TUVALU COASTAL ADAPTATION PROJECT

FUNAFUTI PHASE 2 (TCAP II)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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1	February 2024	Draft ESIA for public consultation	Phillip Hawes – Safeguards Specialist
2	June 2024	ESIA for submission to DoE	Jehangir Khan – TCAP IPC

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Acronyms and Abbreviations

ADB	Asian Development Bank
CCA	Community Conservation Areas
CBD	Convention on Biological Diversity
CFC	Community Fishery Committee
CMS	Convention of Migratory Species
DoE	Department of Environment
DPO	Disabled Persons Organisation
EDSCP	Erosion, Drainage, Sedimentation and Control Plan
EISA	Environmental and Social Impact Assessment
EPA	Environmental Protection Act
ERW	Explosive Remnants of War
ESI	Environmental and Social Indicator
ESP	Environmental and Social Policy
GAD	Gender Affairs Department
GBV	Gender Based Violence
GCF	Green Climate Fund
GFDRM	Global Facility for Disaster Risk Management
GoT	Government of Tuvalu
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ICH	Integral Cultural Heritage
IUCN	International Union for Conservation of Nature
LCC	Live coral cover
LDC	Least Developed Country
LMMA	Locally Managed Marine Area
MCT	Ministry of Communications and Transport
MHARD	Ministry of Home Affairs and Rural Development
MFAT	Ministry of Foreign Trade and Affairs
MFEP	Ministry of Finance and Economic Planning
MNREE	Ministry of Natural Resources, Energy and Environment
MPUE	Ministry of Public Utilities and Environment
MICRO	Maritime Investment for Climate Resilient Operations
MSL	Mean Sea Level
NBSAP	National Biodiversity Strategies and Action Plan
NCD	Non-Communicable Diseases
NEMS	National Environmental Management Strategy
NGO	Non-Governmental Organisation
PEAR	Preliminary Environmental Assessment Report
PM	Project Manager
PMU	Project Management Unit

PWD	Public Works Department
QEP	Queen Elizabeth Park
SEP	Stakeholder Engagement Plan
SES	Social and Environmental Standards
TC	Tropical Cyclone
TCAP	Tuvalu Coastal Adaptation Project
TCS	Tuvalu Cooperative Society
TEC	Tuvalu Electric Corporation
TPS	Tuvalu Police Service
TWG	Technical Working Group
UNDP	United Nations Development Program
USP	University of South Pacific
UXO	Unexploded Ordinance
WB	World Bank
WMD	Waste Management Department

EXECUTIVE SUMMARY

INTRODUCTION

Following the success of the Tuvalu Coastal Adaptation Project's (TCAP) stage 1 reclamation works the Government of Tuvalu (GoT) has received funding from the Australian Department of Foreign Affairs and Trade (DFAT) and the New Zealand Ministry of Foreign Affairs and Trade (MFAT) for a second coastal reclamation project (TCAP II). TCAP II will benefit from the established TCAP Project Management Unit (PMU) in Funafuti and its supporting technical team that are similarly now well experienced with this work.

TCAP II will follow closely the TCAP I design approach, aiming to provide a further 7~8ha of raised, flood-free, reclaimed land protecting an additional estimated 800m of densely populated and exposed foreshore.

The ESIA is being prepared in response to Tuvaluan law and overall aim is to provide an Environmental Impact Assessment for the TCAP II project. It provides a description of the baseline conditions and details the predicted qualitative and quantitative impacts of the project activities. It also provides the set of mitigation, monitoring, and institutional measures to be taken during the implementation of TCAPII.

The ESIA will accompany a Development Application (DA) to the Department of Environment. As part of the DA process, the ESIA will be put on public exhibition by DoE for 30 days during which time stakeholders are able to make formal submissions regarding the project to DoE for their consideration prior to deciding whether to approve the project or not.

PROJECT SUMMARY

The proposed reclamation will start from the south side of the Queen Elizabeth Park (QEP) reclamation area and extend southward to the dredged boat channel (Figure 1). It will extend seaward to a similar extent as QEP and TCAP and its overall dimensions will be approximately 800 m in length by 100m wide, giving a total area of approximately 8Ha (Figure 1). It will require approximately 281,000m^3 of fill material.

The lagoon foreshore of the reclaimed land will be hardened with a well-designed and well-built retaining wall (bunding). The bunding will be formed from geotextile mega bags overlaid with a protective layer of smaller geotextile bags (Figure 2). The surface of the reclaimed area will be graded to drain into stormwater swales on the landward side of the new area. The swales will have sufficiently shallow gradients to make movement over them easy, yet still convey water off the reclamation to the ocean. The swales will also enable overland flow through the existing coastal village to reach the ocean.

The TCAPII reclamation works will leave sufficient space at the northern end of the reclamation area, for development of a boat ramp and/or boat harbour adjacent to the existing jetty and channel at the southern end of QEII Park.

Figure 1: Proposed area for TCAPII reclamation works on Funafuti

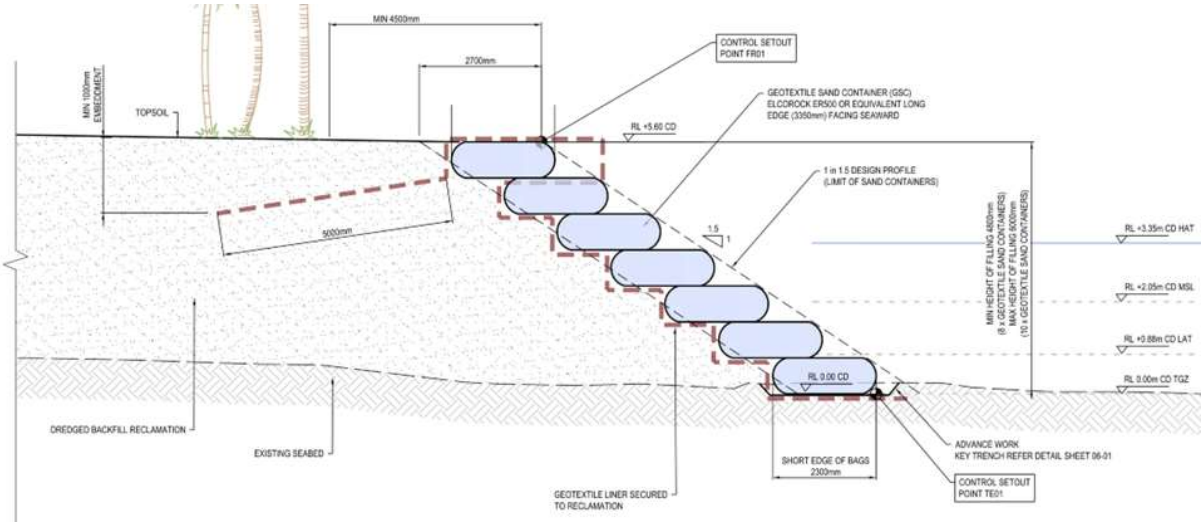

Figure 2: Funafuti Mega Bag Retaining Structure. Source: TCAPII Concept Design Report

The proposed reclamation works will require an estimated 281,000m^3 of suitable fill material, which will be obtained from Fogafale lagoon. Previous successful dredging of the lagoon for similar volumes have used a cutter suction dredge, which has proven to be a cost-effective method. An indicative location for the proposed TCAP aggregate source area is presented as the yellow circle in Figure 3.

