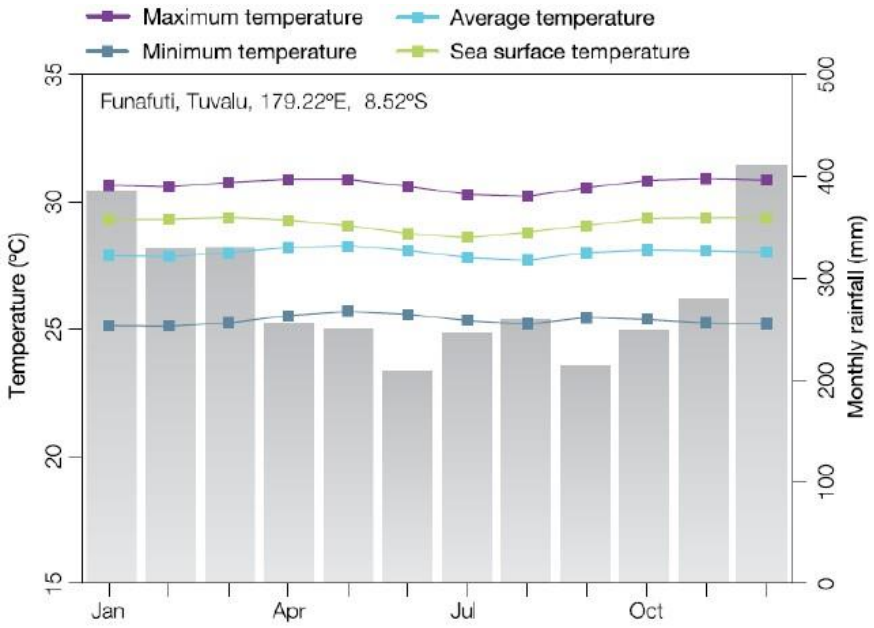
[5] AIR Worldwide Corporation. 2008. Pacific Catastrophe Risk Financing Initiative, Country Risk Profile Tuvalu (Funafuti, Tuvalu)

[6] World Bank. 2011. Pacific Catastrophe Risk Assessment and Financing Initiative: Tuvalu Country Risk Profile (Washington D.C, US)

78. The majority of annual waves (~ 78%) are from a south/south-westerly quadrant and hence the solid approach structure is proposed to be on the southern side of the harbor to provide full protection from this weather. The harbor layout, the orientation and location of detached breakwater(s) have been finalized based on the outcomes of the wave agitation study.

79. **Climate.** Tuvalu has a tropical marine climate with consistently uniform temperature ranging from 26°C – 32°C and high humidity (Figure 4.3). The average annual rainfall is 3,000mm but rainfall can exceed 4,000mm per annum at times, though Tuvalu often experiences droughts because of its location near the Pacific equatorial dry zone. The average rainfall for the period 1942–2005 is 2,875mm per annum. However, rainfall varies from 3,500 mm/annum in the southern islands to 2700 mm/annum in the northern islands.

Figure 4.3: Seasonal rainfall and temperature in Funafuti

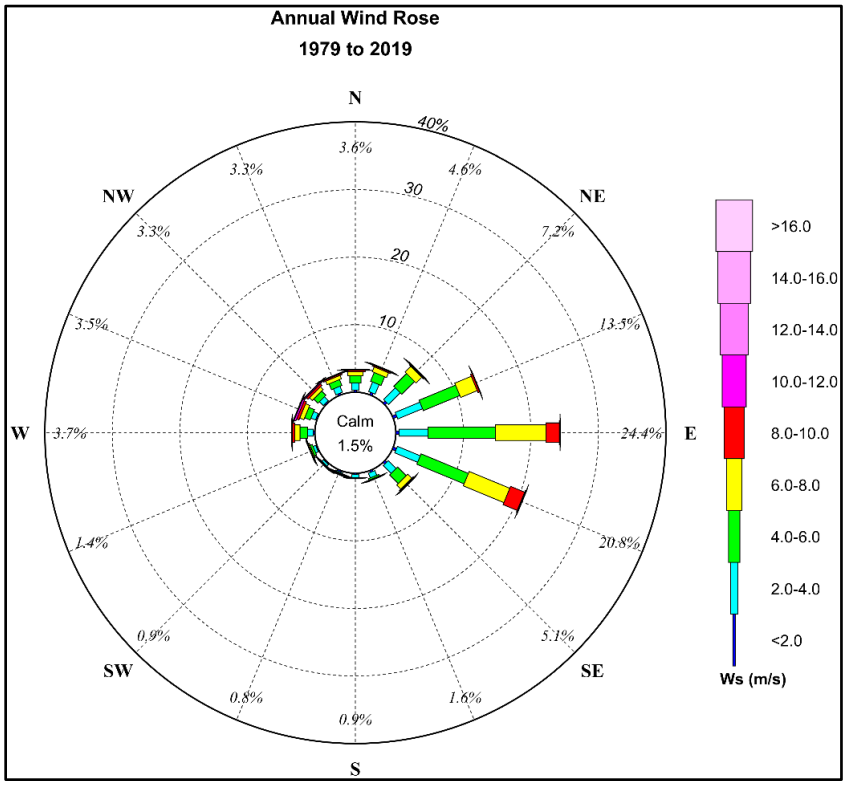


Source: Pacific Climate Change Science Program – Current and Future Climate of Tuvalu (2011)

80. Tuvalu lies within the south-east Pacific trade wind belt just south of the dry belt of the equatorial oceanic climate zone. The country has two distinct seasons – a wet season from November to April with winds from the west and northwest when strong winds and high rainfall can be expected, and a dry season from May to October when light southeast trade winds predominate. The predominant wind direction ranges between east-northeast to east-southeast for all islands of Tuvalu, as shown in Figure 4.4.

81. The cyclone season is from November to April with winds from the west to north-west when strong winds and high rainfall can be expected. An average of eight cyclones per decade developed within or crossed the Tuvalu exclusive economic zone between the 1969/70 to 2010/11 seasons. Tropical cyclones were most frequent in El Niño years (12 cyclones per decade) and least frequent in La Niña years (three cyclones per decade).

Figure 4.4: Annual wind rose



82. Only three of the 24 tropical cyclones (13%) between the 1981/82 and 2010/11 seasons were severe events (Category 3 or stronger). Available data are not suitable for assessing long-term trends.[7] Several severe tropical cyclones have caused devastating damage to Tuvalu in recent years. Notable cyclones include Cyclone Bebe in 1972, a Category 3 cyclone, which knocked down 90% of the houses on Funafuti and resulted in flooding due to seawater coming up through the coral to a depth of 1.5 m.

83. In 1990, Category 4 Cyclone Ofa affected Tuvalu and destroyed homes on Niutao, Nui and Nukulaelae. Cyclone Gavin was the first of three Category 3 tropical cyclones to affect Tuvalu during the 1996-97 cyclone season, with Cyclones Hina and Keli affecting the islands later in the season. In March 2015, Category 5 Cyclone Pam resulted in 3-5m waves causing significant damage to agriculture and infrastructure on most of the islands in Tuvalu including deposition of sand and rubble on the island, erosion of the foreshore and damage to buildings More recently, Category 4 tropical cyclone Ula affected Tuvalu in early 2016 with 3-4m waves affecting all the islands.

[7] Government of Australia and Pacific Climate Change Science Program. 2011. Current and Future Climate of Tuvalu (Canberra, Australia)

84. Storm surges associated with cyclonic disturbances combined with high tides can result in waves washing over low sections of the atolls. As well as disrupting road access, increasing soil salinity, contaminating groundwater, and enhancing coastal erosion processes, the resulting flooding causes agricultural losses, particularly of taro crops, and damage to buildings. These storm surges have implications for the design of the harbor and jetty facilities.

85. **Climate change.** Tuvalu is listed as one of several island groups most likely to disappear beneath the sea in the 21st century due to climate change effects. For the period to 2100, the Pacific Climate Change Science Program of Australia[8] projections and climate science findings indicate:

- Surface air temperatures and surface sea temperatures are projected to continually increase (very high confidence);
- Annual and seasonal mean rainfalls are projected to increase (high confidence);
- The intensity and frequency of extreme heat days are projected to increase (very high confidence);
- The intensity and frequency of extreme rainfall days are projected to increase (high confidence);
- The incidence of drought is projected to decrease (moderate confidence);
- Tropical cyclone numbers are projected to decline in the south-east Pacific Ocean basin (0–40ºS, 170ºE–130ºW) (moderate confidence);
- Ocean acidification is projected to continue (very high confidence);
- Mean sea-level rise is projected to continue (very high confidence); and
- The risk of coral bleaching will increase in the future (very high confidence).

86. **Water resources**. There are no freshwater rivers or streams on the island, however fresh water exists underground as water lenses floating on seawater. As on other islands in Tuvalu, fresher water sits in a "lens" above the saltwater that leeches in through the coral. These are derived from the infiltration of rainwater into the water table below the ground. These lenses exist along the length of the island and are deepest at the center and shallowest on the sides facing the ocean or lagoon. The lens is formed where the island is sufficiently wide to reduce the outward flow of the accumulated underground lens. These freshwater lenses are extremely vulnerable to occasional environmental influences.

87. Water quality measurements on the islands indicate that groundwater is heavily polluted with a high bacteria count. Due to the increase in the level of pollution and salinity of ground water sources and, all islands are now predominantly reliant on rain water collected from buildings and houses with iron roofs and stored in concrete tanks above and below ground or more recently in plastic tanks provided by European Union and Government of Australia financed projects. Nui has a desalination plant to provide fresh water from sea water.

[8] Government of Australia and Pacific Climate Change Science Program. 2011. Climate Change in the Pacific - Volume 2: Country Reports, Chapter 15 Tuvalu (Canberra, Australia)

88. **Unexploded ordnance.** Tuvalu was used as an important staging base for US aerial attacks in the Battle of Tarawa in Kiribati during World War II. Bomber bases were established on Funafuti, Nanumea, and Nukufetau, being the only islands big enough to accommodate them, with the latter two being considerable closer to Tarawa. Funafuti, Nanumea and Nui were the only islands to be bombed during this operation.

89. In the case of Nui, American planes dropped two bombs on the reef near the northern islet of Meang, as part of a practice bombing run. It would appear unlikely there remains any unexploded ordnance (UXO) in and around the existing channel into the harbor.

B. Terrestrial Biological Resources

90. **Flora.** As the soils are generally of poor quality, they can support only a limited variety of flora. Thaman et al notes that the total number of vascular plants reported present at some time in Tuvalu is about 356 species of which only 64 (18%) are possibly indigenous. The remaining 292 species (82% of flora) are exotic species that have been introduced.[9] Most of the exotic species are described are ornamental or food plants or weeds. The most common trees found on all islands are coconut (*Cocos nucifera*) stands which make up around 67% of the land cover area of the outer islands, casuarinas (*Casuarina equisetifolia*), breadfruit (*Artocarpus sp*), hibiscus (*Hibiscus sp*), papaya (*Carica papaya*) pandanus (*Pandanus tectorius*), flame tree (*Delonix regia*) salt bush (*Scaevola sericea*) and terminalia (*Terminalia sp*). These plants are widespread in the Pacific and tropical regions generally, though most are spread primarily by human cultivation. Papaya and flame tree originate from outside the Pacific region. Indigenous broad leaf species, including *Calophyllum inophyllum*, make up single trees or small stands around the coastal margin.

91. There are no endemic species that are unique to Tuvalu and almost all indigenous plants are widespread, easily dispersed pan-tropical, Indo-Pacific or pan-Pacific coastal species that can cope successfully in environments with loose shifting sands, soilless limestone and rock outcrops, high wave action, high salinity and sea spray, periodic flooding, strong sunlight, strong winds and drought – all of the them conditions common on the atolls and islands of Tuvalu. The low number of indigenous species is an indication of the lack of habitat diversity on atolls and low islands compared with larger high islands, the difficulty of cross-ocean dispersal of plants and the difficulty of long term survival in the harsh atoll and low island environment. From the most “natural” to the most highly modified/disturbed vegetation, the main vegetation types found on the atolls and islands of Tuvalu include:

- Inland broadleaf forest and woodland – in Nui this is represented by scattered remnant trees
- Coastal littoral forest and scrub
- Mangroves and wetlands
- Coconut woodland and agroforest
- Excavated taro gardens, village house yard and urban gardens; and
- Intensive vegetable and fruit gardens.

[9] Thaman, R, Fihaki, E. and Fong T. 2012. Plants of Tuvalu. USP Press Suva.

92. Mangrove forests, comprising two recorded species *Lumnitzera littorea* and *Rhizophora stylosa* (Rhizophoridae), also exist on muddy shores and coastal beaches where water is calm and in areas that are protected from waves and strong currents. The mangroves of Tuvalu are listed as a threatened ecosystem.

93. **Fauna.** The fauna of Nui is typical of the inhabited islands and atolls of Tuvalu.[10] The indigenous terrestrial vertebrate fauna of Tuvalu includes no indigenous land mammals, amphibians or freshwater fishes. There are some of terrestrial reptiles, all lizards, one of which is Tuvalu's only recorded endemic vertebrate, the Tuvalu forest gecko (*Lepidodactylus tepukapili*) which was found only on Tupuka Islet, Funafuti. Pigs, fowl, and dogs, all of which were imported in the 19th century, flourish on all the islands. There are also insects, land crabs and lizards, which are commonplace. The only indigenous mammal is the Polynesian rat which was most likely brought in with the first people.

94. **Avifauna.** A total of 41 species of birds have been identified in Tuvalu, of which 28 species are indigenous. There are three main families which include *Sternidae*, comprising eight species of terns and noddies; *Scolopacidae*, comprising six species of tattlers, godwits, curlews and stints; *Procellariidae*, comprising five species of shearwaters and petrels. These three families account for 46% of the total number of bid species recorded. Terns and noddies are resident birds and most of them are breeding in Tuvalu. Tattlers, godwits, curlews and stints are migratory birds. Shearwaters and petrels are visitors, quite uncommon and for which no breeding sites are known.[11] There are 22 known species of butterfly and moth.

95. **Baseline assessment of the project area.** Three specific project affected areas were sampled to gauge the terrestrial resources that would be affected by the project. These include the area around the construction of the passenger and cargo terminal and the landside extension to accommodate these facilities and the foreshore environment where these facilities will be constructed. The other two areas include the laydown and contractor accommodation area, which lies a short distance away from the harbor site, and the road linking the two places. Twelve systematic sample plots, each of $100m^2$ in size were established at the site of the proposed temporary laydown facilities. Data on soils, vegetation and fauna were collected at each quadrat site. The site of the onshore facilities and road was assessed using a walked meander technique to cover the entire area affected by the project.

96. **Laydown area.** The most dominant canopy species is coconut (*Cocos nucifera*) which was recorded across all survey areas and particularly the temporary laydown area. Other commonly encountered species that were generally found in the sub-canopy include sea hibiscus (*Hibiscus tiliaceus)* and Pandanus (*Pandanus tectorius*). A shrub layer does not consistently occur, but where it does, it supports species including native mulberry, *Pipturus argenteusi, Morinda citrifolia*. The ground layer is dominated by coarse leafy litter from canopy trees as well as a number of grass species including *Lepturus repens, Stenotaphrum micranthum* and *Thuarea involuta*. Ferns were commonly encountered with the laydown area and these are located both epiphytically and also as ground ferns. Some of the common species include *Microsorum grossum, Nephrolepis acutifolia* and *Asplenium nidus*.

[10] Government of Tuvalu. 2016. Tuvalu National Biodiversity Strategy and Action Plan: Fifth National Report to the Convention on Biological Diversity (Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour)

[11] Job, S. 2009. Tuvalu Marine Life Project - Phase 1 Literature Review (Funafuti, Tuvalu)

97. The most commonly observed fauna were copper-tailed skinks (*Emoia cyanura*). Numerous crab holes were observed possibly from nesting rainbow crab (*Cardisoma rotundum*). A range of insects were noted, including *Euploea lewinii* and *Eriophora spp*.

98. **Wharf and associated facilities.** The site is a highly disturbed area with exposed sand and no coastal vegetation except for a small number of coconut trees located behind the community hall and along the periphery of the church and surrounded by buildings. Patches of grass comprising species such as *Lepturus repens, Stenotaphrum micranthum* and *Thuarea involuta* were also recorded around the existing buildings whilst patches of *Fimbristylis cymosa* was also observed.

99. **Access road.** The flora of the access road site is dominated by coconut trees which is consistent with other survey areas on Nui. The vegetation in this area is likely to play an important role in the stabilization against wind and wave erosion and would provide a refuge for local fauna. The western side of the proposed access road, the foredune area, is dominated by creeping vines such as *Ipomoea pescarpae* with other species such as *Canavalia rosea, C. sericea* and *Vigna marina* also noted. This area also supports a number of grass species including *Lepturus repens* and *Thuarea involute*. Extending landward, the mixed shrub and small tree zone supports species including *Scaevola taccada, Pipturus argenteus, Tournefortia argenta, Acacia simplex, Hibiscus tiliaceus* and *Premna serratifolia*. The most landward portion of this survey area is dominated by coconut trees, pandanus and *Premna serratifolia* to average heights of 15m to 20m.

100. With respect to fauna, the copper-tailed skink was again observed regularly. Importantly, the larger *Pisonia grandis* trees contained active nesting and roosting areas for the black noddy (*Anous minutus*) which is a species of local cultural importance and the white tern (*Gygis alba*).

C. Marine Biological Resources

101. **Overview.** Tuvalu's marine environment is the main local source of animal protein, products, such as shells, for handicraft production and revenue from licensing agreements with foreign fishing nations fishing within Tuvalu's exclusive economic zone (EEZ).[12] Exploitation at the local level is mainly for subsistence use, although there has been limited local commercial fishing of finfish and shellfish for local sale and limited export on Funafuti.

102. **Coastal resources**. Tuvalu's shallow marine environments consist predominantly of fringing and patch reefs, with reef flats and intertidal rocky/sandy shores. There is no continental shelf seaward of any of the islands and the only substantial areas of shoal water are found within the internal lagoons. These atolls and low coral islands are generally subject to constant change through continuing growth of living corals, erosion and accretion of wave action. Water depths increase very rapidly from the coast to over 1000 m within a few kilometers from the shore or outer reefs (Sauni 1998).

103. The coastal areas of Nui are characterized by white sandy beaches, reef flats, reef patches, lagoons, mangrove forests, extensive reef mud flats and sea grass beds. These areas contain a variety of habitats, numerous eco-systems and marine organisms. The islands are vulnerable to coastal erosion due to human activity and the effects of tropical cyclones.

[12] Government of Tuvalu. 2016. Op cit

104. The impact of mining of beach sand, gravel and other aggregates for construction purposes on the coastal processes has significantly affected coastal areas on all islands. Consequently, the removal of beach gravels and sands are now limited only for the construction of houses for personal use. Any project-scale removal of gravels and are sand are not permitted. Thus, infrastructure projects are now required to import suitable aggregate, mainly from Fiji, adding considerably to the costs of construction.

105. **Marine ecological baseline survey methodology**. A grid of 74 pre-determined survey points were sampled at sites on the reef crest and slope at the seaward margin of the project site and within an approximate 50m buffer of the proposed infrastructure by remote underwater vehicle (ROV) deployed from a small tender and the reef flat surveyed on foot from the shore at low tide (December 2019). Each sampling site was navigated by using a hand-held GPS and the percentage cover of coral, macroalgae, coral rock, coral rubble and soft sediment at each site was determined and recorded on a data sheet. Photos and video of each site, including the types of coral, macroalgae and other biota (fish and mobile invertebrates), were taken for subsequent identification of taxa present. All video was reviewed and analyzed in the laboratory following completion of the field survey. Foreshore and reef flat locations in the areas north and south of the project area were briefly inspected.

106. **Foreshore.** Foreshore in the zone north of the proposed maritime infrastructure consisted of a beach (approximately 14 m wide) of predominantly of fine to medium pale yellow sand with occasional large boulders along the high tide mark. The shoreline was vegetated with occasional coconut palms and low relief under-story (see Plate 4.2 a and b).

107. Foreshore in the zone south of the proposed maritime infrastructure consisted of a gently sloping beach between 5 m and 15 m wide with occasional large boulders and patches of pebbles and coral rubble. There was a slightly raised bare platform of flat limestone reef approximately 5 m wide before reaching the lower reef flat**.**

Plate 4.2 a and b: Representative foreshore habitat at Nui

108. **Reef Flats.** Reef flats to the zone north of the proposed maritime infrastructure development were flat limestone with various potholes, crevices and unconsolidated coral rubble. The reef flat was colonized by a thin layer of turfing brown and filamentous green algae ingrained with beach sand.

109. Reef flats to the zone south of the proposed maritime infrastructure development were flat limestone with occasional larger boulders and patches of unconsolidated coral rubble. The reef flat was colonized by a thin layer of turfing brown and filamentous green algae ingrained with beach sand, but also some widespread mats of green algae (*Caulerpa racemosa*).

110. Reef flats within and around the vicinity of the proposed maritime infrastructure (excluding the channel itself) consisted of predominantly flat limestone with patches of unconsolidated coral rubble and small boulders and occasional potholes with shallow pools. The reef flat was colonized by a thin layer of turfing brown algae ingrained with beach sand but was otherwise mostly bare (see Plate 4.3 a and b). Of the sites surveyed on the reef flat, mean macroalgae cover was 7.1% (±2.8) and the rest coral rock, rubble and sediment. Live coral was not associated with this habitat type.

Plate 4.3 a and b: Representative reef flat habitat

111. **Reef crest**. Habitat surveyed on the reef crest consisted of higher relief rocks and some boulders with crevices and natural channels and with generally greater habitat heterogeneity compared to the reef flat. Live coral cover was very sparse, and the reef surface was mostly bare other than encrusting, red and coralline algae, turfing filamentous algae and occasional clumps of green macroalgae (*Neomeris vanbosseae* and *Caulerpa racemosa*). Mobile macroinvertebrates observed at sites on the reef crest mainly included echinoderms such as lollyfish/black sea cucumber (*Holothuria atra*), banded sea urchin (*Echinothrix calamaris*) and mottled sea star (*Linckia multiflora*) and gastropod molluscs (*Lentigo* sp.).

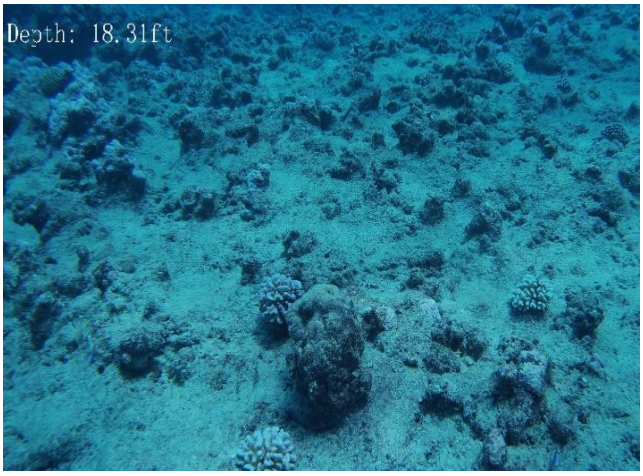
112. Of the sites surveyed on the reef crest, mean macroalgae cover was 7.9% (±1.5), live coral was 4.3% (±1.3) and the rest was bare coral rock, rubble, sediment and turfing/filamentous algae. Representative habitats associated with reef crest within the survey area (see Plate 4.3 a and b).