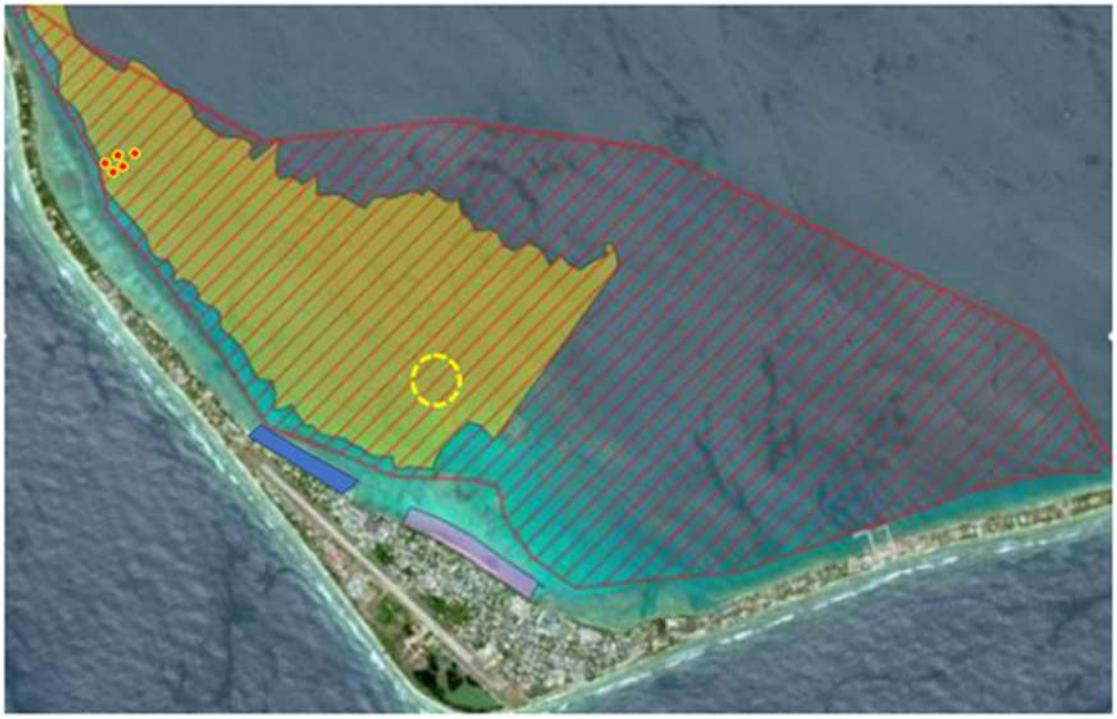

Figure 3: Indicative location of the proposed TCAPII aggregate source area (yellow circle) versus total sand resource (orange area), the mapped zone of dead coral and eutrophication is shown in red, the pink polygon is TCAP and the blue polygon is proposed TCAPII.

Environmental and Social Management

The planned TCAP II works have the potential to create a variety of impacts through their implementation. These impacts can be either positive (e.g., additional safe raised land and improved coastal protection for community members) or negative (e.g., loss of beach access for recreation and fishing) depending on the activity and receptors involved. The impact of this project on the physical, biological, and social environment has been assessed and is described in detail in this report. The key potential project impacts and risks will occur during the construction phase of the project and have been identified as the following:

- Increased nearshore water turbidity during dredging works
- Changing access to, and use of, the coastal marine environment
- Loss of marine habitat in the immediate reclamation area
- Use of heavy machinery on the beach leading to increased sedimentation during construction
- Continued occupation of houses by rented for workers on TCAP
- Continued pressure on availability of seats on Fiji Airways flights in and out of Tuvalu
- Increased risk of traffic/heavy machinery accidents during construction works
- Fuel or other hazardous spills while construction machinery present
- Noise and vibration disturbance during construction
- OHS risks, particularly those associated with unauthorized access of the site by public

This ESIA contains the recommended mitigation measures for TCAPII for pre-construction, construction, and operational phases in order to avoid, reduce, or mitigate all identified impacts. A summary of the key protective mitigation measures is provided in the table below.

The Contractor for the TCAP works will be required to produce a Construction Management plan consisting of a suite of sub-plans, including environmental and social management plan, emergency response plan, quality plan, dredge management and UXO plan. This suite of documents will be the governing documents for the implementation of this ESIA's recommendations during works.

Impact Area	Key Management Measures
Dredging and Fill Works	• Develop and implement a site-specific Dredge Management Plan and UXO Plan • Dredge method will be via a pipeline for conveying slurry to fill sites to minimise losses to lagoon waters. • No ecologically significant areas are included in the design. Dredging concentrates on the zone of dead coral and eutrophication identified in the lagoon. • Dredge plume to be monitored and dredge works halted if plume extends further than 1km. • Dredge waters will be discharged on land and within settling cells/revetment wall to allow filtering and control of dredge wastewater. • Discharge plume will be monitored • Strict control on de-watering release – by pumping to a contained area by using bunded cells, and by route monitoring of discharge turbidity.
Retaining Structure	• The retaining geotextile structure will be designed to absorb and reduce wave energy, prevent overtopping, and minimise any wave reflection issues • Reclamation works will not extend to existing terrestrial vegetation line. • Reclaimed land will drain to stormwater swales then into lagoon. • Set back area (for construction) from seaward edge of reclamation recommendations to GoT. It will be recommended that this set back area be utilized as open space for public recreational and access. • Areas accidentally damaged during works will be restored by clean-up, re-contouring, and planting. • The removal and transfer to safer ground of epifaunal species such as sea cucumbers will be carried out by the Contractor to avoid burial. Where feasible, corals will also be relocated or propagated. • Ensure that any erosion- and sediment-control devices are installed, inspected, and maintained as required. • When and where it is safe to do so, communities will be allowed to access the site outside of work periods to gather shells over subsequent levels of dredged sand