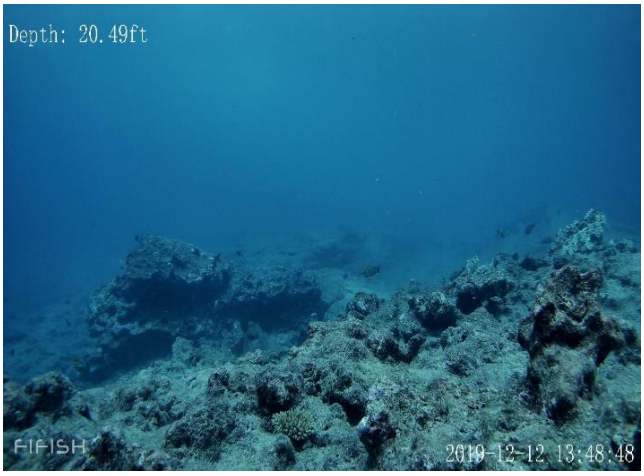
Plate 4.3 a and b: Representative reef crest habitat

113. **Reef slope.** Habitat on the reef slope consisted of relatively low relief reef with numerous small nodules and occasional larger outcrops. Coral cover was relatively sparse with five genera identified during the survey including Acropora sp. Montipora sp. Lobophylla sp. Pocillopora sp. Cyphastrea sp. and Porites sp. These included various different branching, massive, encrusting and digitate growth forms. The majority of the area was bare rock with encrusting red and coralline algae, occasional encrusting sponges and interspersed with patches of sandy sediment and turfing filamentous algae (see Plate 4.4 a and b).

114. Of the sites surveyed on the reef slope, mean macroalgae cover was 3.8% (±2.8), live coral was 10.4% (±1.4) and the rest was bare coral rock, coral rubble, sediment and turfing/filamentous algae.

Plate 4.4 a and b: Representative reef slope habitat





115. **Existing channel.** The existing channel floor consisted of mostly bare sandy substratum with occasional small boulders and unconsolidated coral rubble and the occasional lollyfish. The channel walls were also bare apart from a mat of filamentous brown turfing algae ingrained with sand and some large patched of green algae (*Caulerpa racemosa*) and occasional hard corals (Genus: Porites). Representative photos of the existing approach channel are shown in Plate 4.5 a and b.

116. Of the sites surveyed within the channel, mean macroalgae cover was 31.7% (±29.2) and was concentrated mainly at one survey site. No live coral was recorded at survey sites within the channel.

Plate 4.5 a and b: Representative channel floor habitat

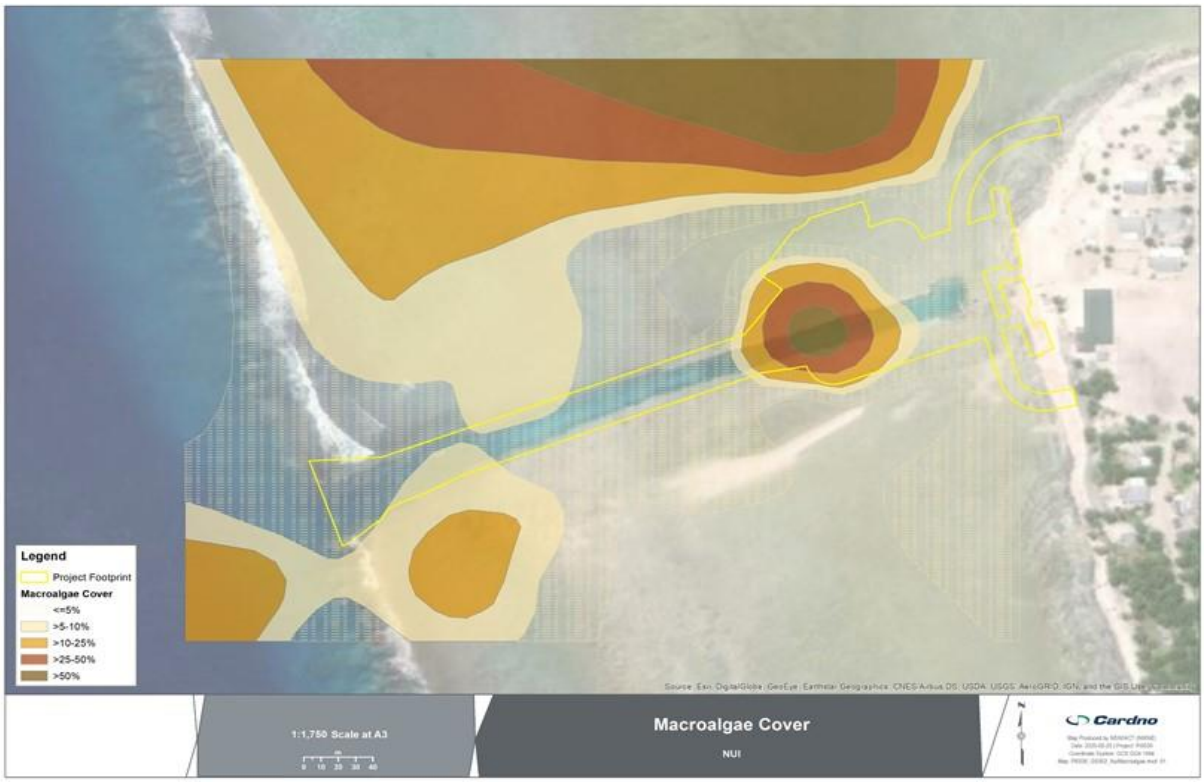
117. **Habitat mapping.** Habitat types were broadly classified according to the percentage cover of the predominant taxa, being macroalgae, live coral, coral rock, coral rubble/soft sediment.

118. **Macroalgae.** The interpolated cover of macroalgae within the project footprint was generally very sparse throughout the survey area, with the largest proportion of the project footprint containing less than 5% cover (see Table 4.2 and Figure 4.4). Only two species of macroalgae recorded, these were both green algae: *C. racemosa* and *N. vanbosseae. C. racemosa* was recorded on the reef flat, within the existing dredged channel and also on the reef crest and slope. *N. vanbosse* was generally associated with the reef crest.

Table 4.2: Indicative area of macroalgae within the project footprint

Cover	Area_(sq. m)	Area_(ha)
>50%	874.91	0.09
>25-50%	1993.02	0.20
>10-25%	2038.17	0.20
>5-10%	1119.65	0.11
>5-10%	414.68	0.04
>5-10%	978.82	0.10
<=5%	12224.46	1.22

Figure 4.4: Percent cover of macroalgae recorded at Nui site



Source: Cardno – Marine Ecology Assessment (March 2020)

119. **Corals.** The interpolated cover of live coral was generally very sparse within the project footprint. The most live coral observed within the project footprint was on the reef slope at the mouth of the approach channel, but this was still comparatively low (around 5%). Some of the sites surveyed just outside of the project footprint (Sites 9, 17 and 18) had live coral cover of 15%, 12% and 10% respectively.

120. Results of the field survey indicate that the percent cover and taxonomic diversity of live coral in and around the existing approach channel and proposed harbor footprint at Nui is relatively low and confined to within a relatively small area of the reef crest and slope where the existing channel would be widened. The indicative percent cover of live coral was comparable to that recorded at Nanumaga and much lower than that recorded at the islands of Niutao and Nukulaelae which were previously surveyed by Cardno in 2016 using similar methods. The different design options proposed, therefore have minimal impact on the more sensitive parts of the proposed harbor site. Refer to Table 4.3 and Figure 4.5.

Table 1.5: Indicative area of live coral within the project footprint

Cover	Area_(sq. m)	Area (ha)
<=1%	5058.65	0.51
>1-5%	6262.76	0.63
>5%	494.29	0.05

Figure 4.5: Percent cover of live coral recorded at Nui

Source: Cardno – Marine Ecology Assessment (March 2020)

121. **Fish**. Species of fish observed from underwater drone footage included mostly small reef fish from the families Chaetodontidae (butterflyfish), Acanthuridae (surgeonfish) and Balistidae (triggerfish). Only ten species were observed at the time of survey, however, this was just a snapshot of species observed from approximately 1 hour of underwater footage. The actual number of species associated with the proposed harbor site is likely to be significantly larger (Table 4.4).

122. **Other marine fauna**. A total of 358 species of fish from 63 families were recorded on the islands of Niutao, Nui and Nanumea between January 1988 and August 1990 as part of an environmental impact study. The most diverse groups were from the families Labridae (wrasses), Chaetodontidae (butterfly fishes), Serranidae (groupers and rock cods) and Pomacentridae (damselfishes). Other speciose groups recorded in these surveys (and which are common to other Pacific islands) included Acanthuridae (surgeon fishes), Balistidae (trigger fishes), Lutjanidae (snappers) and Scaridae (parrot fishes). Several species of sharks and rays (elasmobranchs), including hammerhead, thresher and requiem (reef) sharks were also recorded among the many other families. Jones et al. (1991) considered that the actual number of species likely to occur in the islands of Tuvalu would likely be closer to that of the Marshall Islands (817 species).

Table 4.4: List of fish species recorded in survey

Fish Family	*Scientific name*	Fish Family	*Scientific name*
Carangidae (Trevally)	*Gnathanodon specciosus*	Chaetodontidae (Butterflyfish)	*Chaetodon kleinii*
Pomacentridae (Damselfish)	*Pomcentris coelestis*	Chaetodontidae (Butterflyfish)	*Chaetodon vagabundus*
Apogonidae (Cardinalfish)	*Apogon cyanosoma*	Chaetodontidae (Butterflyfish)	*Cheatodon ephippium*
Acanthuridae (Surgeonfish)	*Acanthurus nigricans*	Chaetodontidae (Butterflyfish)	*Cheatodon pelewensis*
Acanthuridae (Surgeonfish)	*Zebrasoma scopas*	Chaetodontidae (Butterflyfish)	*Chaetodon lunula*
Acanthuridae (Surgeonfish)	*Acanthurus lineatus*	Chaetodontidae (Butterflyfish)	*Chaetodon reticulatus*
Acanthuridae (Surgeonfish)	*Acanthurus triostegus*	Labridae (Wrasses)	*Diproctacanthus xanthurus*
Acanthuridae (Surgeonfish)	*Zanclus cornutus*	Lutjanidae (Snapper)	*Lutjanus monostigma*
Balistide (Triggerfish)	*Melichthys vidua*	Mullidae (Goatfish)	*Parupeneus bifasciatus*
Balistide (Triggerfish)	*Rhinecanthus aculeatus*	Scaridae (Parrotfish)	*Scarus sordidus*

Source: Cardno – Marine Ecology Assessment (March 2020)

123. There are 21 species of cetaceans recorded in the waters of Tuvalu, with 11 species of dolphin, one orca, three sperm whales, three beaked whales and three rorquals. Three species of marine turtles are recorded. These are the loggerhead sea turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*).

124. There are 411 species of macro-invertebrates of which the gastropods (molluscs and snails) are the most diversified group making up 62% of the species. There are 41 species of crabs, 24 species of shrimp and three species of lobsters which make up 17% of the macro-invertebrates. The holothuroid echinoderm (*Holothuria atra*) and gastropod whelks were abundant in the reef flat at all islands. Several starfish (families Echinasteridae and Oreasterisdae) were also observed on the reef crest and slope.

125. **Threatened and protected species.** The International Union for Conservation of Nature (IUCN) Red List of Threatened Species records 3,248 species from 331 families and seven phyla listed as potentially occurring within the south-west Pacific marine region. This includes eight species that are critically endangered (facing an extremely high risk of extinction in the wild) including two sharks, one turtle, two sawfish, one stingray, one coral and one type of mangrove and 43 that are endangered (facing a very high risk of extinction in the wild) including sharks, rays, wrasses, sea snakes, sawfish and the green turtle (*Chelonia mydas*). Some 290 species are also listed as vulnerable and 234 as near threatened.

126. These include several species of sharks and rays, sea snakes, whales, marine turtles (including hawksbill, leatherback and loggerhead) and corals from the families Acroporidae, Agariciidae, Dendrophylliidae, Euphyllidae, Faviidae, Helioporidae, Milleporidae, Mussidae, Oculinidae, Pocilloporidae, Poritidae and Agariciidae.

127. A review by Job (2009)[13] did include a comprehensive breakdown of listed species for Tuvalu. Results indicated that in 2009, there were 442 marine species listed, among which 83 species were considered as threatened (4 endangered species and 79 vulnerable species). Green turtles (*Chelonia mydas*) are the most common species seen in waters and found on beaches nesting. The leatherback (*Dermochelys coriacea*) and the hawksbill (*Eretmochelys imbricata*) species are mostly seen in waters and are caught by fishermen infrequently.

128. The current IUCN Red List database provides summary information regarding the number of threatened and protected species by country (Table 4.5). This indicates that for Tuvalu there are a total of 1023 animal species listed including those that are endangered, vulnerable and near threatened. A large proportion of those species are lower risk/least concern and/or are data deficient. Current species-specific information is not available by country on the IUCN website.

Table 4.5: Summary of Red List categories for Tuvalu

Country	Tuvalu											
Category	EX	EW	**Subtotal**	CR	EN	VU	**Subtotal**	NT	LR/cd	DD	LC	**Total**
#Species	0	0	0	0	8	87	95	118	3	56	751	**1023**

IUCN Red List Categories: EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LR/cd – Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt - Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk, least concern).

Source: IUCN Red List (2016)

129. **Critical habitat.** There are no critically endangered species in Tuvalu. There are four endangered marine species; green turtle (*Chelonia mydas*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*) and the Maori wrasse (*Cheilinus undulates*). There are 87 species listed as vulnerable including 70 species of coral, clams (2 species), grouper (3 species), shark (3 species) and one sperm whale species. No birds or terrestrial species are considered endangered or critically endangered. The migratory green turtle (*Chelonia mydas*) is identified as endangered and lives in other atolls and islands in Tuvalu (within shallow bays and protected shores which include coral reefs and near-shore sea grass beds).

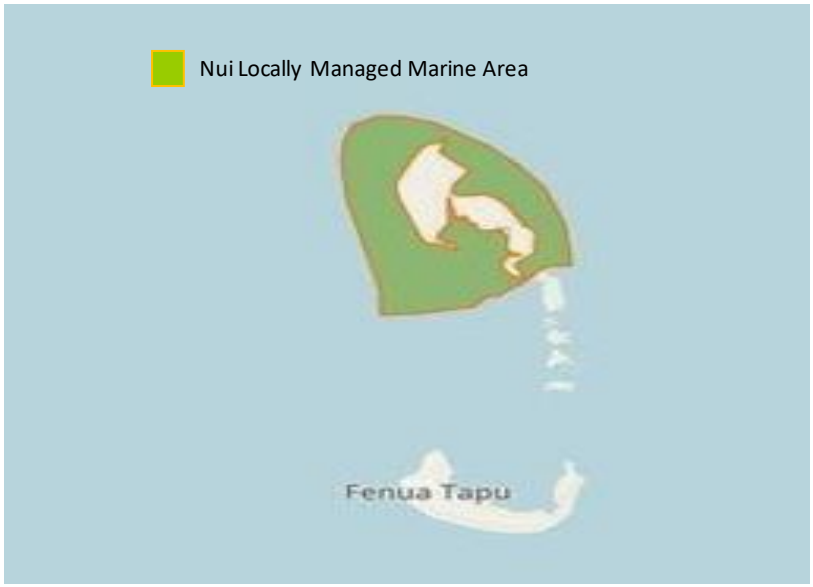
130. The screening and marine ecological survey undertaken for the project confirmed that there is no area of critical habitat within the project area or affected by the project.

131. **Protected areas.** There are six protected marine areas in Tuvalu. Only one (the Funafuti Conservation Area) was established by formal legislation with the rest through local actions and established and managed through by the local government and the communities. Declared 'marine reserves' have been established on Nukulaelae, Vaitupu and Nui. These locally managed marine areas were established to ensure sustainable harvests after recognition that many fish such as grouper, snapper, algal grazing fishes, squirrelfish, drummers and turban shells were becoming scarce.

[13] Job, S. 2009. Op cit.

132. Designation of temporary or permanent local conservation areas on the land, which limit or influence land use options, are determined by the Kaupule. These areas are generally not mapped. The locally managed marine area in Nui was established in 1997 and is managed by the Kaupule. It comprises the two northern atolls of the island and covers an area of 12.2 km^2 as shown in Figure 4.6. This is located at the other end of the island to the project area.

Figure 4.6: Location of Nui locally managed marine area



D. Socio-economic Resources

133. **Population.** The Tuvalu 2017 mini census[14] recorded a total population of 10,507, a decrease in population of 133 (1.3%) since the 2012 census (Table). Nui recorded a net loss in population of 119 (16.3%) between 2012 and 2017. All outer islands show a decrease in average annual growth with Funafuti the only island where the resident population has increased by 16.3% during this five-year period with people seeking better employment, social and health opportunities. Between 2009 and 2012, the number of people who moved to Funafuti from the outer islands (465) were approximately matched by the people moving from Funafuti to the outer islands (445).[15] Funafuti's growth has also masked the overall trend, which appears that Tuvalu population is decreasing more broadly. Out-migration from Tuvalu to Fiji, New Zealand, and Australia, rather than a reducing fertility rate (estimated to be 2.88 children births per woman,[16] and last reported by Tuvalu in 2003 as 3.7 children births per woman[17]), may be the main cause of this negative growth rate.

[14] Central Statistics Division - Government of Tuvalu. 2017 Population & Housing Mini-Census Preliminary Report (Funafuti, Tuvalu)

[15] Tuvalu Government. 2012. Population and Housing Census Volume 1 – Analytical Report. Retrieved from: https://microdata.pacificdata.org/index.php/catalog/50/related-materials

[16] CIA 2020. CIA World Fact Book. Retrieved from https://theodora.com/wfbcurrent/tuvalu/tuvalu_people.html

[17] SPC/Tuvalu Central Statistics Division. 2012. Retrieved from https://tuvalu.prism.spc.int/index.php/social

134. Most of Nui's resident population people lives in Tanraki, the main settlement of Fenua Tapu (the western point of the southern island), while the balance lives on the less populated eastern side of Fenua Tapu and scattered throughout the northern islets, although they are largely uninhabited. As shown in Table 4.6 the 2017 population of Nui was 610 which was a 16.3% reduction from the 2012 Census population. The population density is 218 people per km^2.

Table 4.6: 2017 Tuvalu resident population growth by island

Island	Area (km^2)	Resident population		Change 2012-2017			Density (persons/km^2)	
		2012	2017	Total	%	Average Annual Growth (%)	2012	2017
Funafuti	**2.8**	**5436**	**6320**	**884**	**16.3**	**3.0**	**1941**	**2257**
Outer Islands	**22.8**	**5204**	**4187**	**-1017**	**-19.5**	**-4.3**	**228**	**184**
Nanumea	3.9	612	512	-100	-16.3	-3.6	157	131
Nanumaga	2.8	551	491	-60	-10.9	-2.3	197	175
Niutao	2.5	694	582	-112	-16.1	-3.5	278	233
Nui	2.8	729	610	-119	-16.3	-3.6	260	218
Vaitupu	5.6	1542	1061	-481	-31.2	-7.5	275	189
Nukufetau	3.0	666	597	-69	-10.4	-2.2	222	199
Nukulaelae	1.8	364	300	-64	-17.6	-3.9	202	167
Niulakita	0.4	46	34	-12	-26.1	-6.0	115	85
TUVALU	**25.6**	**10640**	**10507**	**-133**	**-1.3**	**-0.3**	**416**	**410**

Source: Government of Tuvalu (2017)

135. The population of Tuvalu is largely homogeneous, with 87% being of Tuvaluan descent and 12% being Tuvaluan/I-Kiribati or part Tuvaluan descent. Adult literacy rates are high, with 87% literate in English and 99.8% literate in Tuvaluan.

136. While the majority residents of Nui (as with other islands) identify as Polynesian and part of broader Tuvaluan society, there is some linguistic diversity among the islands and atolls. Nui is the only island in Tuvalu where i-Kiribati ('Gilbertese') is broadly spoken, alongside Tuvaluan. Nui residents are members of the *Te Ekalesia Kelisiano Tuvalu*, (EKT), also known as the Church of Tuvalu. Other religions tend to be frowned upon, although some are known to undertake religious practices of other faiths at home.

137. **Education**. Pre-school education is not compulsory and caters mainly for children aged 3-5 yrs. On Nui, the pre-schools are run by the Island Kaupule and subsidized by the government. Attendance at Vaipuna Primary School, which is similarly subsidized, is compulsory and free for all students attending class 1 (6 years) to class 8 (13 years). There is no secondary school on the island and secondary students attend either Motufoua Secondary School on Vaitupu or Fetuvalu Secondary School on Funafuti.

138. In 2014, the last publicly available release of data, 46 students (23 male, 23 female) were enrolled in early childhood care and education (ECCE) on Nui, and 140 in Primary School.[18] The primary pupil to teacher ratio on Nui remained consistent between 2012 and 2014 at 18 students to every teacher.

139. **Health**. Typical of the Tuvaluan diet is *pulaka* (swamp taro), *faga mei* (breadfruit), *futi* (plantains), fish, crayfish, port, chicken, tinned meat, flour, local vegetables and tropical fruits.[19] The average life expectancy is 66.9 years of age. The main cause of death is non-communicable dieases (NCDs), primarily heart disease.[20] In the 2012 Census, cigarette and tobacco usage was higher in the outer islands compared to Funafuti, but alcohol use was lower in the outer islands (33%) compared to Funafuti (37%).

140. High blood pressure was recorded in 26.1% (males) and 21.2% (females) of the populaton. Diabetes is reported to be 24.3% for adult females and 23.2% for males in 2014.[21] Obesity rates were 56.2% for adult females and 47% for adult males in 2016. For children and adolescents (5-19 years), 1.3% of males and 0.7% of females were underweight, whereas for females 63% were overweight and 29% were considered obese and for males 54% were overweight and 25.6% were obese.

141. Over the last decade, the access to clean drinking water and sanitation has improved to over 91%, although UNDP report this to be 99% and 84% respectively.[22] The UNDP's human development index 2019 recorded the under-five moratlity rate as 24.9 per 1,000 live births.[23]

142. According to UNAIDS[24], in 2017, there were 15 cases of HIV registered in Tuvalu with 4 cases being registered in 2016 all males, with none of the registered patients in antiretroviral therapy treatment (ART). The 15 includes one child born to a HIV positive mother.

143. **Health infrastructure**. It is understood that there is one health clinic on the island for outpatients and the provision of check-ups for non-communicable disease (NCD) patients. There is also a 'Sick bay' facility which consists of three rooms can host and quarantine a maximum of six patients if the sickness is not serious. The health staff on the island comprises of two staff nurses, one assistance nurse, and a sanitation aid. There are two houses for the staff nurses who stay on the compound. Overall, only minor cases can be treated on Nui, but serious cases need to be taken to Funafuti Hospital for treatment.

144. Obesity and diabetes are the key health issues of the Nui population and they typically travel to Funafuti for treatment. Typically, women go to Funafuti Hospital to have their first baby three months before delivery. For subsequent births women usually remain in Nui. However, it is noted that many women want to travel to Funafuti for all births because they receive a government per diem (3 months) while awaiting delivery, regardless of whether they have family in Funafuti.

[18] Tuvalu Education Department and Unicef. 2014. 2014 Education Statistics and Indicators. https://prism.spc.int/component/advlisting/?view=download&format=raw&fileId=63
[19] FIU https://elearn.fiu.edu/e-dev/WorldExplorer/Customs/Oceania/Tuvalu.htm
[20] Government of Tuvalu (2016) Te Kakeega III: National Strategy for Sustainable Development 2016 to 2020
[21] Global Nutrition Report https://globalnutritionreport.org/resources/nutrition-profiles/oceania/polynesia/tuvalu/
[22] ILO 2019 https://www.ilo.org/asia/publications/issue-briefs/WCMS_627569/lang--en/index.htm
[23] UNDP 2019. http://hdr.undp.org/en/countries/profiles/TUV
[24] UNAIDS, 2017, HIV/AIDS Country Report, UNAIDS. Retrieved from: https://www.unaids.org/sites/default/files/country/documents/TUV_2017_countryreport.pdf

145. **Local economy**. The UNDP human development indicators place Tuvalu as a lower-middle-income country with a small and highly vulnerable economy, strongly linked to external economic influences (Tuvalu uses the Australian dollar as its currency). Government revenues are primarily derived from license fees from foreign tuna fishing vessels, the '.tv' internet domain, and income from the Tuvalu Trust Fund.[25] Direct foreign aid and project activities also constitute a major source of revenue.

146. **Subsistence, livelihoods and incomes.** The main sources of cash income include salary (mainly from public service employ), remittances from family members working in Funafuti or overseas, rents and pensions (Table 4.7). In 2019, 26.3% of the Tuvalu population was reported to live below the national poverty line.[26] This rate has increased from 2015 when 12% were living on US$3.20/day and 1% were living on US$1.90/day.[27] In 2019, the ILO reported that 65% of the population were of legal working age.[28]

Table 4.7: Proportion of outer islands households receiving cash Income by source

Sources/types of cash income	% of households
Wages/salary	53.9
Remittances	43.4
Land leases/rents	41.0
Investments	24.3
Handicraft sales	26.4
Small business	15.8
Elderly Support Scheme payments	17.2
Fish sales	11.0

Source: Census 2012: Population and Housing Census Volume 1 (Table 31)

147. In the outer islands the average monthly income is in the order of AU$80; largest proportion (AU$30) of which is from agriculture, followed by livestock, fishing and handicrafts each which account for a similar proportion (AUD$15) and other smaller activities contribute about AU$5. By contrast, on Funafuti the average monthly subsistence income is about AU$190. There is an Elderly Support Scheme (ESS) whereby those aged 70 years and older are eligible to receive AU$50 per month if they meet the conditions required. This scheme was implemented in 2009 under the Department of Community Affairs.

148. There are very few economic activities in the outer islands, so people rely on subsistence activities. Small scale livestock is one of the major subsistence activities in Tuvalu and is one of the main sources of meat, largely pigs and poultry.

[25] The Tuvalu Trust Fund was established in 1987 by the United Kingdom, Australia, New Zealand. The Fund, an overseas-managed investment fund, has contributed roughly 11% of the annual government budget each year since 1990. The Fund had initial capital of about AU$27 million at independence and now totals about AU$120 million, with a capital value of about 2.5 times GDP, the Fund provides an important cushion for Tuvalu's volatile income sources from fishing and royalties from the sale of the '.tv" internet domain. The '.tv' domain name generates around $2.2 million each year from royalties, which is about ten per cent of the government's total revenue.

[26] UNDP 2019. http://hdr.undp.org/en/countries/profiles/TUV

[27] Global Nutrition Report https://globalnutritionreport.org/resources/nutrition-profiles/oceania/polynesia/tuvalu/

[28] ILO 2019 https://www.ilo.org/asia/publications/issue-briefs/WCMS_627569/lang--en/index.htm

149. Reef and lagoon fishing, including collection of shellfish and shells, is also an important subsistence activity. The Community Fisheries Centre (CFC) assists fishermen in the marketing of their fish within the community. Only registered fishers are permitted to fish and bring their catch to the CFC which sells it for them. Sea shells and woven items are used in the clothing and handicrafts of Tuvaluan women such as fans, mats and clothing. They also practice crochet (*kolose*). Traditional dances include the *fakaseasea, fakanau, fatele*, which are performed at special ceremonies and functions.

150. Imported food stuffs, including frozen foods, are important sources of food for the local population and relies heavily on the government shipping service. There are frequent delays and some lines of food are in very short supply or run out until the next service arrives. Agriculture opportunities are very limited due to poor soil fertility and are predominantly centered on the traditional taro-like root crop; pulaka, coconut, breadfruit, bananas, and pandanus all of which are important traditional food crops and are cultivated by most outer island households. Handicrafts such as brooms and mats, usually made by women, are another source of cash income.

151. **Employment and unemployment.** At the time of the 2012 census, around a quarter of the workforce is employed within the public sector, which includes the island Kaupule and about 15% of adult males work as seamen on foreign flagged merchant ships. The rate of unemployment on Nui is 52.3% (Table 4.8).

Table 4.8: Level of unemployment

Island	No. of total unemployed			% of total population
	Total	Male	Female	
Nanumea	332	165	167	54.3
Nanumaga	279	140	139	50.6
Niutao	375	167	208	54.0
Nui	381	182	199	52.3
Vaitupu	912	418	494	59.1
Nukufetau	357	170	187	53.6
Funafuti	2114	1014	1100	38.9
Nukulaelae	197	96	101	54.1
Niulakita	19	12	7	41.3
Total	**4966**	**2364**	**2602**	**46.7**

Source: Tuvalu National Population & Housing Census 2012 (Table 51)

152. In 2012[29], only 77 people (17%) of the Nui population over 15 years old were employed, mainly through government work as nurses, teachers and Island Kaupule employees which together provided 68% of the formal employment. Some 335 people of working age were registered as unemployed; others worked as seafarers (10%). Self-employment is very low (6%) on the island with only six registered in the census as involved in self-employment in the canteen, fuel supply, bike hire and local tobacco making.

[29] 2012 Nui Island Profile

153. Most of the unemployed are women although they are involved in subsistence activities such as feeding livestock, farming, fishing toddy cutting and handicraft making. The employment situation has changed since 2012. In 2017, the Tuvalu labor force indicators showed a significant change in the labor force participation and unemployment rate, shown in Table 4.9. The overall labor participation rate for Tuvalu had fallen, with only 40.9% of the population in Tuvalu's outer islands in the labor force, and 34.5% of those unable to find work.

Table 4.9: Labor force indicators 2012 - 2017

Indicators	2012 Tuvalu (%)	2017 (%)				
		2017 Tuvalu	Male Tuvalu	Female Tuvalu	Funafuti	Outer Islands
Labor force participation rate	59.4	49.3	58.5	39.7	54.8	40.9
Employment population ratio	28.6	32.7	40.0	25.2	38.8	23.4
Unemployment rate	39.6	28.5	27.2	30.4	25.5	34.5

Source: Government of Tuvalu 2017 Mini Census

154. The overall national labor force participation rate was more recently recorded as 50.1% in 2019, an insignificant increase from 2017, and still significantly lower than the 2012 rate. The unemployment rate was higher for females (30.4%) than males (27.2%) in 2017. Women in Funafuti were found to be more economically active than those the outer islands.[30]

155. **Land tenure, ownership and use**. The land tenure system is held in title by families and individuals, passed down through kinship ties. The foreshore area and area under the high- water mark is Government owned, or 'Crown' land. The area of the project where the land infrastructure is proposed is largely Kaupule communal land, while the proposed construction laydown area and campsite is on privately held land which will be leaded through negotiated settlements of land leases and compensation. A small portion of a number of lots will also require to be leased in order to facilitate a construction road linking the camp site to an existing coastal road. Land tenure processes are documented in the social due diligence report.

156. **Power and decision-making**. Each Island, including Nui, has a local governance structure operationalized by the *Kaupule* which undertakes the administration and management of the local island government responsibilities. Their leadership and decision-making body is the *Fale Kaupule* ('Assembly of Elders'), made up of most men and women who are over 50 years old. In customary structures, there are two parallel and equal leadership structures usually active on Tuvaluan islands: in the *Aliki*, a person whose role is similar to a Chief and inherits from their father's line, and an elected role of *Pule Fenua* ('Island leader'*),* who leads in conjunction with, and supported by, the heads of each of the clans.[31]

[30] Government of Tuvalu 2012 Census

[31] UN 2008. Consideration of reports submitted by State parties under article 18 of the Convention on the Elimination of All Forms of Discrimination against Women. Retrieved from: http://docstore.ohchr.org/SelfServices/FilesHandler.ashx?enc=6QkG1d%2FPPRiCAqhKb7yhsqWC9Lj7ub%2FHrJVf1GxZMHH31xXA4CdNZ3MMy0rDBt4tT1i3ISzpjHcqyXFIF%2BJVV6nCYHzWyQ3k9LQeL2A4frVKJ43jhcJj3jt%2BgjMS3hv1

157. There is some suggestion that the Aliki role was eliminated from Nui's governance[32], and the Fale Kaupule, with representatives of each of the three founding families, largely fulfil the role traditionally undertake by the Aliki elsewhere, however this has to be confirmed during site visits. The people who hold these roles, and other community leaders, such as the women's group leader, will be identified during the next site visit.

158. **Transport.** As with all the islands of Tuvalu, Nui suffers from poor connectivity that constrains economic development. Nui has a coral-based road that runs through the middle of the main island, with other roads around the shore near the main village. Local land transport is mainly by motorbike and bicycles. The challenge arises from Tuvalu's dispersed geography exacerbated by inadequate transport infrastructure and services such as:

- Government-owned ships that travel from Funafuti to outer islands and Fiji every three weeks;
- No docking facilities for the government ships, and passengers and cargo are transferred by small workboats from/to the ship floating off-shore;
- No docking facilities for the workboats makes passenger access on/off board difficult and sometimes unsafe due to weather or wave conditions. Cargo is manually carried to/from the workboats; and
- Workboats navigate channels to reach the shore, this can be dangerous depending on the sea conditions. Serious accidents can occur, resulting in loss of life and economic values. Transfer operations are not undertaken when the sea is rough or after dark, which reduces the efficiency of ship operations.

159. **Energy**. Everyone on the island has electricity through connection to a mini-grid supplied by 80% solar power and 20% diesel generator. The diesel generator is used as a back-up supply when solar is low.

160. **Water supply and sanitation**. Rainwater is primarily used for human consumption, agriculture and domestic uses and supplemented by groundwater from wells. There are two known sources of groundwater on Nui, one in Fenua Tapu, and one in Meang (in the north). Most outer islands are known to use septic tanks and drop toilets, however there are plans for Nui to install flush toilets for the main village in 2020.

161. **Waste management**. Domestic solid waste is disposed of at a designated tip area on the island. At the dump site waste separation is practiced with tins and plastics separated from dangerous items such as used batteries. The area is periodically managed by bulldozers and excavators when not working on construction projects. Burning of waste is prohibited on the island.

162. **Physical and cultural resources**. Nui is not known to be the site of any known items of historical or archaeological significance. This must be further confirmed during site visits and due diligence. The island's residents have extensive documented origin mythologies, captured in some anthologies and books, which suggest strong family linkages to the different islets, and some record of animistic beliefs.[33] It is said that the island was settled by families from Samoa and from Tabiteuea and Nonouti in Kiribati.

[32] Sotaga Pape, Hugh Laracy (ed.) 1983. " Tuvalu: A History. Institute of Pacific Studies, Chapter 10 – Nui. University of the South Pacific and Government of Tuvalu, p.75

[33] Ibid

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Overview

163. The IEE provides an analysis of anticipated impacts associated with the construction of improved jetty/wharf and facilities at Nui. Environmental safeguard measures have been incorporated in the project as follows:

a) Pre-construction phase--updating of detailed design, undertaking of further surveys as required and preparation of documentation required under the contract--prior to any construction works. During this period the EMP is updated based on the additional information available, designers incorporate environmental measures in the project design, the updated EMP is incorporated into technical specifications and bid documents, the contract is tendered, a contract is awarded and the contractor may mobilize but civil works (including any site clearance or preparation activities) are not permitted to start until the notice is issued. The contractor will recruit an environment, health and safety officer (EHSO) and a specialist to prepare the construction EMP (CEMP) during this period. The CEMP will be reviewed and cleared by the CSC and its environment specialist (ES) on behalf of the PMU;

b) Construction phase - the period from the time that the "notice to proceed" is issued to the contractor to when the "certificate of completion" is issued. The contractor will construct the project as per the design and technical specifications and implement the measures included in the approved CEMP. This process will be documented by the EHSO and monitored by the CSC and PMU; and

c) Operation and maintenance phase - the period starting when the "certificate of completion" has been issued by MTET until the end of the 20-year lifetime of the project. The MTET will be responsible for implementing the measures identified in the operation phase of the EMP to mitigate post-construction impacts.

164. **Approach to impact analysis**. To assess the anticipated environmental impacts of each phase of the project, it is necessary to understand the activities, sequence and elements of the proposed work leading up to and during the pre-construction, construction and operation phases. The impact analysis is based on a risk assessment approach. The magnitude of impact of activities and works have been identified, required mitigations measures listed, and a concluding statement as to the residual impact made.

B. Design and Pre-construction Impacts

165. **Adaptation for climate change**. The design and construction of the wharf and jetty facilities will take into consideration the impacts of future climate change parameters that have been projected for the region. Specifically, it will be important to factor in the projected rise in the mean sea level such that the relative heights of the structures above the current seal level must take this into account to ensure there is a strong element of climate resilience built into the design.

166. The project will result in no residual impact.

167. **Access to land and seabed**. The sea-side facilities and associated structures such as passenger terminal and cargo warehouse will be constructed on Crown land[34] while part of the access road and construction laydown area will require the lease of additional private land. These private land parcels are generally bush area containing a small number of quality productive trees including coconut. The project will not require compulsory land acquisition or result in displacement but will undertake negotiated settlements with landowners. In line with Tuvalu law, compensation will be paid for any assets (fences, structures etc.) affected or requiring removal (trees and crops). A due diligence report (DDR) has been prepared. The DDR will be updated during the detailed design and third-party verification will be completed at that time.

168. Some residents of properties adjacent to the foreshore works area may be affected by machinery noise and dust during construction. This will be addressed through control methods in the EMP/CEMP, and through engagement and consultation with affected landowners for the determination and implementation of the mitigation measures. There will be negligible residual impact.

169. **Geotechnical investigations and detailed design**. A geotechnical investigation report[35] was prepared in November 2018 to provide information on the site characteristics, surface and sub-surface conditions and comment on the ground condition encountered with respect to proposed structures to assist in the design of the maritime infrastructure. An engineering geology map was prepared to capture surface geomorphology and nine small boreholes were drilled to determine the composition of the reef platform material and identify any weaknesses in the profile. This was not a large-scale drilling operation and there was little or no environmental impact on the reef platform. Borehole depths ranged from 3.7 -12 m. The drill core samples were dispatched to Australia for geo-mechanical testing.

170. The boreholes identified voids and cavities within the drilling column where easy drilling was confirmed and subsequent poor recovery of drill samples. Sampling indicated the reef limestone has an inferred strength of medium to high. A noticeable feature of the rock mass is a 0.3 - 0.5m thick hard cap overlying 1.0m of highly voidaceous horizon. The cavities are noted to be persistent and extend laterally for a significant distance.

171. The report indicates that the coral gravels and highly fractured reef limestone on the shore platform are expected to be easier to excavate than the relatively intact limestone where very hard ripping conditions are expected, which may require heavy machinery. However, the presence of open fissures or other structures indicative of instability are noted in the vicinity of the channel and the possibility of the channel edges undergoing local collapse and the need for periodic cleaning should be noted. Diamond saw cutting has been proven to be an effective way to construct the edges of the dredged area as it prevents overbreak and creates a strong edge with smoother surfaces to resist wave action.

172. The amount of sediment plume created during excavation will be related to the method of extraction used. Any method where the rock can be cleanly broken will cause less sedimentation than scraping rock out using excavator tines. An analysis of the bore samples indicates that it is unlikely that the excavation of rock will cause clay-sized particles that would tend to stay in suspension and form a plume. Rather, sand-sized particles are more likely as a result of excavation and are more likely to settle quickly after disturbance during dredging work.

[34] Crown land, also known as royal domain or demesne, is a territorial area belonging to the monarch, who personifies the Crown. This is considered as government or public land, although the term still exists in Tuvalu which used to be a British Protecto rate.

[35] Cardno. 2018. Geotechnical Investigation Report - Nui, Tuvalu: Prepared for Tuvalu Government, Ministry of Communication and Transport.

173. Provided that the findings of the geotechnical investigations are integrated into the design and the contractor constructs the project as designed, there will be negligible residual impact.

174. **Updating of the EMP, national clearances and bid documents.** The PMU, with support from the CSC will undertake tasks associated with updating the IEE and EMP and inputs to the tender documentation and bid evaluation. Terms of reference have been prepared for the environmental specialists (for the ES included in the CSC and the contractor's EHSO) and are included in the PAM.

175. The IEE and EMP will be updated following the update of the detailed designs based on geotechnical investigations, changes/modifications to structural designs and to include any additional information or requirements in respect of dredging. The IEE will be checked for compliance with requirements of the Environment Protection Act 2008 and submitted for clearance to the DOE and issue of the development approval. The updated IEE and EMP, along with any conditions of the development approval, will be incorporated into technical specifications and bid documents.

176. The project (outline) EMP to address predicted negative environmental impacts is included as Table 7.2 which covers foreseeable negative environmental impacts. Provided that the contractor undertakes a risk assessment approach (or similar) and develops their CEMP based on the outline EMP, implements and monitors effectiveness of implementation, this should result in negligible, if any, residual impact.

177. **Construction EMP**. Following contract award, the contractor, with support as required from the CSC, will prepare the CEMP responding to the EMP and the conditions of the development consent issued by the DOE. The CEMP, based on the EMP in the IEE, will be prepared by the contractor in the preconstruction stage.

178. The CEMP, will aim to control impacts such as dredging, stockpiling of materials, installation of coastal protection and enhancement planting for erosion control. With implementation of the CEMP the residual impacts should be minor as the impacts will be mostly manageable. The CEMP will provide the site-specific drawings, work method statements, sub-plans (as detailed in next sections), details of construction methodologies (including specifics around dredging method, impact mitigations and dredge spoil disposal). The CEMP will be based on how the contractor intends to approach the works, undertake the activities and implement the mitigation measures to meet the requirements set out in the EMP, and be linked with the construction program and schedule of activities. The CEMP will be submitted to PMU and will be reviewed by the CSC and ADB for comment and approval before any construction activities, including any clearing, is undertaken at the site.

179. Based on a risk assessment or similar, all foreseeable impacts must be captured in CEMP. The CEMP will include sub-plans and site-specific plans (SEMP) as relevant to the works and required mitigations. The CEMP will demonstrate the manner (location, roles, responsibilities, schedule/timeframe, budget, etc.) in which the contractor will implement the works in compliance with the approved CEMP. The CEMP will be updated as necessary to respond to any unanticipated impacts that may arise as the project is implemented.

180. The following sections or sub-plans will be included in the CEMP (based on the EMP in this IEE):

- Water supply for works, workers and water conservation measures;
- Waste disposal (covering spoil disposal, general waste and hazardous waste);

- Sources/supplies of construction materials and management;
- Sediment and erosion control;
- Dredging and excavation plan
- Maritime works and coastal protection requirements;
- Groundwater contamination prevention;
- Dust and noise minimization;
- Construction camp establishment (if required) including hygiene, sanitation and disease prevention;
- Worker code of conduct (to be agreed with leaders of the island Council);
- Labor influx management;
- Power provision and utilities protection;
- Health and safety - workers and public. The health and safety plan (HSP) will aligned with the WHO 2020 Considerations for public health and social measures in the workplace in the context of COVID-19[36] which includes guidelines on the use of personal protective equipment (PPE) in the context of COVID-19;
- Measures to control invasive and alien species;
- Accidental discovery of physical cultural or archaeological assets, sites or resources;
- Rehabilitation, revegetation and re-contouring of construction areas to facilitate erosion control; and
- Enhancement planting for surface stabilization.

181. Abstraction from water resources may be permitted if approval has been obtained from the PMU in consultation with Island Council leaders and local authorities.

182. Provided this procedure is followed and the above mitigation measures are implemented, there are considered to be no residual impacts.

183. **Coastal sediment transport.** A sediment transport model was developed to determine the impacts of the landside infrastructure on coastal processes under different wave conditions, being normal, storm and cyclonic wave conditions. The model was aimed at investigating the movement of beach sand under storm conditions. During large storm events or cyclones, waves could break up the reef and mobilise boulders or coral debris. This process was not included in the model and should be allowed for in the design of the channel in the form of over dredging to allow for some channel sedimentation.

184. The modelling undertaken assumed a completely sandy shoreline, which is not the case on Nui. This is common practice with sediment transport modelling and gives a conservative estimate. The sand to the north and south of the harbour is perched on a rock platform, indicating that it is only available for transport during significant storm events combined with high tides.

[36] https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19

185. The model predicts only minor morphological changes under normal conditions, which are generally limited to flattening of the shoreline profile. The bulk of this change is likely due to the natural response of the shoreline to the simulated wave conditions and would not be associated with the construction of the harbour. The modelling is predicting some accretion on the southern side of the reclamation, and in the lee of the harbour which is due to the partial blocking by the landside facilities.

186. During storm conditions, the model is predicting a general flattening of the shoreline and a typical storm erosion trend. There does not appear to be any exaggerated erosion caused by the harbour. The model does predict that there will be some sedimentation within the harbour under storm and cyclonic conditions due to sediment entering the existing basin shoreward of the new dredged basin.

187. The harbor is expected to have localized, minor impacts on sediment transport. The modelling undertaken for the project indicates that there will be a small buildup of sand on the southern side of the shoreline reclamation, with an increased risk of short-term erosion on the northern side. Coastal protection will be installed to reduce this risk. Provided this procedure is followed and protection measures are implemented, there will be negligible residual impacts on transport of sedment.