Noise and Vibration	• Minimise nuisance from noise, especially closer to residential areas and sensitive receptors, through establishment and communication to affected parties of working hours, including night works. • Care will be taken to avoid increased noise and quantity of operating equipment outside of advertised hours and through populated areas. Advertise working hours at the site entrance. • Signage providing contact numbers for raising issues and/or making complaints will be provided. • A Grievance Redress Mechanism will be put in place to resolve any issues/complaints. • Contractor will develop a work schedule or operations with Kaupule to identify hours and days of no work due to religious and cultural activities.
Community Services and Infrastructure	• Waste management practices will prioritise reduce, reuse, recycle • Preference shall be given to materials that can be used to construct the project that would reduce the direct and indirect waste generated. • All hazardous or contaminated waste will be exported from Tuvalu under the conditions of the Waigani Treaty and will be coordinated in consultation with the Waste Management Department. • Disposal of waste shall be carried out in accordance with the Government of Tuvalu requirements. Waste that cannot be recycled, reused, composted, or otherwise disposed of in Tuvalu will be exported and disposed of in a licensed facility in another country. • Any dangerous goods (including batteries) stored on site shall be stored in accordance with Tuvalu regulations and international best practice. • The Contractor will be responsible for repairing any damage caused by construction works to the existing road network. • The Contractor will create its own freshwater using a portable desalination plant to avoid putting pressure on islands freshwater supply. Excess desalinated water may be provided to the community if required.
Hazardous Substance Management	• A spill management plan has been prepared. • Store and handle all chemicals, fuels, oils, and potentially hazardous materials as specified in relevant standards and guidelines. • Hydrocarbon wastes shall be stored in labelled drums placed in secure storage areas on site. • Fuel and chemical storage and handling shall be undertaken at designated areas that off limits to the general public. • Bulk fuel storage shall be in dedicated double-skinned fuel bunkers, clearly marked as such. • Emergency clean-up kits for oil and chemical spills will be available onsite and in all large vehicles.

UXO/ERW	• The dredge will be fitted with a suitable screening mechanism to exclude explosive remnants of war (ERW). • The Contractor's C-ESMP will detail their protocols for safely handling and disposing of ERW if any ERW are encountered during construction.
Social Environment	• Ensure opportunities to incorporate men's and women's views and interests into project decisions and implementation are purposefully created and enabled in the stakeholder engagement processes throughout the project life. • Develop and implement a Stakeholder Engagement plan for the project. • Contractor will seek to maximise opportunities to use local labour. Where appropriate, training will be provided to ensure that workers have the necessary knowledge to undertake tasks assigned. Women will be encouraged to participate in the workforce and in uptake of job opportunities.

CONCLUSION

The new land will provide Funafuti with additional safe, flood free land that will assist in providing climate resilience to the population in the face of rising sea levels and worsening inundation frequency.

Based on the findings of this ESIA, it is considered that the impacts associated with the construction of the TCAPII reclamation are acceptable and can be managed through the application of mitigation measures that represent good industry practices.

1 INTRODUCTION

Following the success of the Tuvalu Coastal Adaptation Project's (TCAP) stage 1 reclamation works the Government of Tuvalu (GoT) has received funding from the Australian Department of Foreign Affairs and Trade (DFAT) and New Zealand Ministry of Foreign Affairs and Trade (MFAT) for a second coastal reclamation project (TCAP II). TCAP II will benefit from the established TCAP Project Management Unit (PMU) in Funafuti and its supporting technical team that are similarly now well experienced with this work.

TCAP II will follow closely the TCAP I design approach, aiming to provide a further 7~8ha of raised, flood-free, reclaimed land protecting an additional estimated 800m of densely populated and exposed foreshore.

Under Tuvaluan law, projects with the potential to have environmental and social impacts are required to prepare an environmental impact assessment to accompany the Development Application to the Department of Environment (DoE). The ESIA is being prepared in response to Tuvaluan law and overall aim is to provide an Environmental Impact Assessment for the TCAP II project.

It provides a description of the baseline conditions and details the predicted qualitative and quantitative impacts of the project activities. It also provides the set of mitigation, monitoring, and institutional measures to be taken during the implementation of TCAPII.

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1.1 PROJECT BACKGROUND

Tuvalu is the fourth-smallest nation in the world. It comprises nine inhabited islands with a population of 11,204 (2021)[1] and a total land area of 26km^2. Funafuti atoll, where the nation's capital is located, is home to more than half the population. With extremely low elevations above sea level, Tuvalu is one of the most vulnerable countries in the world to the impacts of climate change in the form of sea level rise, inundation, and extreme weather events.

Following the success of the Tuvalu Coastal Adaptation Project's (TCAP) stage 1 reclamation works, the Government of Tuvalu (GoT) has received a commitment to funding from DFAT and MFAT for a second phase of major reclamation works to reduce the impact of increasingly intensive wave action on key infrastructure in Funafuti as a result of climate change-induced sea-level rise and intensifying storm events. Building on the initial Tuvalu Coastal Adaptation Project, TCAP II will extend the area of raised land providing coastal protection south of QEII Park. TCAP II will follow closely the TCAP I design approach, aiming to provide a further 7~8ha of raised, flood-free, reclaimed land protecting an additional estimated 800m of densely populated and exposed foreshore.

The project is to be implemented by the United Nations Development Programme (UNDP) in partnership with the GoT, TCAP II will benefit from the established TCAP Project Management Unit (PMU) in Funafuti and it's supporting technical team that are similarly now well experienced with this work.

This EIS has been prepared to facilitate assessment and approval of TCAP II by Tuvalu Department of Environment, as well as meeting the requirements to consider potential impacts of projects under UNDP, DFAT and MFAT social and environmental standards. It identifies potential environmental and

[1] http://datatopics.worldbank.org/world-development-indicators

social risks associated with the works so that they may be mitigated through the application of appropriate management measures.

1.1.1 Project Objectives and Need

The lagoon shore of Funafuti is a protected shallow water shore, and therefore, it is protected from open ocean swell and cyclone waves. The lagoon shore of Funafuti is not subject to life threatening, catastrophic wave overtopping but rather it is subject to regular (annual/seasonal) nuisance wave over topping. In contrast the oceanside shore of Fogafale is subject to catastrophic cyclone driven wave impacts which can be so severe that they cause flooding across the whole island.

SPC's (The Pacific Community) Marine Science Team undertook modelling at the request of TCAP to determine the potential return period for catastrophic cyclone landfall at Funafuti. A Cat 3 cyclone, equivalent to the last event (TC Bebe, 1971), which saw a catastrophic level of wave overtopping with water depths up to 1.5m of fast-moving water over the main runway and through much of the settled area of Fogafale, is estimated to be a 1 in 100-year event. However, this return frequency does not account for climate change and thus the frequency is expected to increase.

TCAPII will provide additional safe, raised land on the shore furthest from the ocean-side deep water coast. By doing this TCAP can provide "protection for people and infrastructure from the increasing wave intensity and the effects of future wave overtopping." A detailed technical description of the new infrastructure is contained in Section 2.2.1Error! Reference source not found..

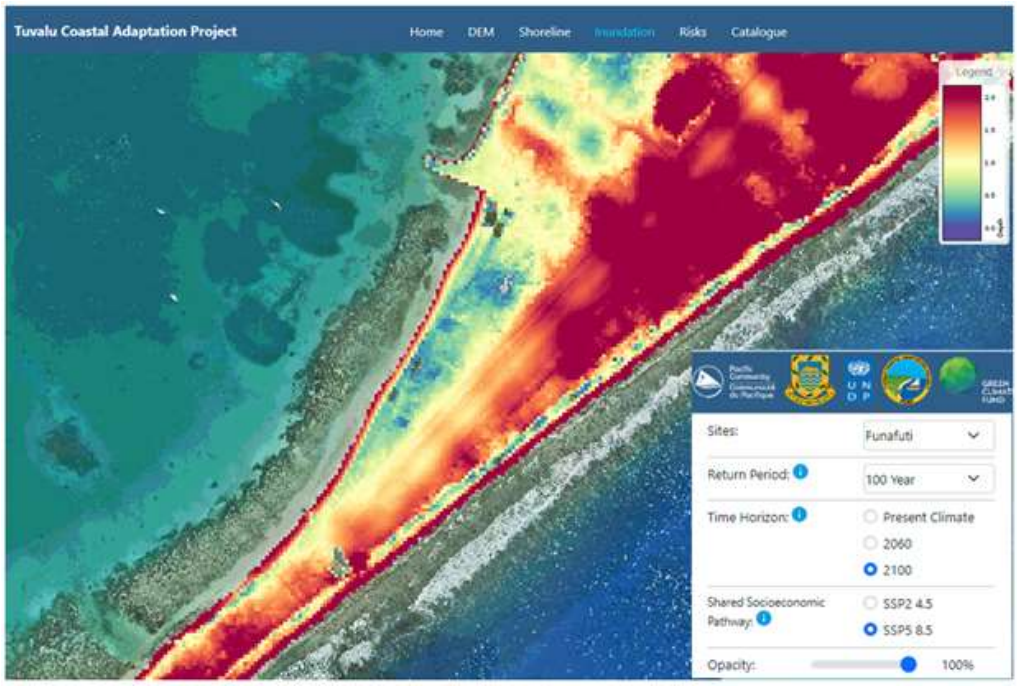

Figure 4 Inundation risk map at the proposed TCAPII site from a 1:100 year storm event under SSPC 8.5 scenario[2]

1.1.1.1 Long-term Adaptation

The Government of Tuvalu (GoT) with assistance from UNDP has developed a high-level coastal protection and land development concept design for the island of Fogafale. Based on the best available science today, Tuvalu's new Long-Term Adaptation Plan (L-TAP), 'Te Lafiga o Tuvalu' (Tuvalu's Refuge), presents a new approach to adaptation, designed to provide comprehensive solutions beyond 2100.

[2] https://opm.gem.spc.int/tcap/inundation

In its current concept design, L-TAP aims to reclaim 3.6km^2 of raised, safe land from sediments sourced within the Funafuti lagoon basin. L-TAP plans to then provide a staged relocation of people and infrastructure over time; a sustainable water supply; greater food and energy security; and space for expanding civic and commercial areas, including government offices, schools, and hospitals.

The first phase of L-TAP is expected to consist of a lagoon-ward reclamation of the central area of Fogafale, resulting in a reclamation footprint of approximately 330ha and stretches from Funafuti Port in the north to Funangongo (Papa Elice) Island in the south (

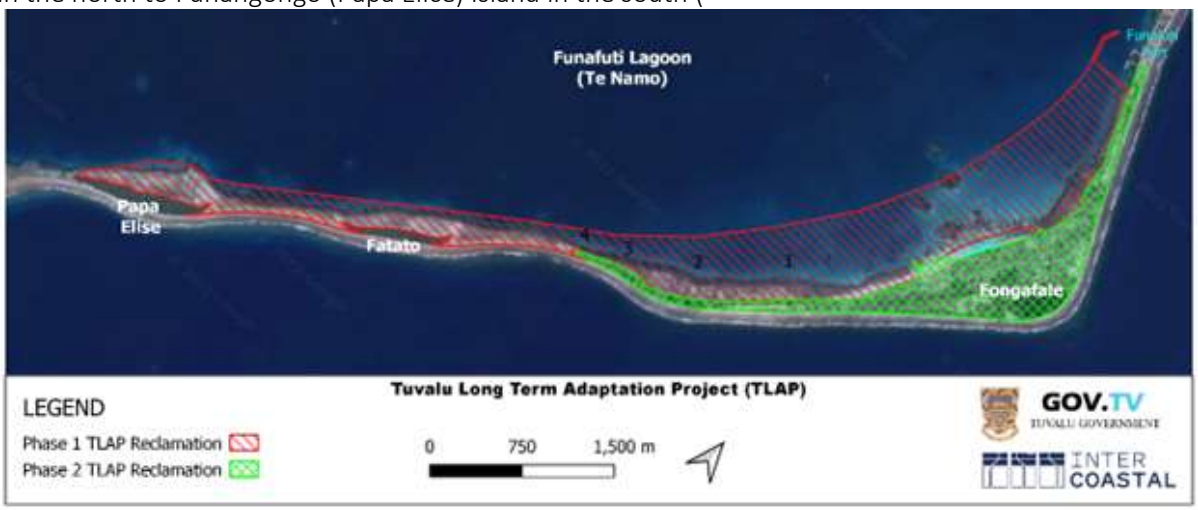

Figure 5). Current conceptual designs for L-TAP show the reclamation divided into eight different land use types: Housing; Commercial (business areas); Recreation; Green zones; Beach; Seaport facilities (harbour and onshore); Airport facilities (runway and hangars); and Rainwater storage.

L-TAP also incorporates contingency for later additional need for space or further vertical adaptation. The natural island of Fogafale is projected to become untenably flooded by the year 2100, in turn it is expected that people and assets will have all been relocated to L-TAP's higher ground by this time. This allows the GoTV to consider raising the existing island of Fogafale to a suitable elevation. It is acknowledged these are far future contingencies and design details will be informed by science and needs at that time.