188. **Sediment plume and impacts.** Given the highly sensitive marine environment and potential for dredging to affect coral beyond the area that will be removed/excavated through the dispersal of suspended sediments, a dredging sediment plume model will be developed. This will be carried out during the detailed design phase when the layout and construction method has been approved. The dredging sediment plume modelling will be based on a similar model developed for the construction of the harbor facility on Nukulaelae, with excavators using rock hammers to break up the reef platform and removing the loose material with an excavator and bucket into trucks for transport to the spoil disposal site on land. It will analyze the quantities of fine sediment released or suspended in the water column during dredging operations, the likely extent of the sediment plumes, determine the thickness of sediment deposited on the seabed and evaluate the increase in suspended sediment above ambient levels due to the dredging activities. This dredging sediment plume modelling will be prepared during the detailed design phase when the final design criteria are formalized. A marine ecologist will interpret the results in terms of the impacts on the corals, and any environmental impacts that are identified will be included in the update of this IEE and provided to the contractor for inclusion in the dredging plan.

189. The key mitigation measure to ensure compliance with environmental criteria will be the length of time of dredging work that is carried out within each period of activity. From experience gained on Nukulaelae, dredging typically was limited by the tidal depth and swell conditions, resulting in an effective operational time of around 3-4 hours per low tide cycle. This represents around a third, to a quarter, of the time used in the sediment plume modelling. Thus, if dredging is occurring for shorter periods than assumed in the model, then any sediment plume is expected to be correspondingly smaller than the model predictions.

190. The use of silt curtains will be re-evaluated during detailed design. Given the high energy wave environment, the results of the sediment plume analysis and the expected duration of dredging in each low tide cycle. Silt curtains are typically comprised of an impervious material that hang suspended from a floating boom in a stable water column to control the lateral movement of water-borne sediment and to provide the time for the suspended sediment to settle to the bottom of the water column.

191. On Nui, the reef platform is exposed with each low tide so a suspended silt curtain would be impractical to contain any sediment. A fixed silt curtain, generally a tight weave product anchored to the reef platform on either side of the excavation area, will form an impermeable wall and be subject to rigorous wave action, tidal surges and currents. It is considered that the effectiveness of any containment of material over the duration of the excavation period will be highly questionable. A more appropriate mitigation measure is to limit the time of dredging at each tidal cycle to allow for dispersal of the sediment plume as supported by the sediment analysis report. This will be detailed in the dredging plan.

192. **Dredging plan**. As the impacts from uncontrolled or unmitigated dredging may cause unacceptable modification of coastal processes and impacts on marine resources, the following is included in the EMP:

- Dredging to follow detailed designs and recommendations from studies including the sediment plume analysis;
- Assessment of dredging impacts and result showing acceptable modification of coastal processes included in detailed designs;
- Use of explosives to blast the channel and turning bay will not be permitted due to the impact on the reef ecology (see Section V.D);[37] and
- Dredging plan to be prepared and included in CEMP covering but not limited to:
    - Type of equipment and how the equipment will be used
    - Based on sediment plume analysis, the rate and maximum volume of dredging per day and best times for dredging based on sediment plume reduction (i.e. x hours either side of high tide)
    - Assessment of dredging impacts and result showing acceptable modification of coastal processes included in detailed designs.
    - Original and proposed final bathymetric contours
    - Reuse options on land and locations and methods for stockpiling
    - Mitigations in the event ecosystem functions and fisheries affected
    - Management plan for extraction.

[37] Kaly U.L & Jones G.P. 1990. Construction of Boat Channels by Blasting Coral Reefs: Immediate effects of Blasting and Broad-scale Survey of Channels on Three Islands in Tuvalu. Report No. 3. An Environmental Assessment of the Impact on Reef Channels in the South Pacific, report for New Zealand Ministry of External Relations and Trade (Wellington, New Zealand).

193. The recommendations of this IEE are that: (i) dredging for the channel and the basin will preferably be carried out by 40 or 50 tonne excavators using hydraulic rock breaker and bucket attachments (rather than the use of a grinder/suction head)[38]; and, (ii) dredging will commence from the outer edge of the reef platform and work towards the shore involving the removal of an estimated 15,000m^3 of coral material. The excavated material will be transported by truck from the work site and entirely within the footprint of the designated construction zone of the channel and turning bay to the spoil disposal site located on the land via existing roads in the island. This zone will be surveyed and marked prior to dredging to prevent machinery movement outside of this designated zone.

194. The contractor will provide a dredging plan as part of the CEMP and will include the dredging sequence, anticipated duration of dredging during each tidal cycle, the management of machinery and trucks within the limits of the construction zone and the means of removal of the dredged material from the excavation site to the spoil storage area on land. The CEMP will be approved by the CSC prior to commencing any work on the reef platform. Should dredging be proposed over a 24-hour period, the sediment plume model will need to be re-run to determine if the impact of the sediment of the reef coral is within acceptable limits.

195. Given the general sea conditions at edge of the reef, it is not anticipated that dredging will be carried out by an excavator operating from a barge at the mouth of the new harbor channel. Thus, it is not expected there will be any loss of excavated material from the barge at the end of each dredging period during transportation back to shore.

196. If the contractor wishes to use different equipment or adopt a different approach, they will provide a detailed explanation as to why in the dredging plan.

197. Provided that the contractor prepares the dredging plan, the dredging plan is reviewed and cleared by the Engineer and CSC, and the contractor subsequently implements and monitors effectiveness of the dredging plan, there will be negligible residual impact.

198. **Alien and invasive species introduction**. The mobilization of construction machinery/equipment and materials from the source country may result in the accidental introduction of soil-borne weeds, pests and pathogens becoming established on the island and reef environment. All construction machinery and equipment must be steam cleaned and all organic material must be removed in the source country prior to deployment with a biosecurity import permit and appropriate approved phyto-sanitary certificate issued supported by any other documentation required under the Biosecurity Act 2017.

199. The requirement of the EMP, included in the bidding documents and contract will be to follow all DOE requirements in respect of Invasive or alien species including Biosecurity Act measures. The contractor will be required to under a risk assessment as part of the preparation of the CEMP and identify all measures required comply with the provisions of the Biosecurity Act and Tuvalu's National Invasive Species Strategy and Plan which sets out the necessary targets and actions to control invasive or alien species at the country level.

[38] The volume of suspended sediment resulting from the grinder/suction method is anticipated to be more extensive than when using the excavator method as the daily time period for dredging is not limited by the tide to the same extent. Therefore, the receiving environment has longer periods of exposure to the sediment plume with an increase in the rate of sediment deposition on the outer reef habitat. any sediment plume generated by a grinder/suction dredge would be significantly greater over a longer period of daily operational time than the excavator method which is limited by the tide. It would have a greater residual impact on the benthic community with the large volume of sediment produced.

200. Provided the requirements of the National Invasive Species Strategy and Plan and Biosecurity Act are followed, the contractor undertakes a risk assessment and identifies and implements mitigation measures identified in the NISSAP, there will be negligible residual impacts.

C. Construction Impacts on Physical Resources

201. The main impacts on physical conditions relate to excavation of construction materials for works, reuse of cut materials from dredging, minor disturbance of seabed and small landward areas to locate and fix navigational aids, routine construction impacts such as dust and noise, temporary traffic arrangements, and hazardous and general waste disposal. The construction will create some minor additional unavoidable dust and noise in addition to the main civil works and all the above foregoing to be addressed

202. **Air quality**. There are no anticipated permanent impacts on air quality from the construction activities. Exhaust emissions and dust (see Section E) will be generated from construction machinery, pile drivers, vehicles and mobile generators. Mitigation measures will include:

- Use and operation of fully maintained vehicles and diesel equipment that have been certified as compliant with local air quality legislation prior to trans-shipment to project site; and
- Avoiding idling of vehicles when not in use and unnecessary operation of vehicles and equipment.

203. Implementation of the measures will result in no or limited residual impact on air quality.

204. **Soil erosion and coastal protection works**. Potential environmental impacts associated with coastal protection works include: (i) the collapse of the exposed beach profile after excavation and prior to construction of the wall resulting; (ii) the loss and dispersion of excavated material placed in heaps on the beach environment; (iii) increased erosion of the foreshore from unexpected high tides; and (iv) release of hydrocarbons or other contaminants from earthmoving machinery during construction works.

205. Excavation work and other earthworks will be planned on the beach-land interface to connect the jetty facility with the island. The soils along this interface are nearly entirely loose undifferentiated sand deposits, coral fragments and storm debris and are highly erodible, even when they are not disturbed by excavation works. High tides and storm surges can result in rill and/or scour erosion around the adjoining buildings, headwalls, ramp or access track leading to the beach. Surface water runoff from the adjoining land and road infrastructure also plays a critical role in the level of soil erosion at this sensitive transition site.

206. General measures to minimize and mitigate soil erosion at the beach-island interface include:

- Careful planning of works such that only short sections of excavated trench for any seawall or jetty headwall structure are exposed at one time and which can be completed between periods of low tide, or if sufficiently above high tide mark, that can be completed before any advancing weather system approaches the island;
- All excavated material to be immediately removed to the designated spoil disposal area. No excavated material is to remain in stockpiles on the beach or reef flat between tides;

- Minimize the period that excavated areas are left unprotected and open to tidal movement or storm effects;
- Minimize or reduce the clearing of any vegetation near the seawall or jetty headwall structure and retain a 15m buffer zone of vegetation along the construction zone sea frontage. Consultation with Kaupule undertaken in finalizing the locations and numbers of trees to be cleared;
- Construct sediment traps where appropriate to divert overland runoff into a safe disposal area;
- Place concrete demolition waste from damaged buildings on the sea-side of the bund to provide protection from tidal surges. This should not be placed along the beach margin such that it impedes long-shore movement of beach sands;
- Incorporate bioengineering solutions where practicable (e.g. this could include, , planting ground cover species and local tree and shrub species in rows on the land side of the bund to reduce exposure to wind as part of the site remediation plan after completion of works).

207. Implementation of the above measures will result in negligible residual impact on soils and coastal erosion.

208. **Water quality**. Dredging will cause the disturbance of unconsolidated sediments within the channel floor and turning bay in the harbor. This is expected to lead to short-term increase in concentrations of total suspended solids and turbidity immediately around the active dredging site. Tidal flow will take this sediment plume out through the channel and into the sea.

209. Measures to minimize the environmental effects of sediment removal on water quality due to dredging activities include:

- The CSC will include a suitably qualified ES and the contractor will engage a suitably qualified EHSO. The contractor will engage an environmental specialist/marine ecologist to prepare a detailed method statement in the CEMP, to be approved by the CSC and its ES prior to the commencement of any works. The statement will identify the methodology and the rationale for any selected dredging system chosen and how the contractor intends to minimize the spread of suspended sediments. During works, the contractor's EHSO will need to have appropriate experience in marine ecosystems or have ready access (by phone) to a suitable expert for timely advice as required;
- Hydraulic excavators shall be in sound and well maintained condition and free of any leaks of any fluid. A pre-start inspection will be carried out on all machinery prior to the commencement of works at the start of each work period and records kept for monitoring purposes;
- All plant will only be operated by certificated and experienced operators;
- All excavation operations shall comply with relevant laws of the government of Tuvalu and international conventions to which it is a signatory;
- Excavation operations will be monitored visually by the EHSO. Photographs of plume movement will be taken along with details of sea conditions, wind speed and direction for each work period and phase of the tidal cycle. If the EHSO, on advice from a suitable expert, considers the plume density or extent to be at a level that

could be having a detrimental effect on coral on the reef slope then the CSC will be consulted so that dredging is adapted to an agreed means for reducing the plume density or extent. This may, for example, involve reducing dredging intensity;

- Excavation operations during incoming tides or strong westerly winds (which occur intermittently, mainly between April and September) will only be permitted if it can be demonstrated that plume movement does not result in deposition of material on the reef platform;

210. A comprehensive set of guidelines relating to reef channel excavation and construction has been developed. The guidelines prepared identify the major environmental impacts and mitigation measures associated with harbor projects on the outer islands.[39] These guidelines will be a key reference document to be used by the contractor in developing the CEMP.

211. Implementation of the above measures will result in negligible residual impact on water quality.

212. **Waste and spoil management**. The management of construction waste from maritime projects can have a significant environmental impact on small remote island communities. There is generally very little ability to effectively manage solid waste as can be observed with the amount of solid waste generated by these small communities and the method of disposal. While waste pits are used, there are potential problems associated with leachate entering groundwater, which is already subject to degradation in water quality in all project sites.

213. The guiding principle to be adopted will be to remove all inorganic and solid waste generated from the construction of the facilities from the island environment. There may be some exceptions where surplus concrete used in the concrete elements in the wharf and jetty structures or aggregate can be utilized for the construction of community facilities. This will be done in consultation with the Kaupule at the appropriate time.

214. A large (10,000m^2) of land about 1km from the harbor site has been identified and approved by the Kaupule for the contractor to stockpile dredged spoil material. The contractor will undertake a risk assessment and propose management and mitigation measures in their waste and spoil management plan to be included in the CEMP. The CEMP will be reviewed and cleared prior to no objection being given for commencement of physical works.

215. Waste management measures to mitigate the impact of solid waste and sewage at the project site include:

- The contractor will develop an implement a detailed waste and spoil management plan as part of the CEMP.
- Store and remove all waste hydrocarbons and filters in appropriate bunded storage containers covered by a roof to keep out rain and remove from the island at the completion of works;
- Store and remove all inorganic solid waste including steel, formwork, fittings, pipes, hydraulic hoses, tires and any other spare parts used with construction equipment;
- Install on-site toilet facilities with an appropriate self-contained sewage tank; and

[39] Kaly U.L & Jones G.P. 1989. Construction of Boat Channels Across Coral Reefs: Results of Initial Survey of Reef Communities at Niutao (Tuvalu). Report No. 2. An Environmental Assessment of Impact of Reef Channels in the South Pacific, report for New Zealand Ministry of External Relations and Trade (Wellington, New Zealand).

- Compost all green and organic wastes to assist soil improvement for communal food crops or use as pig food.

216. Implementation of the above measures will result in waste and spoil generation creating a low residual impact on the environment.

217. **Storage and handling of hydrocarbons**. Hydrocarbons (fuel, lubricants and marine paints and solvents) stored, dispensed and used during construction works by vehicles and plant and equipment pose a potential hazard to the marine environment, communities as well as the subsurface freshwater lens on the island if leakage or spillage occur. Large quantities of hydrocarbons will be required for the duration of the project due to the logistics and the long supply line. Extreme care is required to ensure there are no accidental spills.

218. All hydrocarbons will be stored in a dedicated land-based facility. The proposed storage shed has been selected in conjunction with the Kaupule to ensure it does not impact any houses or water supplies. Measures to minimize or prevent the environmental impacts of accidental spillage of hydrocarbons include:

- A hazardous substances management plan, including spill response plan, will be included in the CEMP;
- A comprehensive site induction prepared by the contractor, with input from the Kaupule, will be required for all personnel involved with the project, with specific attention made to the sensitive atoll and reef environment;
- All personnel involved in the handling of dangerous goods will be trained and inducted in the handling, emergency procedures and storage requirements for different types of substances;
- Where fuel is stored on land, it will be in dedicated areas in sealed tanks placed within a concrete bund that has 110% of the capacity of the drums or storage and covered by a roof to keep out rain;
- Storage areas to be located at least 50m away from the marine environment and should be fully secured and locked when not in use;
- Material safety data sheets are to be provided for all hazardous substances;
- Smaller volumes of hazardous substances should be contained within a metal storage locker within the storage shed;
- Due to the porosity of the soil, lined pits to separate oil and water will be required near any workshop or maintenance shed to prevent leaching of hydrocarbons into the water table;
- Vehicles and machinery will be refueled by authorized and trained personnel only in designated areas to reduce the likelihood of spillage in a sensitive environment;
- Drip trays will be used during refueling or servicing to prevent spillages onto the ground or the reef;
- Refueling is not permitted over water or in the reef environment. All refueling must take place on land in a designated area;
- Development of procedures for cleaning up and reporting of accidental spills;
- Spill-kits will be made available for land and sea-based fuel facilities;

- Collection, disposal and removal of all waste oil, filters off the island; and
- Limit the amount of any marine paint to be used on the jetty facility to no more than two liters at any one time contained within a larger volume drip tray to reduce the risk of any accidental spillage into the water.

219. Implementation of the above measures will result in use and storage of hazardous substances creating a low residual impact on the environment.

220. **Construction demobilization and site rehabilitation**. When the construction activity has been completed, the works yards and construction camp (if required) will be demobilized. To minimize any ongoing impacts from the establishment of laydown or construction camp areas, the contractor will provide a detailed management plan on how the site will be rehabilitated. This will include the removal of all equipment unless otherwise agreed in writing by the Kaupule, used or unused construction material, debris and waste, and may include revegetation activities.

221. Implementation of the above measures will result in demobilization and rehabilitation activities having a low-moderate residual impact on the environment.

D. Construction Impacts on Biological Resources

222. **Vegetation loss**. The removal of vegetation for the construction camp, laydown and transit shed area on the fragile soils can result in increased erosion and sedimentation, loss of the protective ground cover with the loss of habitat and shade. Any construction works proposed at the site of land-based facilities must protect the foreshore vegetation. Any building or shelter required at this site should not be located closer than 20m to the foreshore.

223. Therefore, no vegetation should be removed from within a 15m buffer zone to provide long term protection to the foreshore area. Similarly, there should be no clearance of any vegetation within 50m of the existing foreshore for any camp or laydown area. Formerly cleared land should be chosen as a preference and where suitable for the purpose.

224. Measures to minimize any damage to critical shoreline or other vegetation will include:

- Clearly identify and mark on the trees and a site plan, with the assistance of the Kaupule, the exact location of any area to be cleared and what trees are to be retained prior to any cutting or removal. Ensure the site plan is provided to the contractor;
- Clearly identify alternate suitable beach access sites if the current one is not appropriate for the machinery. The alternate site will be preferably the one which causes the least damage to the shoreline.
- Retain a 15m buffer zone along the foreshore where vegetation clearance is not permitted.
- All contractor staff, especially machine operators, will be made aware of the location and what vegetation is permitted for removal by way of a comprehensive site visit which includes the Kaupule; and
- Retain mature trees for amenity value, shade and protection of the soil resource where practicable.

225. Implementation of the above measures will result in a low-moderate residual impact on terrestrial ecology in the area.

226. **Direct loss of habitat and sessile fauna**. This would occur within the footprint of the dredge channel, break wall and foreshore armoring/infrastructure. The direct loss of habitat from dredging and placement of the marine infrastructure would result in the irreversible loss of intertidal flat and subtidal reef habitat. At Nui, a total area of approximately 10,545 m^2 would be lost from within the proposed dredge footprint. Additional habitat would also be lost within the footprint of break wall, totaling a removal of some 15,000m^2. Foreshore habitat would also be modified with predominantly impermeable rock armoring. Some shading of habitat on the upper shore would also occur due to placement of jetties and pontoons. In general, cover of live coral at Nui was greatest on the reef slope. Macro-algae occurred on the reef flat, crest and slope and was generally at its greatest cover on the reef crest.

227. Most of the footprint will occur on reef flat, where there is no coral. Hence, very little live coral or coral habitat, and other biota associated with this habitat such as reef fish and invertebrates, would be directly affected by the project. Given there would only be a small area of reef crest directly affected, the overall loss of coral from the project will be small. Given macro-algae grows on the reef flat, more macro-algae habitat would be directly affected by the project than coral habitat. However, the direct impacts to macro-algae assemblages would be inconsequential given the reef flat is a very common habitat.

228. It is expected that corals, macro-algae as well as sponges, ascidians and a variety of other invertebrates would re-colonize and grow on the new artificial structure created by the harbor and walls of the dredged channel, given this has occurred at the existing dredged channel at Nui. This 'new habitat' is likely to compensate for some of the coral habitat directly affected in the footprint of the new channels and break wall. In turn, the sessile benthic community on the new structure would provide shelter and food for a variety of fish and other fauna.

229. Although there would be a small residual loss of coral habitat due to the project, the habitat to be removed at the new boat harbor location at Nui is not unique and reef regrowth measures will be identified by a suitable marine ecologist and implemented. Therefore, the project will achieve no net loss of biodiversity associated with the coral reef. The proportion of live coral cover and species in the footprint and wider impact area also live in the reference locations where they occur in greater abundance and diversity. While only a small proportion of habitat on the island was surveyed, aerial imagery indicates that extensive similar reef habitat exists on all islands. It is therefore unlikely that there would be a net loss to biodiversity associated with the intertidal reef flat or subtidal coral habitat due to the project.

230. Overall there will be a small net loss of reef area (and a small residual net loss of coral), the following will be undertaken to minimize further impacts:

- The dredging plan to be prepared based on the information from the sediment plume analysis will help reduce impacts on the coral beyond the dredge area by determining the rate at which the contractor can dredge materials to minimize sediment plume and impacts on coral. The CSC will ensure that the contractor complies with the requirements set out in the dredging plan and only excavates the volume per day stipulated in the plan;
- A marine ecologist will undertake an assessment of coral reef regrowth potential, identify required measures and prepare a plan (fully costed) to be implemented by the contractor, under supervision of the marine ecologist;

- The construction zone will be marked on a plan and marked out on the ground (flags or clearly visible tape), all workers will be instructed to operate plant and machinery only within the zone. Operation of equipment and plant outside of this zone will be a breach of the EMP and CEMP;
- Any vessels and workboats associated with the construction works will not anchor over areas of coral reef habitat to prevent anchor dragging and damage. Designated anchoring zones outside of mapped coral habitat will be established and marked with buoys.

231. Post-construction monitoring will be undertaken to ensure that impacts to coral reef habitat has not occurred beyond the footprint of the dredge channel and ancillary structures.

232. Provided the above measures are implemented, and monitored for effectiveness, the residual impact will be low, and no net loss of biodiversity can be achieved.

233. **Temporary impact on water quality.** The dredging to extend and widen the existing channel and the work boat harbor has potential to increase sediment mobilization and turbidity in the surrounding marine environment. Increased sediment suspension from dredge plumes may result in increased turbidity and reduced light available for photosynthesis of corals and macro-algae. Sediment deposition may also result in smothering of corals in the area adjacent to the dredging works.

234. Reduction in light available for photosynthesis and partial or complete burial can lead to decreases in growth rate or loss of coral cover, bleaching and higher prevalence of diseases. The extent of these impacts would depend on the type of dredge material and method used.