The proposed TCAP II reclamation works fit well within the footprint of the L-TAP design and can be seen as a very small 'puzzle piece' fitting into the GoT's long-term reclamation vision.

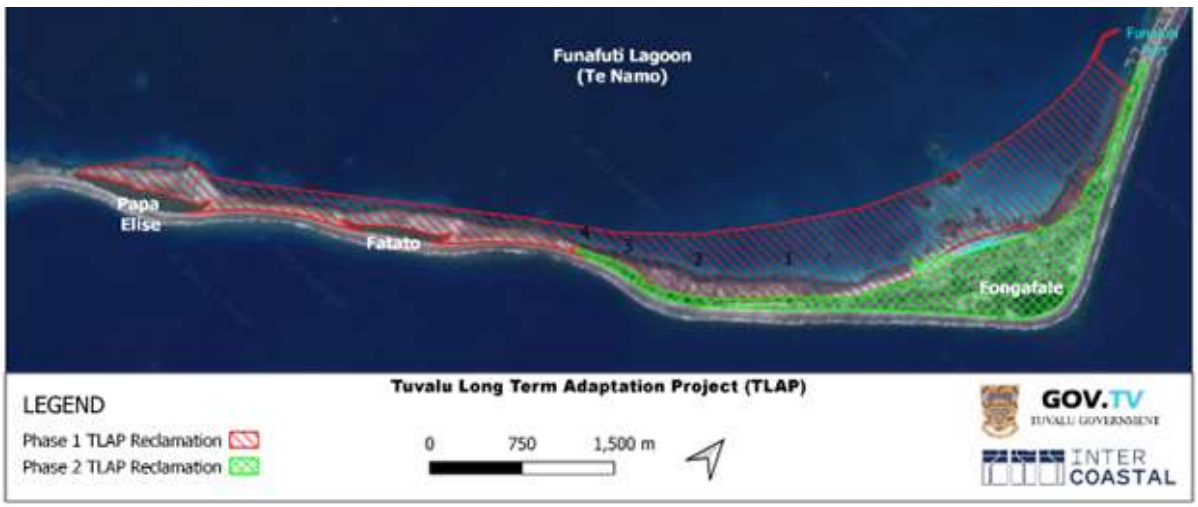

Figure 5 Tuvalu Long Term Adaptation Plan Preliminary Concept Reclamation footprint

1.1.2 Analysis of Alternatives

1.1.2.1 The 'No Project' Alternative

The 'no project' alternative for the purposes of this ESIA is the situation where the reclamation works do not proceed on Funafuti. Under this scenario, there are no adverse environmental or social impacts caused by the reclamation works.

However, the need to protect the high value shoreline of the island and provide land above predicted sea levels, and therefore the need for the project, is driven by the government and the community's stated need to protect the island's community and infrastructure from the increasing impacts of storm-driven marine flooding. Should the project not proceed, shoreline inundation events will continue to worsen, and related safety risks currently experienced by the community will be exacerbated and will likely increase as the effects of climate change become more pronounced. Furthermore, as Funafuti is already densely developed and there is scarcity of available land, 'no project' would likely mean that people and assets would have little option other than to adapt to living in suboptimal conditions, as relocation within Funafuti or Tuvalu is not an option as the country is already land constrained.

The 'no project' option is not considered to be a feasible or sustainable option in the opinion of this ESIA. The 'no project' option does not meet the community and government goals.

1.1.2.2 Alternate Design Approaches

A range of alternatives were considered as part of TCAP, including alternate locations, seawalls, beach nourishment, and alternative design approaches. It was concluded on TCAP that foreshore reclamation was as the preferred solution as it was the only engineering alternative that provided a complete suite of potential benefits: shoreline stabilization, wave overtopping protection, and provision of higher, safer land.

1.1.2.3 Alternate Locations

The location of TCAPII is one of the site options considered under TCAP. It represents a logical extension of the newly completed TCAP and QEII Park. The other site options were not contiguous with already completed foreshore protective works.

1.1.2.4 Revetment materials

TCAP considered the use of alternate revetment materials eg rock revetments, sheetpiling and geotextile units. Ultimately it was determined that geotextile containers were the optimal solution. Based on the experience on TCAP with geotextile container structures, a similar reclamation bund design has been chosen for TCAPII ie GMC core with outer layer of smaller GSC units.

1.1.2.5 Design Options

A Feasibility Study (Lewis 2024) was undertaken to set design parameters, objectives and to determine feasible design options. A design options analysis was undertaken and relative merits were considered as part of the Feasibility Report (Lewis 2024). The preferred concept option is shown in Figure 6.

Figure 6 TCAPII Concept – Preferred option

A coarse filter assessment was undertaken to provide a high-level comparison of differing concept options against key design objectives. Each option was rated as being either meeting or not meeting the objectives such as maximizing protection of this vulnerable shore, maximized provision of safe flood free land, efficient construction design, ease of ongoing maintenance, as well as factors such as maintaining amenity for artisanal fisher-folk etc. Amenity will always have a degree of subjectivity but must be taken into consideration nonetheless, whereas other objectives such as cost (which may make an option un-constructable) are not graded based on numerical ranking. The nature of this opportunity is to work within the available construction budget (AUD16.9m) and thus options that could not be achieved within this budget were rejected.

Based on the outcome of the CFA, the preferred option (see conceptual plan above) will be carried forward for detailed design (refer Chapter 2 - Project Description).

1.2 Need for an Environmental Assessment

Tuvaluan law requires the preparation of an EIA for the TCAPII works. Environmental management and the requirement for an environmental impact assessment in Tuvalu are controlled by the Environment Protection Act (EPA) 2008. The Department of Environment (DoE) administers the Act and Regulations. Specifically, Part 5 of the Act (Sections 17 and 18) sets out the process and procedures for the undertaking of an Environmental Impact Assessment (EIA).

The Environmental Protection Regulations 2014 provides the regulatory management of EIA in Tuvalu. It provides for the undertaking of environmental impact assessment (EIA). All projects must comply with the legislation and regulations. Under Regulation 4, the Minister determines what projects should have either a PEAR or EIA. Pursuant to Schedule 1 (9) public works that require either a PEAR or EIA include (d) soil erosion, beach erosion and siltation control; and (k), seawalls/land reclamation. Regulation 5 exempts routine maintenance of for example, seawalls; however, this project involves the construction of for example, seawalls, which is not routine maintenance.

DFAT and the UNDP both have environmental and social standards or policies that describe how both entities integrate environmental and social considerations into their decision-making and operations to effectively manage environmental and social risks and impacts and improve outcomes.