235. Similarly, land-based construction works have potential to mobilize sediments. In the absence of proper sediment and erosion controls, heavy rainfall or wind may result in sediments being mobilized and transported into the ocean. These impacts can largely be mitigated through:

- Standard erosion and sediment controls for land-based construction to be implemented as part of the EMP;
- Implementation of the dredging plan (approved by the CSC) including clear statement as to whether silt curtain will be suitable and effective at Nui or not, and if not, alternative sediment containment methods;
- Water quality monitoring of turbidity with triggers for adaptive and contingency dredge management procedures; and
- Best-practice vessel management and site management should be adopted to minimize the risk of contaminant spillage. Work vessels should provide sufficient spill response materials. All work vessels should be inspected to ensure fuels and equipment are appropriately stored and work surfaces kept clean of waste and litter.

236. Implementation of the above measures will result in a low residual impact on water quality.

237. **Increased disturbance to marine fauna from marine traffic**. Increased vessel traffic during construction has the potential to increase the risk of collision between vessels and marine fauna. Marine turtles and cetaceans (whales and dolphins) are particularly susceptible to harm from vessel strike but these are unlikely to be in the vicinity of the construction works. Disturbance from vessel noise and light also has potential to alter the behavior of sensitive species, however, this would be temporary, short-term and localized to within the construction area.

238. The key mitigation measure to minimize potential boat strike and noise related impacts would be to establish 'go slow' zones around the harbor construction sites. The EMP also includes provisions to educate skippers of construction barges and work boats as to how best avoid boat strikes, what to do during vessel interactions with marine fauna and reporting of boat strikes or fauna interactions. Vessel masters should be competent in protected marine species interaction procedures. The contractor should ensure visual assessment is undertaken by trained Tuvalu Fisheries Department (TFD) officers prior to dredging activities, while dredging and while construction vessels are on route to/from Nui.

239. Implementation of the above measures will result in a low residual impact associated with increased disturbance to marine fauna from marine traffic.

240. **Impacts on marine fauna from construction noise**. Underwater noise generated from construction activities could deter fauna away from the vicinity of the construction site. Excavation works using the methods described are considered unlikely to generate noise of an intensity or duration that may result in physiological impacts on species but would likely temporarily alter behavior i.e. marine fauna would move away from the construction area. These impacts would also be intermittent and short term (approximately two months) and localized. However, management measures could be applied to further reduce underwater noise impacts to protected marine species.

241. The EMP should include procedures to limit physiological impact to marine megafauna due to sound and vibrations generated during dredging and construction activities. The construction Contractor should ensure that all equipment is maintained in good operating condition and has proper sound control systems in place. The contractor is to apply sound mitigation, where appropriate and practical. This should include:

- Ensuring that all equipment is maintained in good operating condition and has proper sound control systems in place;
- Application of sound minimization tools, where appropriate and practical. This may include for example mufflers, propeller shrouds; and tuned propellers and drive shafts; and
- Sound-generating equipment should be switched off when not in use.

242. Implementation of the above measures will result in a low residual impact associated with construction noise impacts on marine fauna.

243. **Impacts on marine and terrestrial fauna from lighting.** Construction works using the methods described are considered unlikely to generate light of an intensity or duration that may result in physiological impacts on species but could temporarily alter behavior. Any night construction activities would generate light which could deter or attract fauna away from the vicinity of the construction site.

244. These impacts would also be intermittent, short term (approximately two months) and localized. However, management measures could be applied to further reduce lighting impacts to protect marine and terrestrial species sensitive to it. Although it is understood that works would be done during daylight hours, any lighting used during the period of construction would need to be shielded and all effort should be made to minimize light emanating from the construction site.

245. Implementation of the above measures will result in a low residual impact associated with lighting impacts on marine and terrestrial fauna.

246. **Ciguatera**. Ciguatera is a foodborne illness caused by eating certain reef fish whose flesh is contaminated with a toxin made by dinoflagellates such as *Gambierdiscus toxicus*. These dinoflagellates adhere to coral, algae and seaweed, where they are eaten by herbivorous fish which in turn are eaten by larger carnivorous fish. Exacerbation of the effects of Ciguatera outbreaks were linked to reef blasting in Niutao in 1989 (Tebano 1991). A severe outbreak of ciguatera was recorded on Nui island in 1988 (Sauni 1998).[40] It is therefore possible that disturbance through dredging has potential to increase the risk of Ciguatera via the disturbance of these dinoflagellates. Dredging and excavation both disturb the reef and can promote the growth of algae. The residual sediment on the reef surface encourages the growth of these algae.

247. It is recommended that although the risk of a Ciguatera outbreak is considered low, the following mitigation measures should be in place:

- A risk assessment be undertaken to determine whether there is a need to incorporate testing for harmful dinoflagellates in fish tissues into the EMP for implementation during the construction works. This should be carried out in consultation with TFD;
- Minimize the disturbance of the reef surface in any marine infrastructure project and remove any sediments from the reef surface to reduce the likelihood of an algal bloom occurring on the fresh reef material
- A register should be established to document any cases of Ciguatera brought to the attention of medical staff for a period six months before, during, or six months after construction;
- Any cases should be reported to the PMU, CSC and the TFD so that appropriate safeguards can be put in place. This could include (for example) a TFD notice to advise against consumption of herbivorous reef fish on the islet until further testing has occurred and/or sufficient time has passed post-construction and such fish are considered safe to eat; and
- Removing spoil from the excavated site to an approved location on the land to reduce the surface area impacted by any loose reef deposits on which the algae can colonize.

248. Implementation of the above measures will result in a negligible residual risk associated with ciguatera.

249. **Introduction of invasive or alien species or pests.** Vessels and movement of offshore equipment have potential to act as vectors for introduced species. Introduced species (such as the crown of thorns starfish, (*Acanthaster plancii*), have potential to be translocated into the project marine area via work boats through the release of ballast water (in the case of planktonic larvae or species) or via reproduction from individuals attached to the hull of a vessel. Marine pests are a long-term, but reversible impact to which marine communities would have an existing level of exposure.

250. In addition to the prohibition on recovery of any sands or gravels from coral islands, there will not be sufficient suitable aggregate at the site, it is proposed that all concrete elements of the harbor, breakwater and jetty facility will be pre-cast elsewhere in the region.[41]

[40] Sauni, S. 1998. The status of the coral reefs of Tuvalu.

[41] Pre-cast items for the wharf and work boat harbor at Nukulaelae were fabricated at Lae in Papua New Guinea.

251. As noted at paragraphs 198-200, materials (and plant and equipment) including these pre-cast concrete elements will be shipped by barge to the project site. Some aggregate may be trans-shipped to the project sites and used for the construction of lay-down pads, possible construction camp sites and other ancillary works associated with the project. There is a small chance that weed seeds or invertebrates/insects may be present in this material and it will be important to ensure the likelihood of this is minimized with attention by the supplier to phyto-sanitary and hygiene requirements for imported material.

252. Mobilization of equipment and hygiene requirements will be a key consideration to ensure no alien weed species or other organic matter is inadvertently transported to Tuvalu and then to Nui. The following requirements will be implemented:

- As outlined in Section V B, the contractor will conduct a risk assessment and address any impacts identified in the CEMP through preparation of an invasive species management plan;
- All machinery and equipment be steam cleaned to remove any soil or organic matter and a phytosanitary certificate issued by the authorities in the country of origin prior to shipment to the project site;
- Appropriate phytosanitary documentation must be issued for all imported aggregate shipments into Tuvalu to confirm they are clean of organic material and soil and pests;
- Standard practice procedures for ballast water management should be observed by vessel operators and individual vessels should be assessed to determine that the vessel presents a low risk of introducing marine pests to the area;
- Ballast waters must not be discharged within 5km from the shoreline with confirmation provided by the captain by way of logbook details; and
- All materials and equipment to be imported for the project must be cleared, and the contractor must have obtained the appropriate license or certificate for imported material and/or equipment.

253. Implementation of the above measures will result in a negligible residual risk associated with invasive species.

254. **Impacts to threatened and protected species and habitats**. There are over 3,000 species of threatened corals on the IUCN red list for the South West Pacific Marine Region. It is not possible to identify most coral taxa to species level without microscopic examination of skeletal structure, hence, there is potential for some corals in the project site to be on the IUCN Red List. Some of the genera observed in the baseline ecological survey were species on this list.

255. The Nui Locally Managed Marine Area on islands north of the Nui atoll is sufficiently distant from the project site to be unaffected by construction activity. Of the species of fish identified, none are recorded as critically endangered, endangered or vulnerable.

256. The marine ecological survey confirmed that there is no critical habitat within the project impact area or within the broader area that could be affected by the project. Habitat within the footprint and broader impact area of the proposed new boat harbor would not be considered unique within the islands. Furthermore, the foreshore areas surveyed at Nui was not considered to contain sandy beach habitat suitable for turtle nesting. It is possible that these species, if occurring within the construction area, could be temporarily affected by disturbance from altered

water quality, noise, light and the risk of boat strike. It is most likely however, that these species would be deterred by construction activity and would move away from the area.

257. Provided the mitigation measures outlined in the previous sections are incorporated into the EMP, including requirement for a marine ecologist to identify coral regrowth measures, and appropriately implemented, these potential impacts are likely to be suitably managed. Implementation of these measures will result in a low residual impact on marine ecology and the project will achieve no net loss of biodiversity.

E. Construction Impacts on Socio-economic Resources

258. The beneficial social impact of the project is to increase access to better quality maritime infrastructure. Key project outcomes include safe and resilient inter-island navigation and connectivity and improved ship to shore transfers. This will reduce the number of maritime safety incidents and result in safer and more regular domestic vessel service to/from Nui and Funafuti and other islands.

259. The ability to move people and cargo safely aboard ship and between Nui and the capital may create investment opportunities in tourism and improve the supply chain for coconut products, fisheries and craft products.

260. **Noise and vibration**. Noise will be generated from construction machinery and particularly from the hydraulic rock breaking attachment proposed for the channel widening and preparation of reef surface for the concrete blocks for the breakwaters and jetty. Noise from construction machinery is generally between 80 ~ 110 dB. On-shore winds will carry noise to the village as it is very close to the boat ramp and harbor.

261. Given these works will be carried out during periods of low tide, the noise levels are expected to be intermittent and of relatively short duration. Noise may be an issue during times of church services, important village ceremonies and close to sensitive receptors such as houses, schools and health clinics. Noise mitigation measures include:

- Use modern and well-maintained equipment;
- Operate hydraulic rock picks during daylight hours only and between times as agreed with the Kaupule;
- Liaise with Kaupule to minimize disruption to church services, schools and health clinics and any other sensitive receivers; and
- Functioning GRM and community liaison through stakeholder reference group and Kaupule.

262. Implementation of the above measures will result in no residual impact associated with noise and vibration.

263. **Dust control**. As most of the associated works will be carried out in the inter-tidal and marine environment during low tide, there will be minimal or no dust produced related to the shallow excavation of reef material and the placement of modular concrete breakwater or jetty structures.

264. Dust may be generated by some land based activities including: (i) excavation, haulage and dumping of spoil and sand during construction of the seawall or jetty headwall and other facilities; (ii) movement of machinery on excavated areas; (iii) clean up and removal of storm debris for use as backfill behind the seawall, and (iv) activities including crushing of coral material, aggregate preparation and concrete-mixing.

265. Dust mitigation measures will include:

- Use of sprayers using seawater on bare sandy areas within the village and foreshore area;
- Limit or suspend excavation and other dust producing activities during periods of strong onshore winds when working adjacent to village buildings and houses; and
- Covering of stockpiled materials where feasible.

266. Implementation of the above measures will result in no residual impact associated with dust.

267. **Use of water**. Potable and fresh water is a scarce commodity on any of the outer islands. Construction activities may impact on the supply of groundwater which is known to be increasing in salinity. There will be insufficient water within the villages to rely on any stored water for construction related activities. Any construction camp will need to be self-reliant on water from either rainfall collected in tanks or supplied from associated barges or supply ships or from a desalination plant.

268. Mitigation measures to ensure the project does not impact on the island water supply include: (i) the contractor to be self-sufficient in the supply and storage of all fresh and potable water to be used in the construction camp and for mixing of concrete; and (ii) use only seawater for dust suppression if/as required.

269. Implementation of the above measures will result in low residual impact associated with use of water.

270. **Influx of labor - impacts of foreigners and non-local workers**. A construction project can have a social impact on a remote island community and there may be some community concerns in respect of the construction program. As a priority, a set of protocols (code of conduct) will be established and agreed upon with the Kaupule to determine the social and cultural parameters for working on the island. These protocols will form part of the contractual obligations of the civil works contractor. Measures to mitigate these concerns will be addressed in discussions with Kaupule and full public consultation prior to any mobilization to ensure all construction personnel are aware of locations and the importance of the sensitive areas both within the reef environment and on land and to avoid disturbing them. All employees, local and non-local, are to be inducted prior to commencement in principles including health and safety, gender and cultural awareness/cross cultural training (if workforce contains non-Tuvaluans), the prevention of sexual abuse, exploitation, and harassment, child protection, core labor standards, and the agreed code of conduct. All employees and contractors must sign an induction form showing completion. The employment of a local community liaison officer (CLO) by the contractor will facilitate productive communication between the community and the contractor.

271. The presence of construction workers in small island communities can increase the risk of communicable diseases included sexually transmitted infections (STI) and COVID-19. Communicable diseases including STI are present in Tuvalu, with higher prevalence of chlamydia, syphilis and hepatitis B in the most recently available studies.

272. There have been 11 people diagnosed with HIV since 1995, a high rate for the low population.[42] Education and training in STI, HIV/AIDS and COVID-19 awareness and prevention is an important health risk mitigation factor for the community members and projects workers, both expatriate and those from elsewhere in Tuvalu.

273. There are qualified agencies in Funafuti and the Pacific that can provide HIV/AIDS and STI awareness and prevention training to both the construction workers as well as the general community. The requirement to fulfil this training will form part of the tender document.

274. There may be concerns associated with the location of any lay-down area or construction camp or the presence of a temporary work force on the island. The design team will undertake a careful assessment of potential locations for any construction camps and lay-down areas that may be necessary on the island. Suitable sites will be identified and approved by the Kaupule to ensure these are not placed on or near any areas of cultural significance or require any removal of shoreline vegetation or result in any damage or removal of indigenous vegetation. Preference will be given to sites that have already been modified.

275. The following measures will be included in the CEMP to manage or mitigate potential conflict or social impacts arising from influx of workers:

- Implementation of the project's CCP;
- Ensure that community and stakeholders are aware of the GRM and how to access the GRM;
- Engagement of the contractor's CLO and appointing a grievance focal point (GFP) from the Kaupule;
- CSC and Kaupule to facilitate agreement of protocols—worker code of conduct--between the contractor and community leaders. The protocols will govern workers' conduct while at work and in communities, behavior around local men, women and children, restrictions on alcohol consumption, any restrictions on workers fishing, implementation of awareness programs, implementation of the GRM and handling of complaints, hiring of local labor, and implementation of the health and safety plan (HSP);
- Workers' access to portable toilets and associated sanitation facilities will be provided at the site, including separate and safe female facilities.
- Following the CCP, the contractor will distribute information (through meetings or pamphlets) regarding the scope and schedule of construction, as well as certain construction activities causing disturbance or nuisance;
- For unskilled and semi-skilled activities and labor, every effort to hire local people, including women and disadvantaged populations, for these positions will be taken,
- Child and/or trafficked labor will be strictly prohibited for any activities associated with the project;
-

[42] Ministry of Health. 2015. Global AIDS Progress Report. The first HIV case in Tuvalu was found in 1995. The cumulative number of HIV cases to 2015 is 11, two of whom have died. Of the nine people with HIV still alive, none are currently enrolled in anti-retroviral therapy.

- The contractor will engage/recruit an approved service provider to deliver the communicable diseases (STI, HIV/AIDS and COVID-19) awareness and prevention program to workers and community;
- The communicable diseases awareness and prevention program will be included in the bill of quantities of the contractor and delivered by a service provider approved by the government (Ministry of Health or Tuvalu Red Cross);
- Ongoing training and workshops presented to the community at regular intervals; and
- Availability of condoms, at no cost, to all on-site staff.

276. Implementation of the above measures will result in low-moderate residual impact associated with influx of labor.

277. **Hygiene and sanitation**. The construction phase can cause a range of hygiene and sanitation impacts through use of the island's water supply causing water shortages and lack of proper disposal of water and wastewater used by workers and/or construction activities. General health and safety matters and spread of communicable diseases is dealt with separately. The contractor will also be required to implement the following measures:

- Plan to provide adequate accommodation for all workers either through island accommodation or the construction camps and establish clean canteen / cooking and eating areas;
- Construction camp(s) will be established in areas with adequate drainage and be connected to a septic tank in order to facilitate disposal of effluents and avoid contamination of underground water;
- Potable water, clean water for washing, hygienic sanitation facilities/toilets with sufficient washing water, worker rest area and first aid facilities will be provided. Separate toilets shall be provided for male and female workers;
- Portable lavatories (or at least pit latrines in remote areas) will be installed as temporary measure where necessary and open defecation will be prohibited. Lavatory facilities will be kept clean at all times;
- Wastewater effluent from contractors' workshops and equipment washing yards will be passed through gravel/sand beds and all oil/grease contaminants will be removed before collection for safe disposal. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed waste management section of the CEMP;
- Predictable wastewater effluent discharges from construction and operational activities shall have the necessary permits from DOE, PMU and Kaupule before the works commence;
- Solid and liquid wastes will be disposed as agreed with DOE and Kaupule and managed in line with the provisions of the waste management section of the CEMP; and
- Land used for campsites shall be restored to the original condition as far as practicable and cleaned to the satisfaction of the Kaupule and PMU after use.

278. Implementation of the above measures will result in low residual impact associated with hygiene and sanitation.

279. **General approach to worker and community health and safety.** The construction of maritime infrastructure on a remote island carries significant risk to construction workers and the community if not appropriately managed. Relatively minor injuries may result in life threatening consequences due to the difficulty in getting access to appropriate and timely medical treatment. It will be necessary to include a health and safety plan as part of the CEMP to be approved by the CSC prior to mobilization. This plan should also include details of the location and response times to emergency hospital services and an emergency medevac plan with lines of responsibility for action. The provision of care would be best met by having a qualified medical doctor in the mobilized team. The following of all health and safety requirements, plan, and procedures will be fundamental to maintaining zero harm.

280. The construction contractor must meet Tuvalu's legislative requirements for Workers Compensation (as outlined in *Workmen's Compensation Act 2008*) for foreign and local workers. All relevant and suitable PPE must be provided for the carrying out of construction work. Access will be strictly controlled to the site, patrolled by trained security, preventing children and locals from accessing the site and dangerous machinery. Similarly, any use of shared roads with machinery will be managed responsibly with traffic control and community awareness carried out.

281. **Health and safety - workers**. Health and safety risks of construction works in a remote marine environment are high for both construction workers and the small island community. Medical assistance may be unavailable for extended periods particularly during bad weather. Therefore, all construction personnel must have a comprehensive first aid certificate prior to mobilization with at least one member being competent in advanced emergency first aid to deal with potential injuries and more serious accidents.

282. Risk can be limited by having a clear health and safety policy and an emergency response plan for all personnel and the adjacent community. To minimize health and safety risks, the contractor will provide the CSC and PMU with a comprehensive health and safety plan (HSP) and emergency response plan (ERP) as part of the CEMP which will:

- At least one month before construction commences the contractor will demonstrate to the PMU they are properly resourced and a designated environment and safety officer (EHSO) will be identified. Define responsibilities and authorities within the contractor's staff for adhering to occupational health and safety (OHS) requirements;
- The EHSO will complete health and safety checklists as part of their CESMP implementation monitoring and these will be included in the monthly reports. The EHSO will undertake daily hazard identification checklists, risk assessments and toolbox sessions. Prepare appropriate work method statements for each construction activity and ensure all personnel understand the task before commencing work for the day. Clearly define procedures for handling construction materials, conducting tests, operating heavy equipment in a remote marine environment;
- The contractor will prepare and submit the HSP and ERP as part of the CEMP; the plan will cover worker risks and measures to eliminate, control or minimize the risks. The HSP which will include the measures to demonstrate compliance with the World Bank Group's EHSG. Approved plans will be implemented in full;

- The HSP and ERP will identify measures that are aligned with the planning guidance based on traditional infection prevention and industrial hygiene practices and which focuses on the need for employers to implement engineering, administrative, and work practice controls and PPE to avoid and control spread of COVID-19, as prepared by WHO (2020) Considerations for public health and social measures in the workplace in the context of COVID-19;[43]
- The ERP will cover emergency situations resulting from extreme events, pandemics (such as COVID-19), disasters and the like. The ERP will define appropriate emergency and medical evacuation procedures;
- The contractor will conduct training (assisted by PMU) for all workers on safety and environmental hygiene at no cost to the employees. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice for all operatives before they start work;
- The contractor will ensure that toolbox talks including use of personnel protective equipment (PPE) are undertaken regularly, the talks will be documented. Workforce training will be provided to all workers starting on site (and will include safety and environmental hygiene);
- Workers shall be provided with appropriate PPE such as safety boots, helmets, reflector vest, gloves, protective clothes, dust mask, goggles, and ear protection at no cost to the workers;
- Use of guns and hunting equipment by workers will be banned and workers will be dismissed for hunting or being in possession of wildlife;
- Barriers or fencing will be installed on all areas of excavation greater than 1m deep and on sides of temporary works;
- Reversing signals (visual and audible) shall be installed on all construction vehicles and plant. Drivers will be educated on safe driving practices to minimize accidents and to prevent spill of construction materials during transport;
- Potable water shall be provided (at least 2 litres/worker/day) in all work locations;
- Construction camps (if required) shall be provided with toilets/sanitation facilities to prevent any hazard to public health or contamination of land, surface or groundwater. To ensure these facilities never overflow they shall be well maintained and cleaned regularly to encourage use and allow effective operation and emptied regularly at disposal site approved by PMU and Island Council;
- Accidental damage to utilities will be minimized by (i) obtaining plans from the public utilities identifying locations of pipelines, conduits and power cables and (ii) consultation with staff on the location of utilities prior to commencing excavation operations, however any accidental damage will be appropriately compensated by the responsible party and documented in the GRM;
- Provide for installation of lights, barricades and cautionary signs in hazardous areas;

[43] https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19

- Ensure operators of vehicles and equipment are properly licensed and trained;
- Provide information on emergency assistance procedures on community notice boards and location of first aid kits and other emergency equipment;
- Ensure safety and inspection procedures, setting schedules for regular checking; and
- Set procedures for safe handling of toxic materials and other hazardous substances.

283. There will also be a program to provide general health and safety awareness for construction workers prior to their arrival on site and at any time there are new employees. The program will provide the information from the HSP in the CEMP and will include: (i) introduction to OHS issues in construction sites; (ii) education on basic hygiene practices and procedures to minimize spread of tropical or contagious diseases including COVID-19; (iii) HIV/AIDS and STI awareness, including information on methods of transmission and protection measures an prevention; (iv) prohibition of drugs and alcohol on construction sites; and (v) availability of medical assistance for emergency or non- emergency situations. The communicable diseases awareness and prevention program will be delivered by an approved service provider recruited by the contractor and will be delivered to the workers and the community prior to and during worker presence on the island.

284. Implementation of the above measures will result in low residual impact associated with worker health and safety.

285. **Health and safety - community**. The construction activities will create health and safety impacts on the adjacent community related to noise, dust and other risks and impacts such as communicable diseases associated with the influx of temporary construction labor. Mitigation measures include:

- The contractor's HSP and ERP will address community health and safety impacts and management measures in addition to worker health and safety. The HSP and ERP will be appropriate to the nature and scope of activities, meet the requirements of good engineering practice and national law and regulations and comply with the EHSG;
- The HSP will include agreement on consultation requirements, establishment and monitoring of acceptable practices to protect community safety, links to the complaints management system for duration of the works (in accordance with the GRM) and system for reporting of accidents and incidents. The PMU will ensure these actions are enforced;
- The contractor will coordinate directly with the GFP appointed from the Kaupule for the project;
- Before construction commences, the contractor/s will appoint an approved service provider to conduct training for all workers on environmental safety, environmental hygiene including delivery of the communicable diseases awareness and prevention training and the code of conduct;
- The contractor, following the requirements of the project's CCP, will inform the community of the works (likely impacts and control and mitigation measures), including the timeframe through information brochures and/or community meetings;

- Tuvalu minimum wage requirements to be observed for local workers. There should be proper enforcement of the labor laws at the workplace;
- Child and/or trafficked labor will be strictly prohibited for any activities associated with the project;
- Children will be prohibited from entering the sites (including worker's accommodation, works area/construction zone and laydown area) and prohibited from playing on any equipment or machinery;
- All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Tuvaluan, the language of the main nationality of workers and repeated in English; and
- The contractor will clearly fence off and post warning signs at the site to prevent the public from entering during the construction period.

286. Implementation of the above measures will result in low-moderate residual impact associated with community health and safety.

287. **Site decommissioning and rehabilitation**. When the construction activity has been completed, the construction camp will be demobilized. This will include any reasonable requests to use such areas for community purposes and will be done in conjunction with the Kaupule. All efforts will be made to engage local labor to undertake the decommissioning works, and where practicable, the use of women's or community groups.

288. Implementation of the above measures will result in low residual impact associated with site decommissioning and rehabilitation.

289. **Information disclosure.** A communication and consultation plan (CCP) will be prepared by the CSC and will be implemented for all phases of the project. The CEMP will identify the relevant elements of the CCP that must be implemented by the contractor. Provided this procedure is followed, there will be no residual impact associated with disclosure of information.

290. **Grievance redress mechanism**. A grievance redress mechanism (GRM) will be established and managed by the Contractor (supervised by the CSC) to deal with any community or individual concerns related to the project. It will be expected that there will be full and free access to the CSC to raise any issues of environmental concern due to the construction works. All efforts will be made to address any community or individual concerns in a timely and transparent manner and without retribution to the affected person to minimize any impacts that may affect project implementation.

291. The community will be advised of the GRM through a public awareness campaign and by way of the Kaupule. The process of lodging a concern or complaint and contact details of the contractor and CSC will be identified on a public notice board. The GRM is described more fully in Section VII D.

292. The CEMP will identify the relevant elements of the GRM that must be implemented by the contractor. Provided this procedure is followed, there will be no residual impact associated with the resolution of grievances.

F. Operation Impacts

293. **Physical resources**. Following construction of the workboat harbor, wharf and jetty, there may be an increase in the rate of erosion due to the impact of the facility on the coastal processes. This erosion may be exacerbated by cyclonic storms and wave surges causing physical damage to the structures or undercutting of the concrete structures, abutments and piles. Major maintenance works may be required.

294. Periodic maintenance activities are typically scheduled over periods of several years and include minor repairs to rails, lights, signage, painting, jetty decking, bollards and landing platform and clearance of the culverts under the concrete jetty. A regular inspection of the entire facility should be made as part of the maintenance schedule carried out by MTET and particularly after each significant storm event.

295. Provided the measures identified in the EMP are implemented, there will be low residual impact on physical resources.

296. **Disturbance to marine fauna from increased vessel traffic**. Once constructed, long-term operation of the small work boat harbor at Nui could increase the volume of vessel traffic in northern Tuvalu. In turn, this would exacerbate the risk of vessel strike on certain species as identified in the previous section. It would also increase disturbance from underwater noise. Given the relatively small size, distance from the main village and intermittent use of the new boat harbor, associated noise intensity would not be considered to increase significantly from that already experienced.

297. Improved infrastructure may also result in less engine noise as disembarkation and loading would be faster and less maneuvering would be required.

298. Appropriate vessel speeds and controls should be established for vessels operating within the boat harbor approach, channel and basin. This may include permanent signage and establishment of ongoing procedures and mechanisms for reporting of any vessel interactions.

299. Provided the measures identified in the EMP are implemented, there will be low residual impact on marine fauna from marine traffic.

300. **Changed coastal processes**. Any longer-term changes to hydrodynamic regime and wave refraction could potentially impact sensitive flora and fauna including corals. Water movement provides nutrients (food) and dissolved oxygen to aquatic vegetation and corals, removes wastes, and can reduce predation by herbivores and coralivores. The construction of the safe harbor structures including break wall is expected to alter local hydrodynamics and therefore has the potential to impact on the local marine ecosystem. Another consequence of constructing the small harbor breakwaters is that the structures would potentially reflect waves and thereby increase wave heights in the nearby areas of reef crest or slope inhabited by coral.

301. Provided the measures identified in the EMP are implemented, there will be negligible residual impact on costal processes.

302. **Water quality effects**. Increased vessel movements during operation increases the risk of spills from hydrocarbon fuels, oils, greases and other contaminants associated with vessel operations could degrade water quality through spills of hydrocarbon and other contaminants, nutrient enrichment, littering and waste disposal. The increase in hard-stand areas associated with the new land-based infrastructure also has potential to influence sediment laden surface run- off and nutrients into the marine environment, potentially impacting on water quality in the long term. Corals could be directly impacted by changes in water quality. Changes to the hydrodynamic regime due to the new channel and breakwaters may also influence tidal flushing and water quality.

303. The new infrastructure will provide suitable facilities for the storage of fuels and wastes and be designed to ensure best practice in surface run-off and storm water management. It is possible that increased vessel use may result in minor spills, however, the improved facilities would also help minimize risks of spillage due to safer ship to shore transfers. The movement of liquid materials from the workboats to the wharf can result in spillage or loss into the harbor area causing pollution of the marine environment.

304. Spillage of hydrocarbons into the water or onto the reef platform can result in damage to the aquatic biota. Mitigation measures to reduce the impact of spillages and waste entering the marine environment would include:

- Store all hazardous materials within the designated bunded storage area on vessels delivering the materials;
- Only personnel inducted and trained in appropriate handling and storage of bulk liquids to be permitted to undertake ship to shore transfers;
- Emergency response plan and procedures should be in place in case of an accidental spill;
- Spill kits should be available at the new boat harbor and on vessels transferring liquid cargo; and
- Education for boat drivers utilizing the facilities should be incorporated into the EMP to include best practice in spill management to minimize risks to the marine environment.

305. Provided the measures identified in the EMP are implemented, there will be low residual impact on water quality.

306. **Introduction of marine pests**. As discussed in Section C and D, vessels and movement of offshore equipment have potential to act as vectors for introduced species. Marine pests are a long-term, but reversible impact to which marine communities would have an existing level of exposure. Standard practice procedures for ballast water management should be observed by vessel operators throughout the operational life of the working harbors.

307. Provided the measures identified in the EMP are implemented, there will be low residual impact from marine pests.

308. **Artificial lighting**. Artificial lighting has potential to disturb species such as marine turtles that are nesting or breeding. The specific project location is a not a known or suitable turtle nesting site. Given the relatively small scale of the proposed boat harbor, the associated level of lighting would be minimal and the risk of disturbance to marine fauna considered minor. Impacts of lighting could be further minimized through suitable design and placement of lighting.

309. Provided the measures identified in the EMP are implemented, there will be low residual impact from artificial lighting.

310. **Increased fishing pressure**. There is potential for increased fishing to occur due to more people potentially visiting the outer islands once new infrastructure is in place. This has potential to affect the abundance of some fish and crustacean species. It is, however, considered unlikely that the increase in fishing activity would be to a scale that would amount to any ecologically significant impact to local fish assemblages. Monitoring of fishing pressure should be managed through the EMP in consultation with the TFD.

311. Provided the measures identified in the EMP are implemented, there will be low residual impact.

312. **Impacts to threatened and protected species and habitats**. Long-term impacts to threatened and protected species as identified in Section D have potential to include disturbance from increased vessel traffic (e.g. vessel strike, vessel noise and light), changes to the hydrodynamic regime (particularly corals), degradation of water quality, introduction of marine pests and artificial lighting.

313. Provided the mitigation measures outlined in Section D are incorporated into the operation stage EMP and appropriately implemented, these potential impacts are likely to be suitably managed and the residual impact will be low.

314. **Cargo handling and passenger movements**. The improvements to the workboat harbor, wharf and jetty facilities will significantly improve cargo handling and the reduction in loss of value of spoiled or damaged goods from improper handling the cargo through the tide to the shore. There will also be improvements to the efficiency of operations with an increase in the rate of transfer from the workboat to the shore, allowing the boat to reduce the time required to idle unmoored in the sea nearby. As noted in Sections C and D, vessel and cargo movements between islands includes a risk of spread of invasive species and pests.

315. The project will also greatly improve safety to passengers, particularly the old and infirm, when embarking and disembarking from the workboats to the shore by way of a wharf and passenger access to the workboats without the need to wade through, at times, difficult tidal and sea conditions.

316. The use of a facility by the community will generate domestic waste material. Domestic waste and general litter include non-biodegradable materials such as plastic and glass associated with food items and packaging discarded by people visiting the jetty. Over time the cumulative effects of waste have an impact on the surrounding area and can result in injury to people using the wharf.

317. Commercial waste includes materials associated with the transfer of cargo and other construction related material over the wharf or dumping of solid waste, tires, motorbike parts, empty drums and concrete blocks into the harbor and can result in damage to workboats and other vessels or injury to swimmers.

318. Mitigation measures to reduce the impact of domestic and commercial waste include:

- As outlined in Section V B, the CSC will assist the MTET conduct an invasive species risk assessment for operations and address any impacts identified in the assessment through inclusion of measures in, and updating of the operations stage EMP. If risks are deemed to be moderate-significant the CSC will assist in the preparation of an invasive species management plan;
- Vessels and any cargo to be trans-shipped to other islands to be checked and cleaned as necessary at port of entry to remove any soil or organic matter. If required, a phytosanitary certificate issued by the authorities prior to onward shipment;
- Standard practice procedures for ballast water management should be observed by vessel operators and individual vessels should be assessed to determine that the vessel presents a low risk of introducing marine pests to the area;
- Ballast waters must not be discharged within 5km from the shoreline with confirmation provided by the captain by way of logbook details; and
- All materials and equipment to be imported for the project must be cleared, and the contractor must have obtained the appropriate license or certificate for imported material and/or equipment;
- Public awareness campaign conducted by the Kaupule and church leaders to keep the public facility in a clean and tidy condition, like the condition usually associated with other public facilities such as churches and hospitals;
- Provision of waste receptacles near the jetty and a program for the regular removal of the waste;
- Signs in a prominent position to ensure litter and waste is placed in the receptacles provided; and
- Regular community clean-up programs initiated by Kaupule, community leaders, youth and women's groups.

319. Provided the mitigation measures outlined above are implemented, these potential impacts are likely to be suitably managed and the residual impact will be low-moderate.

VI. CONSULTATION AND INFORMATION DISCLOSURE

A. Consultation

320. Following general good practice and as a requirement of the SPS and Access to Information Policy 2019, public consultations were undertaken during the development of the IEE to determine community attitudes to the project and elicit information germane to establishing baseline conditions and understanding potential environmental and social effects.

321. During preparation of the initial OIMIP project, site visits and discussions at national and island level began in December 2015 through the site visit of the study team for the first phase. The team was accompanied by the Director of Ports, representing the implementing agency (MTET, previously MCT), and visited each of the eight outer islands of Tuvalu. A national workshop was held 15-16 and 18 April 2016 in Funafuti with representatives of five island communities and relevant government agencies.

322. Initial consultations with the Nui Kaupule were carried out in December 2019 to review different harbor and access bridge options and suitable locations for the construction laydown, camp area and disposal of any surplus spoil. Detailed community consultation activities were originally scheduled for December 2019, then following boat availability issues, March 2020. However, the global spread of COVID-19 has required the further delay of these activities.

323. Consultation with key stakeholders, particularly the Falekaupule, Kaupule, landowners, women, and vulnerable populations, in both focus group and interview formats, will be undertaken as soon as applicable travel constraints ease, expected to be in mid-2020.

324. During implementation, MTET through PMU/CSC will ensure that meaningful public consultations, particularly with project affected persons', if any, continue to be undertaken. The process will follow the stakeholder consultation and participation plan prepared for the project. The EMP includes a grievance redress mechanism (GRM) so that any concerns raised during construction or operation can be addressed.

B. Information Disclosure

325. All safeguard documents are subject to public disclosure, and therefore will be made available to the public. Following clearance of the IEE by ADB, the document will be posted on government and ADB websites as per the Access to Information Policy (2019). Provided it does not contain any commercially sensitive information, the approved CEMP will also be disclosed.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. General

326. The EMP contains the components crucial to effective environmental management within the project, these include: (i) organizational responsibilities (for various aspects of EMP implementation); (ii) consultation and information disclosure (explained in Section VI and reflected in the EMP table); (iii) grievance redress mechanism; (iv) plan for mitigation of impacts (during pre-construction, construction and operation); and, (v) monitoring and reporting. These are explained in detail in the sub-sections below.

327. An EMP is developed to achieve the following objectives:

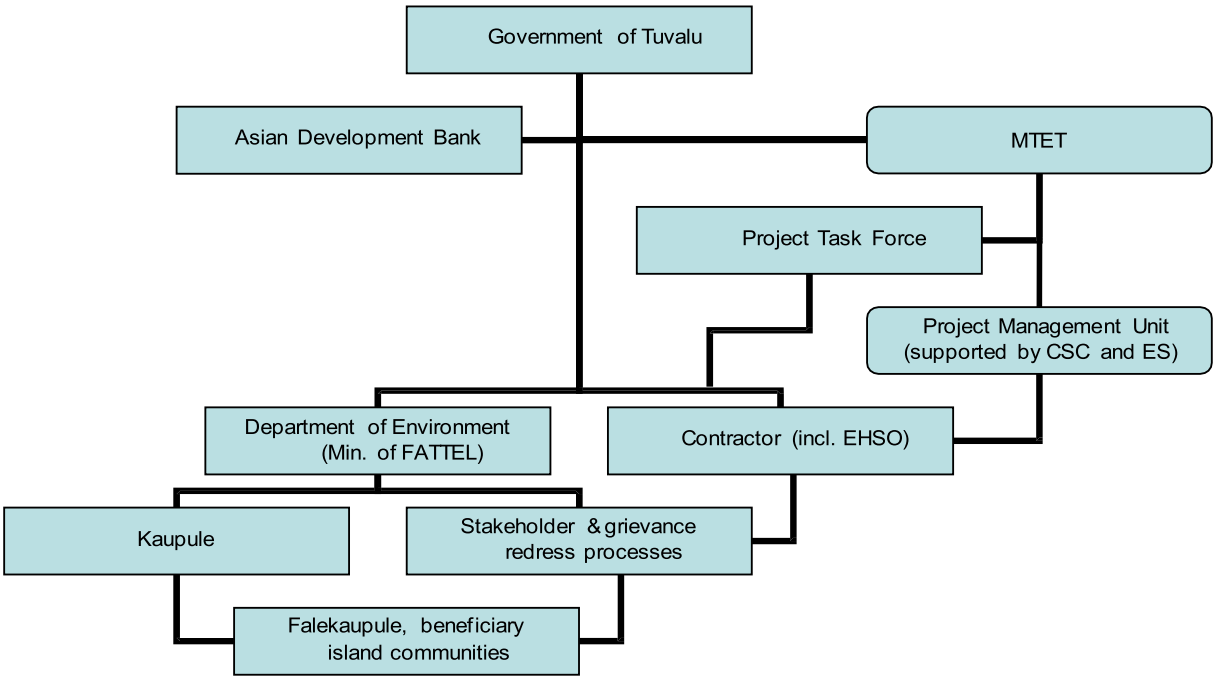
- To reflect the environmental and social issues and impacts identified during project preparation;
- To implement and monitor mitigation measures within the construction area; and
- To comply with the laws and regulations of the country and with international standards and best practice guidelines.

B. Institutional Arrangements for Environmental Management

328. Implementation of environmental safeguards including environmental management provisions and requirements is a joint responsibility between the MTET, project management unit (PMU)[44], CSC, and contractor. MTET, as the project executing agency, has overall responsibility for ensuring that the project activities comply with the project agreements and covenants. The PMU, on behalf of MTET and government, will implement the project, including managing consultants and the contractor, according to the requirements. An individual environmental specialist (prior to the CSC recruitment) and the CSC will support the PMU. The overall organizational structure for environmental management for the project is shown in Figure 7.1.

[44] The PMU has been established under the ongoing project.

Figure 7.1: Organizational Structure for Environmental Management



329. **Government agencies**. The MTET will ensure compliance with assurances contained in the project grant agreement, including environmental safeguards and updating and submitting the updates, and required environmental monitoring reports. The PMU, headed by a Project Director, implements the project and is responsible for overall planning, management, coordination, supervision, and progress monitoring of the subproject including updating the EMP with the assistance of the international and national environmental safeguards specialists.

330. Owing to the small size of the DOE, it has limited staff capacity to provide environmental compliance monitoring of the projects on the outer islands during the construction phase. However, a budget allocation needs to be made to assist the Project Support and Master Planning Consultant (PSMPC) to develop and build institutional capacity to undertake the necessary monitoring activities within the project scope. To assist with building institutional capacity within the DOE, staff will be encouraged to assist the PSMPC to carry out specific site monitoring activities to ensure there is compliance with the national environmental legislation as well as specific project requirements.

331. **Pre-CSC environmental safeguards**. The individual environmental specialist recruited to support the PMU prior to the recruitment of the CSC will deliver the following key tasks:

- Update the IEE including its EMP, as required, filling information gaps and elaborating baseline as required based on surveys, updated detailed design based on geotechnical investigations and any modifications to structural designs;
- Assist the PMU prepare and submit the development approval application including reformatting the updated IEE and EMP as a PEAR as per the requirements under Environment Protection Act 2008;

- Incorporation of updated IEE mitigation measures and EMP and any conditions on the development approval into bidding documents and technical specifications;
- Prepare, for inclusion in the bidding documents, the terms of reference (including requisite qualifications and experience) for the EHSO as part of contractor's team; and
- Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements including the suitability of the EHSO proposed as part of the contractor's team.

332. **Construction supervision consultant**. The CSC will include a suitably qualified ES to ensure all project activities comply with the safeguard requirements of the country safeguards system and the SPS. The ES will need to have appropriate experience in marine ecosystems or at least have ready access (by phone) to a suitable expert that can provide timely advice as required. The tasks include:

- Prior to works commencing ensure the baseline conditions are benchmarked and recorded as required by the EMP for subsequent monitoring;
- Provide induction training to the contractor prior to the preparation and submission of the contractor's CEMP and, as required, work with the contractor's EHSO to identify appropriate construction methodologies and detailed site-specific mitigations.
- Review and approve the contractor's CEMP including site-specific plans, construction methodologies; and work method statements;
- Review the monthly reports from the contractor and monitor and make site visits as required to report the compliance of the contractor with the approved CEMP and through the Engineer issue corrective action requests as required;
- Undertake inspections and monitoring of contractor compliance with the approved CEMP and effectiveness of the mitigations; and
- Provide inputs on safeguards matters to quarterly progress reports, and prepare semi-annual safeguards monitoring reports and submit to MTET and ADB for disclosure.

333. The CSC will also include a site supervisor at the island as well as where the prefabricated concrete elements are to be constructed to ensure quality control. Regular compliance monitoring, constrained by access and logistical reasons due to the very remote location and limited shipping service, will be carried out by the PMU and the CSC's ES. The ES will work with the supervision engineer to review and approve the CEMP and to monitor the contractor's implementation of the approved CEMP.

334. All contractor records will be subject to review. Due to logistical constraints in site access, time and distance, this matter will require greater analysis and a degree of pragmatism to achieve the required level of compliance monitoring for both ADB and Government of Tuvalu.

335. **The contractor**. Given the sensitivity of the marine environment, the contractor will be required to recruit an experienced environmental specialist (as the EHSO) to develop the CEMP and to help the contractor implement the CEMP, including the site-specific plans and construction

methodologies (working platforms, dredging methods, and spoil disposal locations and methods) most suited to the environmental conditions at each island. The EHSO will need to have appropriate experience in marine ecosystems or at least have ready access (by phone) to a suitable expert that can provide timely advice as required.

336. The contractor will be supported by the CSC during the preparation of the CEMP which will be submitted to the CSC and PMU for approval prior to the commencement of works.

337. The main responsibilities for environmental management at the different stages of the project are summarized in Table 7.1.