The proposed physical works associated with the proposed TCAPII at Funafuti were screened for social and environmental risks using UNDPs Social and Environmental Screening Procedure (SESP) and have been classified as ‘substantial risk’ according to the UNDP Social and Environmental Standards (SES). Under the SES, substantial risk projects are those that include activities with potential adverse

social and environmental risks and impacts that are more varied and complex than those of Moderate Risk activities but remain limited in scale and are of lesser magnitude than those of High-Risk projects. Substantial Risk projects may also include a varied range of Moderate Risk activities that require more extensive assessment and management measures. An appropriately scoped ESIA is typically required.

Therefore, this ESIA has been prepared to meet the requirements of Tuvaluan law and the policy requirements of UNDP, DFAT and MFAT.

1.3 Scope and Objectives of the ESIA

The overall aim of this report is to provide an ESIA for the next phase of coastal protection infrastructure (reclamation) proposed for Funafuti, which encompasses all project elements including ancillary sites and activities for the works. As part of that process, this ESIA has undertaken screening of the project and scoping of the potential impacts; it provides a description of the baseline conditions, and it details the predicted qualitative and quantitative impacts from the project activities. It also provides the set of mitigations, monitoring, and institutional measures to be taken during the implementation of TCAPII to avoid, offset or reduce adverse environmental and social impacts to within acceptable levels. The ESIA also focuses on safeguard management through project implementation by providing clear instructions, responsibilities and guidelines to Contractor, Engineers and the TCAPII Project Team.

The ESIA is a tool to assist decision makers in deciding whether to allow the project to proceed. It also provides stakeholders and other interested parties with information about the project and its likely impacts, as well as mitigation measures proposed so that they may provide decision makers with direct feedback.

As part of the requirements of the law in Tuvalu, DFAT and MFAT policies, and UNDP SES, the ESIA is to be publicly disclosed.

2 PROJECT DESCRIPTION

2.1 PROJECT SITE

This ESIA focuses on the Funafuti project site (Figure 7). The coastal protection works will take place along a section of the lagoon-side coastline bounded to the north by Queen Elizabeth Park (QEP) and in the south by "Three Ts". The site has been subject to beach protection and nourishment work[3], which has created a new, artificial sandy beach for the community and fishing boats to use.

TCAPII proposes to undertake land reclamation on this section of shoreline (Figure 8), which has been identified as a high vulnerability coastal area in terms of its relationship between the shoreline exposure to marine hazards and the location of the concentration of people, property and infrastructure.

The TCAPII reclamation will extend seaward as far as the pre-existing features (approximately 100m). The proposed works will provide robust coastal protection to the island and will also provide much needed additional safe, flood free raised land and by extension, also help alleviate the pressure on the existing overcrowding and reduce the propensity for new settlements in increasingly marginal exposed sites.

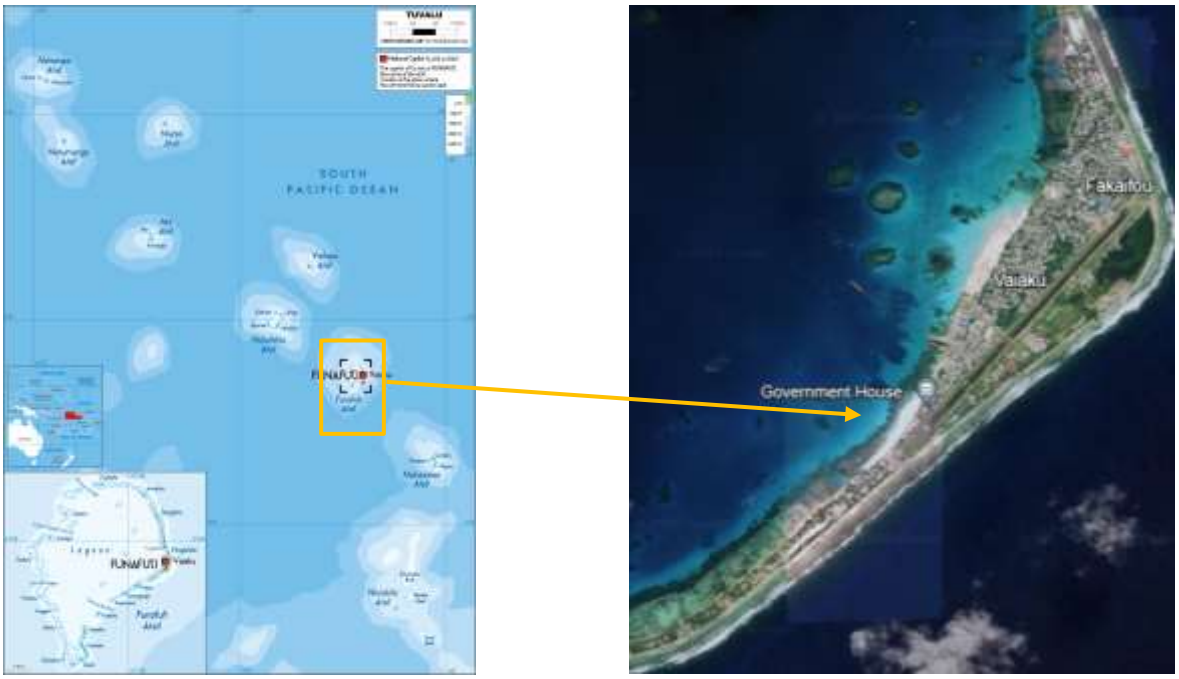

Figure 7: TCAPII Project site general location

[3] Tuvalu Tausoa Beach Nourishment Project, JICA 2015

Figure 8: Proposed project reclamation site between Queen Elizabeth Park and the dredged channel south of the runway

2.2 Scope of Works

The scope of works described below are based on the currently available design plans contained in the TCAPII Detailed Design Report[4].

The design intent of the TCAPII preferred concept is to cover the maximum extent of the southern foreshore within the design budget. The proposed reclamation will lay in the zone between the southern boundary of the Queen Elizabeth Park (QEP) reclamation area and extend to the south to the WWII dredged channel (Figure 9). It will extend seawards to a similar extent as QEP and its overall approximate dimensions will be 750m in length by 90m wide giving a total area of approximately 7.7Ha (Figure 9) and will require approximately 281,000m^3 of fill material.

[4] Lewis, J 2024. Detailed Design Report Tuvalu Coastal Adaptation Project – Funafuti Phase 2 (TCAP II)

Figure 9: Site Plan for TCAPII reclamation works

Entry to the reclamation is via the beach access/fitness park at the southern end of the runway apron. The transition from the existing shore to the reclamation will be as seamless as practical (as per TCAP I design) with a gradual incline from the landward edge towards the lagoon to the high point or constructed storm ridge approximately 25m landward of the bund crest (Figure 9 and Figure 10). By having the highest point landward of the bund wall, the chance of inundation under wave and water level conditions exceeding the design levels is reduced.