Table 7.1: Responsibilities for Environmental Management

Project Stage	Responsible Agency	Responsibilities
Feasibility studies, detailed design review and project approval	FS & DD consultant	Review designs prepared as part of ongoing project and complete detailed design Prepare feasibility study including safeguards due diligence
	ADB	Review all feasibility study documentation (incl. IEE) Prepare documents package for Board review (incl. requirements and TOR in PAM and covenants in grant agreement) Board approval of project Assist government to recruit CSC
Pre-construction incl. detailed design update	FS & DD consultant	Update detailed design based on geotechnical investigations and any structural design modifications Prepare bid documents Assist PMU evaluate bids and prepare bid evaluation report
	Individual env. specialist	Update the IEE including its EMP, as required, filling information gaps and elaborating baseline based on surveys, updated detailed design based on geotechnical investigations and any modifications to structural designs; Assist the PMU prepare and submit the development approval application including reformatting the updated IEE and EMP as a PEAR as per the requirements under Environment Act; Incorporation of updated IEE mitigation measures and EMP and any conditions on the development approval into bidding documents and technical specifications; Prepare, for inclusion in the bidding documents, the terms of reference (including requisite qualifications and experience) for the EHSO as part of contractor's team; and Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements including the suitability of the EHSO proposed as part of the contractor's team.
	PMU, CSC	Include ES as part of CSC team Elaborate the stakeholder engagement strategy in PAM as the CCP Prior to works commencing ensure the baseline conditions are benchmarked and recorded as required by the EMP for subsequent monitoring Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements including the suitability of the EHSO proposed as part of the contractor's team Provide induction training to the contractor prior to the preparation and submission of the contractor's CEMP and as required work with the contractor's EHSO to identify appropriate construction methodologies and detailed site-specific mitigations Review and approve the contractor's CEMP and advise Engineer of approval to trigger "no objection" to commencement of activities/works
	ADB	Review and clear updated safeguards documents

Project Stage	Responsible Agency	Responsibilities
		Provide comments on the CEMP and proposed monitoring checklists
	Contractor	Recruit suitably qualified EHSO Prior to any works commencing, prepare CEMP including the site- specific plans, work method statements and construction methodologies (working platforms, dredging methods, and spoil disposal locations and methods) and GRM Submit CEMP to PMU and CSC for review and approval (revising as required) Identify materials and equipment sources and arrange necessary permits, consents and compliance certificates Provide pre-mobilization induction on CEMP (incl. OHS) to employees Recruit approved service provider to provide STI/HIV/AIDS awareness and prevention training for workers and community
Construction	Contractor	Inclusion of EHSO as part of core team Provide ongoing training, awareness and "toolbox" sessions for workers Implementation of CEMP Implementation of CCP and GRM as pertains to construction Reporting of CEMP and GRM implementation in monthly reports Implementation of corrective actions as requested by Engineer
	PMU, CSC	Supervise, monitor and report on contractor's implementation of CEMP and all other contractual obligations Enforce contractual requirements Audit construction phase through environmental inspections and review monitoring reports and data Submission of quarterly progress reports and semi-annual monitoring reports Work with contractor EHSO for provision of awareness/training to workers and information transfer to contractor as required
	ADB	Undertake regular review missions Review monitoring reports Disclose project information as required
	DOE	Ensure compliance with government requirements Review complicated issues, if any, arising from the project Participate in monitoring
Operation	MTET	Provide budget to undertake maintenance activities and operation stage environmental monitoring as required by EMP
	Maintenance contractor	Undertake environmental monitoring and prepare bi-annual reports Prepare maintenance reports to adaptively manage environmental risks related to operations (per EMP)

C. Mitigation Plan

338. The EMP includes the description of the environmental impact of a range of project activities during the pre-construction and design phase and the construction phase, with mitigation measures and responsibility for undertaking these measures.

339. The EMP matrix (Table 7.2) provides an operational reference and a tool for environmental management during construction activities. It describes in general terms how the contractor will meet the specified contractual, regulatory and statutory requirements. The contractor will provide the detail in its response (the CEMP) which will set out method statements and site-specific plans as required.

D. Grievance Redress Mechanism

340. A grievance redress mechanism (GRM) will be established for the project. The GRM will cover all project matters, including environmental and social performance, and has been developed based on traditional approaches to conflict and complaints resolution. The community will be informed of the GRM following the methods and manner set out in the communication and consultation plan (CCP) and through discussion with the Kaupule which, if appropriate will appoint a grievance focal point (GFP). The process of lodging a concern or complaint and contact details of the contractor and CSC will be posted on a public notice board. The community is encouraged to voice any concerns or complaints, and these are to be duly investigated and reported through to the contractor. All grievances, complaints or issues raised will be lodged in a register maintained at the contractor's site office. These are included in the monthly reports from the contractor to CSC and PMU and are subject to monitoring by the CSC and PMU.

341. Given the remote location, the small number of construction workers and the small size of the communities involved, it will be expected that there will be full and free access to the site-based members of the CSC team, including the Engineer, to raise any issues arising from the construction works. All efforts will be made to address any community or individual concerns in a timely and transparent manner and without retribution to the affected person/complainant to minimize any impacts that may affect project implementation.

342. The process is shown in Table 7.3), developed in conjunction with the PMU, will be used to address the issues and concerns that a complainant may have. The process is relevant to all subproject sites. The key point of contact for the complainant will be a GFP appointed from the Kaupule, who will liaise directly with both the contractor and the CSC. The contractor will receive and document all matters and issues of social concern from the local community and forward copies of all grievances to the CSC and PMU. The contractor’s CEMP will set out the process for resolving issues and complaints related to construction activities or behavior of workers as per the GRM.

343. For concerns such as damage to trees or food gardens i.e., taro plots without permission or compensation, the complainant will discuss this with the Kaupule, who will raise the matter immediately with both the contractor and the CSC. If the concern can be addressed without delay, and the outcome is satisfactory to the complainant, the matter is closed. The contractor will provide a corrective action report to the CSC as soon as the complaint has been resolved.

344. For more extensive complaints relating to damage to buildings or land issues such the encroachment by the project or the contractor onto land outside the designated work area, the complainant will make a formal written statement to be delivered to the Kaupule, who will forward this to the contractor. The contractor will document the complaint and forward a copy to the CSC and PMU. The complaint must be attended to within 24 hours of the complaint being lodged.

345. The timing and way it will be/has been resolved will be conveyed to the complainant by the Kaupule within 48 hours. The contractor will provide a corrective action report to the CSC as soon as the action has been taken.

346. If the complaint is not resolved by the contractor or CSC to the satisfaction of the complainant, then the Kaupule will forward the complaint directly to MTET, and with a copy to the Ministry of Home Affairs and Rural Development. The matter will be addressed with due

consideration to the seriousness of the complaint and be carried out promptly. The MTET will attend to the complaint within 24 hours and advise the Kaupule how it will be addressed. MTET will make a decision within two weeks. The complainant may, if so desired, discuss the complaint directly with PMU or its representative at a mutually convenient time and location. If the complaint of the complainant is dismissed, the complainant will be informed of his/her rights in taking the complaint to the next step. However, every effort will be made to resolve the issue to the mutual satisfaction of both the parties.

347. Should this process not resolve the matter, then the complainant can take the grievance to the Tuvalu judicial system. The filing of the grievance will be at the complainant's cost, but if the court shows that PMU has been negligent in making their determination, the complainant may seek costs.

Table 2: Procedures for resolving grievances

Step	Process	Duration
1	Complainant lodges grievance with contractor and/or CSC or the GFP/Kaupule	Any time
2	GFP/Kaupule reviews the issue, and in consultation with the CSC and contractor (if appropriate), then records a solution to theproblem.	24-48 hours
3	GFP/Kaupule reports back to complainant and gets clearance from the complainant.	48 hours
If unresolved		
4	Kaupule takes grievance to Director-MTET for resolution Director-MTET considers matter and responds	24 hours Decision within two weeks
5	Complainant refers matter to government ‘s legal office	2 weeks
6	Government legal office refers to an internal committee	4 weeks
7	National agency reports back through relevant government agency/complainant	2 weeks
If unresolved or if at any stage and complainant is not satisfied with progress		
Complainant can take the matter to appropriate national court.		As per judicial system

E. Monitoring and Reporting

348. During the period of project design, monitoring has ensured that (i) design measures are specified for sensitive areas, (ii) bidding documents contain environmental requirements, and (iii) criteria for the selection of qualified contractors are clearly defined and followed. The baseline conditions established in this report have been further elaborated and recorded/benchmarked for required conditions and parameters as per the monitoring requirements in the EMP matrix Table 7.2.

349. When construction commences, a key aspect of environmental monitoring is to ensure overall contractor compliance with the EMP. It also serves to assess the effectiveness of environmental mitigation and management measures.

350. Monitoring of environmental impacts is also carried out during the construction and post-construction period including verification (one year after construction) of predictions of the scale and extent of impact to coral on reef slopes. This measures environmental impacts to ensure that critical factors are not exceeded.

351. It also helps to determine whether mitigation measures are effective or should be altered or improved to address the observed and measured change in impacts. This also assists in the evaluation of impacts as an input to decisions on future projects.

352. The reports to be prepared during the project include:

- Monthly reports prepared by the contractor (including implementation of CEMP and GRM issues);
- Quarterly progress reports prepared by the PMU and CSC which will include safeguards matters as relevant (summarizing above);
- Semi-annual safeguards monitoring reports summarizing above, reporting on corrective actions requested and actioned and training and capacity building activities.

353. The updated IEE, PEAR and semi-annual safeguards monitoring reports, along with other relevant project information, will be subject to disclosure as per the Access to Information Policy 2018.

Table 3: Environmental Management and Monitoring Plan

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
DESIGN AND PRE-CONSTRUCTION PHASE						
Project access to land and seabed/reef	Obstructions during construction if access arrangements not properly negotiated and finalized	• Land ownership arrangements validated and leases/agreements made as set out in the DDR • DDR updated during detailed design and verified by third-party	PMU, Kaupule	As per DDR	As per DDR	As per DDR
Dredging and excavation activity creates sediment	Silt and sediment affect larger area of coral through smothering	• Sediment plume modelling and analysis undertaken • Dredging plan determining expected duration of daily dredging • Dredging plan reflected in updated EMP and bid and contract documents • Contractor responds to dredging plan requirements in dredging work statement and site-specific plan included in CEMP	PMU, FS&DDC	Sediment and fines plume; Coral health	As per dredging plan	CSC
Geotechnical surveys to take core samples, seismic probes	Drilling into reef platform using manually-operated motorized drilling equipment to take core samples will not result in any significant long term impact. Potential for leakage of fuel, oil or hydraulic fluid onto reef from the equipment. Potential impact of seismic waves on marine life and fish	• Small size of the drill will not result in significant amounts of sediments from each site • Carry out drilling during outgoing tide to remove sediment from reef platform • Check manually-operated motorized drilling equipment for potential leaks from all hydraulic hoses and fuel lines • No refueling to be done on the reef platform • Carry out any seismic survey at low tide only and when there is no water on the reef platform	FS&DDC, PMU	Sediment yield, timing of drilling, refueling	Daily during survey Visual inspection	CSC / Contractor

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Bid and contract documents (BCD) preparation, tendering and contractor award	Poor project environmental management if systems not established properly and from outset of project implementation	• PMU to be supported by individual ES prior to recruitment of CSC • IEE updated based on updated detailed designs, and submitted for development approval • Updated project EMP and conditions of development approval incl. in BCD; • BCD requires contractor to: (i) comply with laws and regulations; (ii) designate full-time EHSO; • (iii) prepare and implement CEMP; (iv) provide induction and training for workers (and community) as specified); • CSC recruited and ES mobilized • Contractor to prepare site-specific CEMP; and • CEMP reviewed and cleared by ES prior to works commencing	PMU, CSC, Contractor	BDC (incl. TOR); Bill of quantities; CEMP approved prior to contractor commencing works	Once - env. specialist engaged; BCD includes updated EMP and safeguards provisions; Development approval; CSC recruited and incl. ES; CEMP prepared and cleared; no objection for works commencement; Notes of induction and training	EA, IA, PMU, DOE
Climate change adaptation	Risk of increased coastal erosion and change in longshore sand movement	• Ensure all measures incorporated in design are implemented	FS&DDC PMU	Review of plans and designs	Visual inspection	PMU
Mobilization of machinery and equipment from source country	Introduction of invasive/alien species (soil-borne weeds, pests, pathogens)	• Contractor to prepare invasive species management plan as part of the CEMP; • Ensure all construction machinery and equipment is steam cleaned of all organic material in source country prior to deployment • Obtain approved phytosanitary certificate and any other documentation required under Tuvalu legislation	Contractor CSC	Pathogen-free status of equipment and machinery	ISMP prepared and approved; Visual, once for each shipment Phyto-sanitary certificate issued	CSC, PMU
Supply of aggregate for construction purposes and rocks for seawall	Soil-borne weeds, pests and pathogens become established on the island and reef environment	• DOE consulted about using the dredged material as a source of supplies of aggregate for concrete. Some imported aggregate may also be used, and all rocks will be imported. • All large rocks to be cleaned of all dirt, debris and any residual plant matter prior to shipment • Provide an approved phytosanitary certificate and any other documentation required under Tuvalu legislation prior to dispatch from country of origin	CSC	Pathogen-free status of aggregate	Visual, once for each shipment Phyto-sanitary certificate issued	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Construction activities in remote locations	Hazards and risks to construction workers	• Health and Safety Plan (HSP) as part of CEMP to be approved by CSC prior to construction work starting • Confirm location of emergency hospital services and response times at each site • Provide an emergency medevac plan with lines of responsibility for action	CSC	HSP contains all relevant elements	Once, HSP presented and approved	CSC, PMU
	Hazards and risks to community: Transmission of communicable diseases incl. STI and HIV/AIDS Social disruption Possibility of conflicts or antagonism between residents and contractor Children potentially exposed to sexual exploitation.	• Contractor to engage an approved service provider to deliver the communicable diseases (STI, HIV/AIDS and COVID-19) awareness and prevention program • Conduct a communicable diseases (STI, HIV/AIDS and COVID-19) awareness and prevention program for affected communities and workers PRIOR to mobilization of contractor to project site • Ensure all workers have medical clearance for any contagious/communicable diseases prior to mobilization • Confirm GRM, appoint GFP and advise community of the process • Code of conduct agreed between Kaupule and contractor (agreed set of protocols) • EHSO recruited by contractor	Contractor, Approved service provider, Kaupule	Awareness program conducted Medical clearance certificates GRM available for public inspection Agreed code of conduct EHSO recruited	Once, program delivered As required, all personnel with medical clearance confirmed Once, GRM in place Once, MOU signed Once, EHS on site	CSC, PMU
Delivery of pre-cast concrete elements and other construction material from country of origin	Ballast water from ship may introduce foreign marine organisms or pollution of near shore environments	• Ballast water to be discharged no closer than 5km from the shoreline • Confirm with ship captain and review of log	CSC	Ballast water is discharged at least 5km from shoreline	At each shipment, ship records	CSC, PMU
CONSTRUCTION IMPACTS ON PHYSICAL ENVIRONMENT						
Operation of construction plant and vehicles generating emissions	Emission of exhaust from vehicles and machinery affects air quality	• Maintain construction equipment • Any machinery generating visible smoke is not permitted for construction activities	Contractor	Exhaust emissions from machinery	As required, visual	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Construction activities during the dry season may cause dust nuisance	Air quality impacts (temporary and localized) Increase in levels of dust in and around the construction area Limited supplies of fresh water for dust suppression Dust from exposed spoil disposal sites	• Limit or suspend construction activity near villages during periods of strong winds • Limit truck movement through community areas during periods of high winds. Cover loads with tarpaulins • Use sea water only for any dust suppression • Apply water to access road within 50 m of any occupied dwelling and through village during the dry season to reduce visible dust levels due to construction activities • Spoil disposal sites compacted to reduce exposure of loose debris from wind, as required	Contractor	Levels of dust during operations Application of water on access roads during dry dusty weather Spoil disposal sites compacted when required	As required, visual	CSC, PMU
Construction of temporary working platform on the reef, if required	Sourcing of materials Additional dredging depending on method proposed Sedimentation (if causeway is constructed)	• Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • CEMP to include site-specific plan/work method statement to address this element including: (i) definition of boundaries; (ii) identification of environmental values of the site and surrounds; • (iii) definition of construction activities; (iv) risk assessment; (v) identification of environmental management measures to address risks and impacts; (vi) site drawing/work plan; and (vii) baseline conditions and monitoring plan Contractor to engage suitable experienced professional for assisting in preparing the CEMP given the sensitive marine environment	Contractor CSC	Site-specific plan prepared and approved. Approved method implemented	Suitable EHSO (or other) prepares CEMP: Site specific plan approved; Daily/weekly during construction	CSC, PMU
Disposal area for material dredged from harbor and channel	Loss of sediment from disposal site Damage to surrounding land Removal of vegetation required to establish a disposal site	• Provide a solid barrier around the spoil disposal site to prevent the spread of spoil from the designated site. • Disposal of dredged material into the sea or lagoon is not permitted • Disposal of dredged material not permitted on foreshore • Retention of 15m vegetation buffer zone along foreshore	Contractor	Appropriate soil conservation measures implemented; Placement of spoil during dredging; Effectiveness of bunds at spoil site	Stockpile area agreed with Kaupule; Daily, visual	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Construction of seawalls, headwalls and retaining structures	Loss and dispersion of excavated material from foreshore onto reef platform during high tides Potential for pollution from construction machinery into foreshore environment	• Contractor's method statement approved prior to the start of any excavation • Planning of works such that only short sections of coastal area are exposed at any one time • No excavation works immediately before any advancing bad weather system • All excavated material to be removed from foreshore environment • No excavated material to be stock-piled on the beach or reef flat. The only exception will the use of dredged material for construction of the temporary access bund for excavator access • Plant suitable ground cover vegetation and trees behind seawall • All machinery to be free from visible leaks of hydrocarbons, no refueling on the foreshore	Contractor	Method statement approved; Location of excavated material; Coral on reef platform	Once, method statement identifies mitigation measures. Daily, during construction	CSC, PMU
Removal of pre-cast concrete blocks from vessel and storage on the reef	Damage to reef platform from machinery and vehicles during unloading, temporary placement of concrete blocks outside of construction footprint	• Contractor's method statement approved prior to the start of unloading and placement of 600 pre-cast 20-22t concrete blocks • Define the construction boundary and designated path for vehicle movement • Identify and mark temporary storage area of concrete blocks during preparation of the wharf and jetty footing. • Minimize operation of tracked vehicles, cranes on reef platform to prevent damage to the cemented top layer of coral.	Contractor	Method statement approved; Location of temporary storage area; Coral on the reef platform	Once, method statement identifies mitigation measures. Daily, during construction	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Coastal protection works, disposal of spoil from dredging	Collapse of beach profile after excavation (prior to construction of retaining wall) Foreshore erosion Loss and dispersal of excavated material and sediment from disposal site	• Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • Careful planning of works such that only short sections of excavated trench for any seawall or jetty headwall structure are exposed at one time and which can be completed between periods of low tide, or if sufficiently above high tide mark, that can be completed before any advancing weather system • All excavated material to be immediately removed to the designated spoil disposal area. No excavated material is to remain in stockpiles on the beach or reef flat between tides • Minimize the period that excavated areas are left unprotected and open to tidal movement or storm effects • Ensure that all equipment used below the highwater mark is in sound mechanical condition, and free of any leaks of any fluid • Minimize or reduce the clearing of any vegetation near the seawall or jetty headwall structure. Consultation with Kaupule undertaken in finalizing the locations and numbers of trees to be cleared • Construct sediment traps where suitable to divert overland runoff into a safe disposal area • Retention of 15m vegetation buffer zone along foreshore	Contractor CSC	Volume of spoil is estimated to be 21,920m^3 of which approx 4800m^3 used for road and platforms and 10,900m^3 would be disposed on land; Disposal site agreed with Kaupule; Sediment plumes; Coastal protection measures	Work method statements reflected in CEMP; Dredging plan requirements; Details on site specific plans and drawings; Sediment and erosion control measures implemented; Throughout construction activities	PMU, CSC
		• Incorporate bioengineering solutions where practicable (e.g. planting ground cover species and local tree and shrub species in rows on the land side of the bund as part of the site remediation plan after completion of works to reduce exposure to wind) • Ensure the designated disposal site has capacity for the volume of spoil calculated • Ensure the designated disposal site is appropriately bunded • Consultation with Kaupule undertaken in finalizing location of spoil disposal site				

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Dredging	Disturbance of sediments and short-term increase in suspended solids and transfer of plume by tides affecting water quality	• The CSC will include suitably qualified ES and the contractor will engage a suitably qualified EHSO • Contractor to prepare a detailed dredging method statement in the CEMP which will identify the methodology and rationale for any selected dredging system chosen and how the contractor intends to minimize the spread of suspended sediments • Dredging plan based on the sediment plume analysis and reflected in contractor's work method statements • During works, the contractor's EHSO will need to have appropriate experience in marine ecosystems or have ready access (by phone) to suitable expert for advice as required • Hydraulic excavators shall be in sound and well maintained condition and free of any leaks of any fluid. A pre-start inspection will be carried out on all machinery prior to the commencement of works at the start of each work period and records kept for monitoring purposes • All plant only operated by certificated and experienced operators	Contractor, CSC	Sediment plumes and localized water quality and coral health	ES and EHSO recruited and mobilized; CEMP with detailed work statements as required; Sediment control measures implemented; Visual observation during works; Photos of plume movements with correct date time stamp; Logs and records of excavation works; start and finish times, tidal records, Monitoring records and checklists	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• All excavation operations shall comply with relevant laws of Tuvalu and international conventions to which it is a signatory • Excavation operations will be monitored visually by the EHSO. Photographs of plume movement will be taken along with details of sea conditions, wind speed and direction for each work period and phase of the tidal cycle. If the EHSO, on advice from a suitable expert, considers the plume density or extent to be at a level that could be having a detrimental effect on coral on the reef slope then the CSC will be consulted so that dredging is adapted to an agreed means for reducing the plume density or extent. This may, for example, involve reducing the duration of dredging at each low tidal cycle • Excavation operations during incoming tides or strong westerly winds (which occur intermittently, mainly between April and September) will only be permitted if it can be demonstrated that plume movement does not result in deposition of material on the reef' • No dredging to occur on the reef platform to occur in the cyclone season				
Movement of machinery (land to/from beach and foreshore)	Active rill and gully erosion from movement of machinery weakening fragile land Sediment laden runoff from landward-side eroding ramp and other solid structures	• Retention of 15m vegetation buffer zone along foreshore • Use existing boat ramp or agreed alternative • Temporary retaining structures and sediment traps as required	Contractor	Soil conservation measures implemented; Any removal of vegetation within design parameters	As required during construction; Compliance with design parameters; Vegetation planted along foreshore upon completion	CSC, PMU
Solid waste generated at construction site(s) incl. laydown areas	Contamination of island or reef environment	• Segregate and remove all inorganic and solid waste generated by project from the island • Use waste concrete where appropriate for the construction of seawalls • No solid waste to be dumped in lagoons or water bodies • Burning of solid waste is not permitted • Compost all green and organic wastes to assist soil improvement for producing communal food crops or use as pig food	Contractor	Separate solid waste area in use which can be removed on completion of works; Compost area for green/organic waste	Weekly, visual	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Wastewater and sewage	Contamination of groundwater	• All construction camps and temporary worker sites will have self-contained latrines • All grey water and septic tank material to be regularly pumped out from the septic tank and disposed of to an approved site or removed from island • Facility to be removed at the completion of the construction works unless required by the community and agreed with Kaupule	Contractor	Self-contained latrines on site or on barge; Disposal of grey water and septic tank material; Facility removed at completion of works	Once, visual As required, grey water and septic tank material disposed of safely, records kept Once, facility removed	CSC, PMU
Storage and handling of hydrocarbons; emergency or accidental spills of hydrocarbons	Potential hazard to the marine environment Pollution of groundwater	• Spill response plan to be included in the CEMP • A comprehensive site induction prepared by the contractor, with input from the Kaupule, will be required for all personnel involved with the project, with specific attention made to the sensitive atoll and reef environment • All personnel involved in the handling of dangerous goods must be trained and inducted in the handling, emergency procedures and storage requirements for different types of substances • Where fuel is stored on land, it will be in dedicated areas in sealed tanks placed within a concrete bund or purpose built facility that has 110% of the capacity of the drums or storage • The storage area will be at least 50 m away from the marine environment and should be fully secured and locked when not in use • Smaller volumes of hazardous substances should be contained within a metal storage locker within the storage shed • Due to the porosity of the soil, lined pits to separate oil and water will be required near any workshop or maintenance shed to prevent leaching of hydrocarbons into the water table • Vehicles and machinery will be refueled by authorized and trained personnel only in designated areas to reduce the likelihood of spillage in a sensitive environment • Drip trays will be used during refueling or servicing to prevent spillages onto the ground or the reef	Contractor	Spill response plan is in place; Spill kit at works site with workers trained in its deployment; Storage facility complies with design requirements and monitored for spills and leaks; All hydrocarbon waste removed from island on completion; Refueling practices	Once, visual Weekly, inspection records and spill register; Training records; Once, records and visual inspection	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Re-fueling is not permitted over water or in the reef environment. All refueling must take place on land in a designated area • Development of procedures for cleaning up and reporting of accidental spills • Spill-kits will be made available for land and sea-based fuel facilities, workers trained in deployment of kits • Collection, disposal and removal of all waste oil, filters off the island • Limit the amount of any marine paint to be used on the jetty facility to no more than 2 liters at any one time contained within a larger volume drip tray to reduce the risk of any accidental spillage into the water				
CONSTRUCTION IMPACTS ON BIOLOGICAL ENVIRONMENT						
Site clearance for laydown area, transit shed and works area	Vegetation loss	• Clearly identify on a site plan and place a mark on the trees, with the assistance of the Kaupule, the exact location of any area to be cleared and what trees are to be retained prior to any cutting or removal. Ensure the site plan is provided to the contractor • Retention of 15m vegetation buffer zone along foreshore. All contractor staff, especially machine operators, will be made aware of the location and what vegetation is permitted for removal by way of a comprehensive site visit which includes the Kaupule • Retain any mature trees for amenity value, shade and protection of the soil resource where practicable. • Salvage any suitable plants from the laydown and reuse elsewhere along the road, where practicable.	Contractor CSC	Approved plan; Vegetation/trees cleared and retained	During site preparation and clearance activities	PMU, CSC
Dredging of reef material	Increase in sediment content of tidal waters in channel, reef platform and reef slope Fish and marine life affected by increased suspended sediment levels or sedimentation Potential source of pollution from dredging equipment or barge	• Incorporate existing guidelines into contractor method statement • Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • Limit dredging to the design channel and harbor footprint	Contractor CSC	Water quality (sediment) and coral health; Method statement; Machinery operates in defined area; Machinery free from any leaks of oils, lubricants; Spoil removal from reef	Once - method statement contains existing guidelines Daily - machinery is operating within defined area and during outgoing tides	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
	Potential for an outbreak of Ciguatera Damage to reef platform from machinery	• Limit machinery to the design channel and harbor footprint, or to a clearly defined path agreed upon by the Engineer • All machinery to be in sound condition and free from any leaks of lubricants and fuel • Carry out dredging on outgoing tides as far as practicable to reduce the development of a sediment plume and deposition of sediments on the reef platform and tidal waters • Do not stockpile material on reef platform between tides • Remove material as it is excavated to reduce the growth of algae and incidence of Ciguatera • Daily records of site conditions kept during each work period including plume density and extent. If EHSO (in consultation with appropriate advisor with experience in dredge plume monitoring and impacts on marine ecosystems) considers plume density or extent to be at a level that could create detrimental effect on coral then the CSC will be consulted so that dredging is adapted to an agreed means for reducing the plume density or extent. • Advise community against fishing or harvest of marine life within 1 km of the channel and harbor area during dredging works and for at least 4 weeks after works have been completed • A register will be established to document any cases of Ciguatera brought to the attention of medical staff for a period six months before, during, or six months after construction • Any cases should be reported to the Project Manager and the TFD so that appropriate safeguards can be put in place. (e.g. fisheries notice to advise against consumption of herbivorous reef fish on the islet until further testing has occurred and/or sufficient time has passed post-construction, such that fish are considered safe to eat)		platform; Record sheets for daily conditions during construction; Plume density and extent; Community advice on fishing near working area; Ciguatera cases	Visual inspection of machinery for leaks prior to going onto reef area Visual inspection of plume density and extent No stockpiles on reef platform, all material removed Weekly - confirm daily record sheet for weather and sea conditions Weekly for Ciguatera cases Once, notice in public view and Kaupule advised	

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Location of access tracks from land onto reef platform	Damage to organisms on the reef platform due to the movement of heavy machinery Damage to the reef crust, exposing unconsolidated subsurface material to erosion Damage to ground cover vegetation along foreshore Damage to protective function of tree roots	• Define and mark a clear working zone where machinery will be permitted to operate • Minimize the width of the access track to prevent damage to the root zone of trees and shrubs along the foreshore section. • Define and mark one access track for machinery from foreshore area, preferably where vegetation is already lost • Salvage any suitable plants from the access road and reuse elsewhere along the road, where practicable.	Contractor, CSC	Clear demarcation of machine operating zone on reef platform and beach access	Once Details on plan	PMU, CSC
Dredging and excavation works	Direct loss of habitat and sessile fauna	• Marne ecologist to be engaged to undertake assessment and prepare plan for implementation of coral reef regrowth and coral transplantation measures • To minimize impacts on the marine environment, the channel and basin would be dredged commencing from the outer edge of the reef platform and working towards the shore • Any vessels and workboats associated with the construction works should not anchor over areas of coral reef habitat to prevent anchor dragging and damage. Designated anchoring zones outside of mapped coral habitat should be established and marked with buoys • Post-construction monitoring be undertaken to ensure that impacts to coral reef habitat has not occurred beyond the footprint of the proposed dredge channel and ancillary structures • A coral transplantation plan be considered to offset small residual direct impacts of the project. There is potential to offset the residual coral habitat lost by transplanting coral in the footprint of the proposed harbor to the inner walls of the proposed channel, or another recipient site if one can be found	Contractor CSC TFD	Dredging method; Post-construction monitoring of coral reef; Coral transplantation	Detailed plans and method statements; CEMP; Monitoring reports; Coral regrowth and/or transplantation plan implemented	PMU, CSC TFD

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Works in channels and harbor mobilizing sediment	Temporary effects on water quality	• Geotechnical testing and standard erosion and sediment controls for land based construction to be implemented as part of the EMP • Should specific contaminants be detected management plans may be required • Water quality monitoring of turbidity with triggers for adaptive and contingency dredge management procedures • Best-practice vessel management and site management should be adopted to minimize the risk of contaminant spillage. Work vessels should provide sufficient spill response materials. All work vessels should be inspected to ensure fuels and equipment are appropriately stored and work surfaces kept clean of waste and litter	Contractor CSC	Dredging method; Sediment plumes;	Detailed plans and method statements; CEMP; Sediment/silt control measures implemented; Visual inspection of plume density and extent No stockpiles on reef platform, all material removed Weekly - confirm daily record sheet for weather and sea conditions	PMU, CSC
Vessel traffic	Potential for collision with or disturbance to marine fauna	• Minimize potential boat strike and noise related impacts by establishing 'go slow' zones around the harbor construction site • Educate skippers of construction barges and work boats as to how best avoid boat strikes, what to do during vessel interactions with marine fauna and reporting of boat strikes or fauna interactions • Vessel masters should be competent in protected marine species interaction procedures	Contractor TFD	Boat strikes; Training/ awareness delivered;	Prior to and during dredging activities; During vessel voyage to/from Nui; Records and logs; Incident register	PMU, CSC, TFD
Dredging, excavation works and construction activities in marine environment	Underwater noise affecting marine fauna	• Ensuring that all equipment is maintained in good operating condition and has proper sound control systems in place • Application of sound minimization tools, where appropriate and practical. This may include mufflers, propeller shrouds, and tuned propellers and drive shafts • Sound-generating equipment should be switched off when not in use	Contractor	Condition of equipment and plant; Noise minimization	Prior to and during activities; During vessel voyage to/from Nui ; Records and logs;	PMU, CSC, TFD

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Works (incl. dredging) disturbing reef	Disturbances promote algae growth and potential Ciguatera outbreak	• Carry out a risk assessment to determine whether there is a need to incorporate testing for harmful dinoflagellates in fish tissues as part of CEMP. This should be done in consultation with TFD • Establish a register to document any cases of Ciguatera brought to the attention of medical staff for a period six months before, during, or 6 months after construction • Any cases should be reported to the Project Manager and the TFD so that appropriate safeguards can be put in place. This could include a TFD notice to advise against consumption of herbivorous reef fish until further testing has occurred and/or sufficient time has passed post-construction and such fish are considered safe to eat • Removing spoil from the excavated site to an approved location on the land to reduce the surface area of loose reef deposits on which the algae can colonize. • Care is required to ensure the removal of concrete blocks using tracked machinery on the platform does not damage the hardened reef crust.	CSC, Contractor, TFD	Algal blooms; Risk assessment completed	Register of outbreaks; TFD monitoring reports As required and immediately when the spoil is no longer required	CSC, PMU, TFD

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Vessels and import of plant, equipment and materials	Introduction of invasive and/or alien species and pathogens	• Contractor to undertake risk assessment and prepare an invasive species management plan as part of the CEMP • All machinery and equipment be steam cleaned to remove any soil or organic matter and a phytosanitary certificate issued by the authorities in the country of origin prior to shipment to the project site • Appropriate phytosanitary documentation must be issued for all imported aggregate shipments into Tuvalu to confirm they are clean of organic material and soil and pests • Standard practice procedures for ballast water management should be observed by vessel operators and individual vessels should be assessed to determine that the vessel presents a low risk of introducing marine pests to the area • Ballast waters must be discharged no closer than 5km from the shoreline with confirmation provided by the captain by way of logbook • All materials and equipment to be imported for the project must be cleared by Customs, and the contractor must have obtained the appropriate license or certificate for imported material and/or equipment.	Contractor	Pathogen-free status of equipment and machinery	Visual, once for each shipment Phyto-sanitary certificate issued	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
CONSTRUCTION IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT						
Operation of construction plant and equipment creating noise, vibrations and light	Noise in community Impacts on construction workers	• Construction vehicle exhaust systems and noisy equipment will be maintained to minimize noise • Application of sound minimization tools, where appropriate and practical • Sound generating of equipment should be switched off when not in use • Contractor will develop a work schedule of operations with Kaupule to identify hours and days of no work due to religious and cultural activities • Limit construction activities to daytime hours, i.e. construction activities will mostly occur between 6pm and 6am and will be dependent upon the tide cycle. Where construction is occasionally proposed at night, Contractor will develop a work schedule of operations with Kaupule. Where night construction occurs, lighting should be kept to a minimum and directed inward to minimize impact on marine animals (e.g. turtles and birds) • Provide all workers with appropriate protection equipment (ear-muffs etc.)	Contractor	Vehicles have appropriate and functional exhaust systems Construction work carried out within specified times Workers using appropriate PPE during noisy operations	As required Daily, visual	CSC, PMU
Use of potable water	Lack of sufficient on-island supplies of potable water for construction camp and the number of workers	• Construction camp to provide sufficient quantities of potable water supply • Separate rain tanks required for camp • Manage water use during periods of dry weather • Do not use potable water for dust suppression	Contractor	Separate potable water tanks in place at camps	Once, visual	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Construction camp, laydown area, workshop location and operation, land clearance for transit shed	Potential for disturbance within or near community facilities e.g. church, meeting places, from construction workers and workshop activities Damage or disturbance to the known grave sites near the site of the land based facilities	• Confirm with Kaupule and community the location of any construction camp and workshop facilities • Addressed in CEMP, prepared by contractor and cleared by CSC • Ensure no potential environmental impacts as a result of location and operation of camp • Identify any areas of cultural and spiritual significance e.g. graves. Relocate as required, with the appropriate ceremony according to local protocols • Use of existing village accommodation facilities • Select sites where vegetation has already been modified or cleared previously	Contractor CSC	CEMP; Confirmation of location of laydown and camp options, potential environmental impacts Clear identification of all grave sites in the vicinity of the works prior to start of works	Once Area clearly marked on ground Written agreement with Kaupule CEMP - ongoing	CSC, PMU
Presence of construction workers in communities (influx of labor)	Transmission of highly contagious diseases incl. STIs, HIV/AIDS; Social disruption and/or conflict	• Site induction conducted for all construction personnel at start of construction with the input from Kaupule including STI and HIV/AIDS awareness and prevention training • Implementation of the project's CCP • Ensure that community and stakeholders are aware of the GRM and how to access GRM; • Contractor to appoint a Community Liaison Officer • Appointing a GFP from the Kaupule • CSC and Kaupule to facilitate agreement of protocols--code of social conduct-- between the contractor and community leaders. The protocols will govern workers' conduct while at work and in communities, behavior around men, women and children, restrictions on alcohol consumption, use of illegal drugs, prohibitions (with sanctions for non-compliance) on workers hunting or fishing, implementation of awareness programs, implementation of the GRM and handling of complaints, hiring of local labor, and implementation of the HSP aligned with guidance from WHO 2020[45] • The contractor will engage/recruit an approved service provider to deliver the HIV/AIDS/STI	Contractor, Approved service provider	Site induction completed; Local employment; Knowledge on STIs etc.; Complaints and grievances; Public notices/ information	CCP implemented; Code of conduct agreed; Approved HSP; Approved service provider engaged and mobilized; GFP appointed; Items in bill of quantities; Register of training/ participants maintained; Register of locals employed; GRM; Monitoring checklists	CSC, PMU

[45] https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		awareness and prevention program to workers and community • Workers' access to portable toilets and associated sanitation facilities will be provided at the site (through agreement to use on-land toilets or sufficient ablution facilities on barge) • Following the CCP, the contractor will distribute information (through meetings or pamphlets) regarding the scope and schedule of construction, as well as certain construction activities causing disturbance or nuisance • For unskilled activities and labor, every effort to hire local people (including women) for these positions should be a priority • Child and/or trafficked labor strictly prohibited for any activities associated with the project • Availability of screening for all workers on a voluntary and confidential basis • An HIV/AIDS and STI awareness and prevention campaign delivered at regular intervals for workers and community members included in bill of quantities and delivered by approved service provider • Ongoing training and workshops presented to the community at regular intervals • Availability of condoms, at no cost, to all on-site staff.				
Construction activities	Hazards and risk to construction workers from construction activities	• Accidental damage to utilities will be minimized by (i) obtaining plans from the public utilities identifying locations of pipelines, conduits and power cables and (ii) consultation with staff on the location of utilities prior to commencing excavation operations, and agreed compensation paid in case of damage occurring. • Prepare and implement the HSP which will include the measures to demonstrate compliance with the World Bank Group's EHSG and aligned with guidance from WHO 2020[46]	Contractor	First aid stations fully stocked HSP and CEMP prepared Use of PPE Medevac procedures prepared	Weekly, First Aid station contents checked, records kept, items replaced; Approved HSP Daily, PPE is worn as appropriate; Accident/ incident register; Records of toolbox sessions etc.	CSC, PMU

[46] https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Define responsibilities and authorities within the contractor's staff for adhering to OHS requirements • Provide PPE of appropriate size range for all workers • Define appropriate emergency and medical evacuation procedures • Undertake daily hazard identification checklists, risk assessments and toolbox sessions • Prepare appropriate work method statements for each construction activity and ensure all personnel understand the task before commencing work for the day • Clearly define procedures for handling construction materials, conducting tests, operating heavy equipment in a remote marine environment • Provide for installation of lights and cautionary signs in hazardous areas • Ensure operators of vehicles and equipment are properly licensed and trained • Provide information on emergency assistance procedures on community notice boards and location of first aid kits and other emergency equipment • Ensure safety and inspection procedures, setting schedules for regular checking • Set procedures for safe handling of toxic materials and other hazardous substances			Medevac procedures in place Record of licensed and trained operators	

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Construction activities	Health and safety risks to the community from construction activities and movement of heavy machinery within or near the village	• The contractor's HSP will address community impacts and management measures in addition to worker health and safety • The HSP will include agreement on consultation requirements, establishment and monitoring of acceptable practices to protect community safety, links to the complaints management system for duration of the works (in accordance with the GRM) and system for reporting of accidents and incidents. The PMU will ensure these actions are enforced • The contractor will coordinate directly with the GFP appointed from the Kaupule for the project • Before construction commences the contractor/s will conduct training for all workers on environmental safety, environmental hygiene including delivery of the HIV/AIDS/STIs awareness and prevention training and the code of conduct • The contractor, following the requirements of the project's CCP, will inform the community of the works (likely impacts and control and mitigation measures), including the timeframe through information brochures and/or community meetings • Tuvalu minimum wage requirements to be observed, if local staff are required. Proper enforcement of the labor laws in the workplace • Child and/or trafficked labor will be strictly prohibited for any activities associated with the project • Children will be prohibited from entering the sites (including worker's accommodation, works area/construction zone) and prohibited from playing on any equipment or machinery • All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Tuvaluan, the language of the main nationality of workers and repeated in English • The contractor will clearly fence off and place warning signs at the site to prevent the public from entering during the construction period.	Contractor	HSP prepared Driver safety awareness program conducted Public not in active construction zone, barriers in place, hazardous areas marked; No children in work area or on equipment etc. Advisory signs in place in Tuvaluan language	Once, HSP plan approved ; Once, program delivered Daily, visual during construction	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Encroachment into historical / cultural sites	Effects on cultural values	• Identify all historical and cultural sites prior to construction • Advise community of the nature of the works in vicinity of cultural sites • Ensure due care is taken in any construction activity adjacent to churches and other sites of cultural importance • Chance finds procedures included in CEMP	Contractor CSC	Any sites identified prior to works; Chance finds procedures in CEMP	Once, in conjunction with Kaupule; As required during activities	CSC, PMU
Demobilization	Residual construction material remaining on island; Camp and laydown footprint subject to erosion or degradation	• All residual material to be removed from island unless specifically requested by the Kaupule • Site rehabilitation works of camp and laydown to include scarifying soil and spreading vegetative material to assist with natural regeneration processes unless the area is required for community use • Replant coconut and other site-specific trees as required and as agreed with Kaupule and/or tree-owners	Contractor	Construction material removed from site; Site rehabilitation and planting of site has been completed	Once, visual	CSC, PMU
OPERATION PHASE						
Erosion due to coastal processes exacerbated by cyclonic storms	Undercutting of the concrete structures, abutments and piles Damage to railings, steps, lighting	• Initiate and implement a periodic maintenance schedule • Carry out facility inspections after each cyclonic storm event • Timely repairs to any erosion around wharf and jetty or damage to ancillary fixtures • Removal and disposal of built-up sand, if required, from culvert under jetty	MTET	Periodic maintenance schedule Repairs carried out in timely manner	Maintenance schedule in place and operational Once, Repairs completed Once after each event, sand removed	MTET / Kaupule
Loading and unloading of cargo and passengers at the jetty facility	General and domestic waste deposited into reef environment Spillage of hydrocarbons from ruptured drums Damage to railings, steps, lighting during loading and unloading	• Provide signs and raise awareness of impacts of general waste on reef environment • Provision of rubbish bins on land side of jetty • Kaupule to arrange regular clean-up of general waste around jetty facility and from the water • Ensure proper handling procedures for drums of hydrocarbons from boat to shore are followed • Clean up and safe disposal of any spillage on land	MTET / community	Signs in place Jetty facility and harbor is clear of general and domestic waste Infrastructure is operational	Once, visual Monthly, site is clear of general waste, lights railings etc. are functional and in good condition	Kaupule / community

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Increased vessel traffic and use of facilities	Fish and marine life affected by increased noise and light Potential for vessel strike to marine mammals and turtles	• Appropriate vessel speeds and controls should be established for vessels operating within the boat harbor approach, channel and basin. This may include permanent signage and establishment of ongoing procedures and mechanisms for reporting of any vessel interactions • External lighting on the new infrastructure should be kept to a minimum and directed inward to minimize impact on marine animals (e.g. turtles and birds)	MTET	Compliance with vessel speed limits Incidences of vessel strike to marine mammals and turtles Light fittings are in accordance with design specifications	Anecdotal reports of vessel strikes. Once for verification that lighting meets design specifications	Kaupule / community (vessel strikes) MTET (lighting)
Presence of seawalls and new marine infrastructure	Potential to reflect waves and thereby increase wave heights in the nearby areas of living reef crest or slope	• Design of seawalls to minimize, as practically as possible, potential for reflected waves or reduced water movement to coral on reef slope	PMU	Coral on reef slope	Once for coral, one year after construction finishes	PMU
Vessel and cargo movement between islands	Risk of spread of invasive species and/or pests	• CSC to support MTET to conduct risk assessment of operations • CSC to support MTET to prepare and implement an invasive species management plan for moderate-significant risk	CSC, MTET	Invasive species (flor and fauna)	Preparation and implementation of plan	MTET

Key: BCD = bid and contract documentation; CEMP = construction environmental management plan; CSC = construction supervision consultant; DOE = Department of Environment; DDR – due diligence report; EHSG = Environmental, Health and Safety Guidelines; ES = environmental specialist; FS&DDC = feasibility study and detailed design consultant; HSP = health and safety plan; IEE = initial environmental examination; MTET= Ministry of Transport, Energy and Tourism); OHS = occupational health and safety; PEAR = Preliminary Environmental Assessment report; PMU = project management unit; PPE =- personal protective equipment; TFD = Tuvalu Fisheries Department

VIII. CONCLUSIONS

354. Results of the marine ecology assessment indicate that in general, the reef flat, crest and slope habitats and foreshores within the project footprint of the small work boat harbor at Nui are not unique to the island and that similar habitats (and associated biota) are well-represented, and extensive, elsewhere in Tuvalu. Species of coral listed as threatened on the IUCN red list do have potential to occur within a small part of the seaward parts of the proposed dredge footprint, and hence have potential to be removed due to the construction works. Given these species would be likely to occur elsewhere on the island and very few individuals, if any, would be removed, the project would not result in a net reduction in biodiversity.

355. In addition to the direct removal of some habitat (total of 15,000m^2) there is potential for local changes to hydrodynamics and an increase in reflected waves at the reef crest and reef slope. This can be mitigated if the break wall is designed, as practically as possible, to minimize alterations to hydrodynamics and wave climate in nearby environments. Other threatened and protected species are likely to occasionally forage in or pass through the vicinity of the proposed harbor (turtles, sharks and rays), however, being highly mobile, these species would not be significantly affected by construction or operation of the harbor/jetty. Hence, the project would amount to only a temporary inconvenience to species. Habitats directly impacted by the construction of the proposed boat harbor are not considered to be critical to the lifecycle or survival of populations of any threatened species.

356. The potential negative impacts can be managed by carefully addressing the physical shape and layout of any permanent structures on the reef surface at the project site based on modelling of wave height and other parameters.

357. Provided the mitigation measures outlined in the EMP are incorporated into the bidding and contract documents and appropriately implemented, then the project would not be expected to have any widespread, irreversible or significant or long-term impacts on the marine environment. As such, it is considered that a category ‘B’ level of assessment as per the ADB’s SPS is appropriate to the scale and nature of the project.