The rest of the reclamation slowly declines to each benched side section of the site with the lowest point of the reclamation being 3.6mTGZ (6x small GSC units high). This is approximately 300mm higher than HAT (highest astronomical tide), meaning that the reclamation is dry under all contemporary tide conditions. Otherwise, the reclamation will be designed to be consistent with the elevation of TCAP I sea level rise horizons, in summary this design assures most of the reclamation will remain safe and flood free until 2100 (and likely beyond).

The existing small boat access channels to the north and south of the reclamation are preserved in the design and remain open for use by fishing boats etc. The northern channel near QEII is approximately 70m wide to accommodate larger vessels as required and for later development.

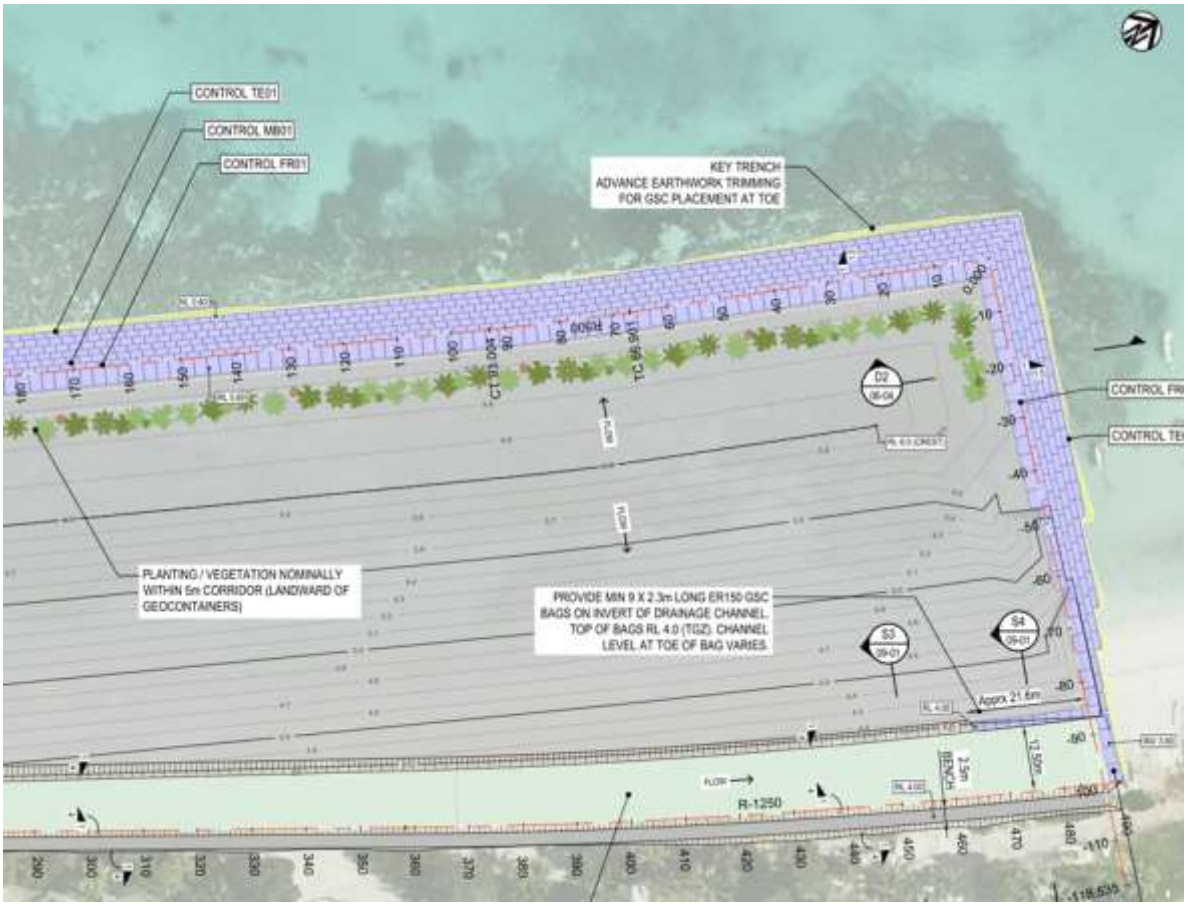

Figure 10 Plan view of northern end of proposed TCAPII reclamation showing grading of surface, setback, and drainage.

2.2.1 Structure Details

The outer (lagoon-facing) reclamation bund will consist of Geotextile Mega Containers (GMC) used as the core of the bund revetment, with 5m^3 Geotextile Synthetic Container (GSC) units, placed short-edge out, used to protect the seaward face of the revetment. The 5m^3 GSC units in the outer bund have been used larger wave heights are expected at the TCAP II site in comparison to those modelled for TCAP I. Geotextile will be laid landward of the GSCs and continued 5m into the reclamation to prevent erosion behind the bags (Figure 11**Error! Reference source not found.**). The 5m^3 GSC units will be stacked seven (7) units high, providing an approximate 5.6m of height above the underlaying reef flat based on the units 800-900mm filled height.

The side (north/south facing) reclamation bund will be a single layer of 5m^3 Geotextile Synthetic Container (GSC) units placed long-edge out, with the whole structure bound by geotextile underlay on its landward (reclamation) face. The 5m^3 GSC units will also be stacked 7 units high at the lagoon side apex, stepping down landward to 4 units high at the base of the drainage swale located at the existing shoreline (Figure 11).

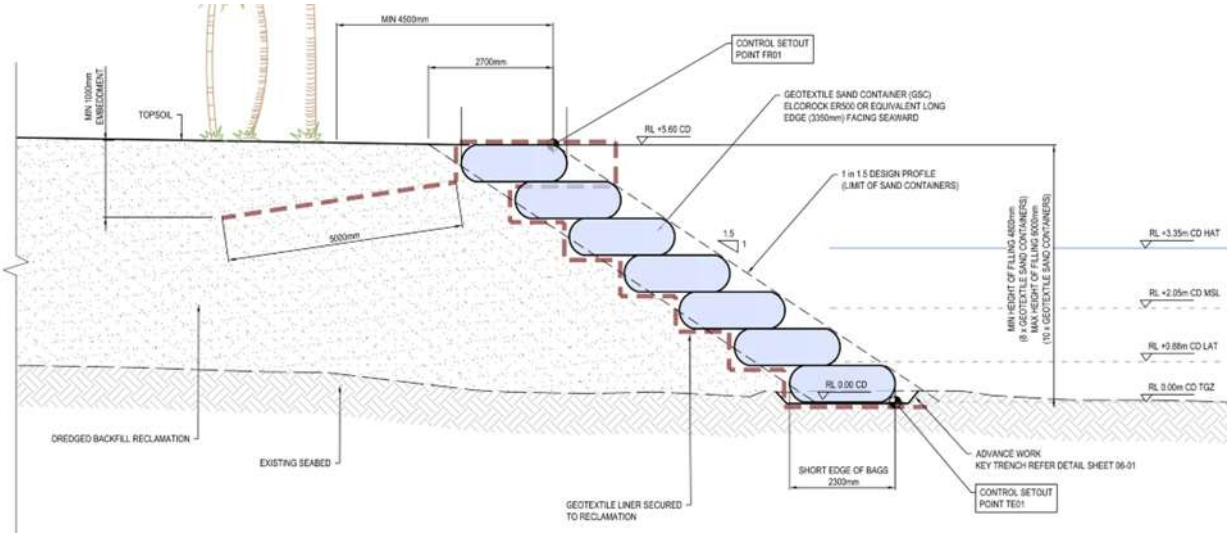

Figure 11 Typical section of northern and southern bund wall design

2.2.2 Drainage

The highest point of the site will be a 6mTGZ contour running the length of the reclamation. This constructed "ridge" lays parallel to the foreshore and approximately 25m landward from the foreshore bund (Figure 10). As with the TCAP I design, this acts to prevent any wave over wash ingress onto the reclamation during very large storm events, as the slope allows marine waters to drain back to sea. The 25m buffer zone is (like TCAP I) is also designed to delineate the physical set back zone during subsequent development.

Drainage will be facilitated by the following design features:

- 6m contour 25m from top of outer bund - 2% slope to lagoon
- Minimum surface slopes of 1%, catchment areas and a drainage swale to capture stormwater runoff
- Stepped-down sidewalls with benched sections splayed from centre of reclamation
- Main drainage swale 300mm higher than HAT running at landward extent of reclamation (Figure 9)
- Existing upper beach dune raised to 4mTGZ to contain swale flow and runoff (Figure 12).

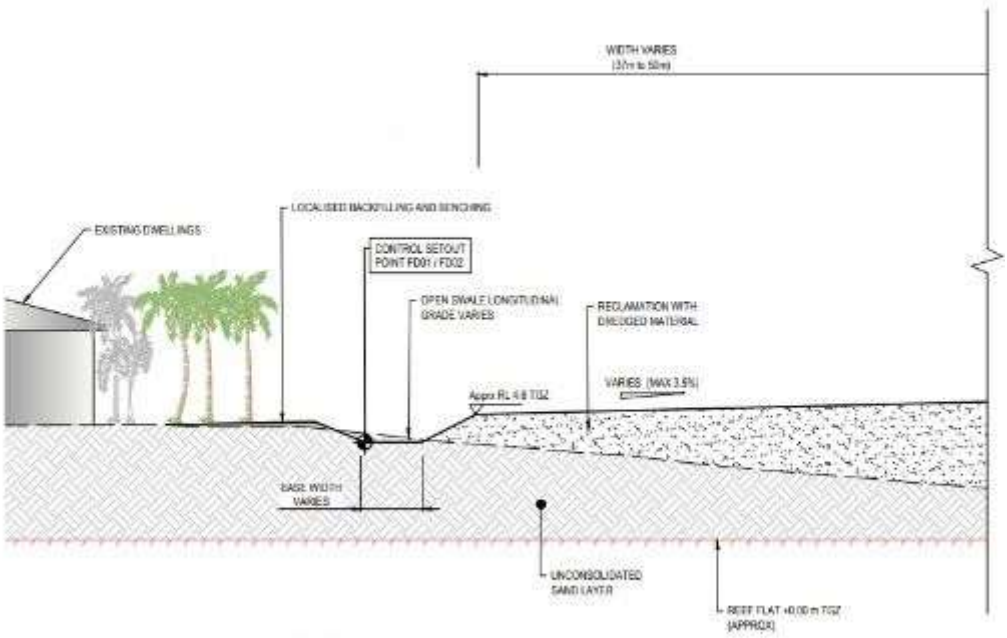

Figure 12 Typical section of landward side of reclamation showing drainage swale

2.3 Construction Methodology

It is expected that work will commence on the current shoreline and work its way out to the bunded wall location, creating a workable platform for heavy machinery. When there is sufficient sand, settling ponds or cells will be constructed to minimize loss of sediment (particularly fines) to the lagoon. Once at the bund location, the excavator will scrape the covering sediment from the reef flat and lay out the geotextile underlay and GMC units to be filled using dredged sand. The mega bag bunding walls will be completed and then the rest of the reclamation area will be backfilled. The mega bags will be laid out as close to low tide as practical so that water depth will be 1m or less.

All the construction machinery and equipment needed will be is currently working on the TCAP project, this includes excavators and dredging equipment, as well as machinery to help place and fill the mega bags. In essence, the methods and approaches used to successfully complete the TCAP I reclamation will be efficiently transferred to the new site.

2.4 Source Material Dredging

The proposed reclamation works will require an estimated 281,000m^3 of suitable fill material, which will obtained from Funafuti lagoon using a suitably sized cutter suction dredge, such as the dredge that was used for TCAP.

Geotechnical investigations undertaken by SPC (Smith, 1995 & 2016) identified an area offshore of Fogafale's lagoon shore with an estimated volume of up to 24Mm^3 of accessible sediment suitable for reclamation. This area was designated as the operational sand resource area (SRA) for the four dredging projects that have been undertaken in Funafuti; TCAP, Borrow Pits Remediation, QEII Park reclamation and the original SOPAC Pilot Study. All of which were granted licenses by the Government of Tuvalu for dredging and reclamation purposes.

An indicative location for the proposed TCAP aggregate source area is shown by the yellow circle in Figure 13. The indicative location is within the primary resource area (24 million m^3) identified by Smith (1995) and within the zone of dead coral and eutrophication identified by Kaley and Peacock (2014).

It is understood that the exact location within the SRA will be determined during dredging operations by the contractor but is expected to be driven by the operational limits of the dredging vessel, pumping/haulage distances and quality of the sediments within the selected area. It should be noted that with the high possibility of future reclamation directly offshore of the project site (L-TAP), it is the preference of the Government of Tuvalu that sediment is sourced from deeper areas or those further afield from the project site within the designated SRA to reduce future need for infilling of source areas and associated costs.

Smith (1995), Kaly and Peacock (2014), as well as recent dredging and sampling activities within the lagoon noted that there is a degree of variability in the quality of sediments across the SRA. Dredging for TCAPI revealed the presence of buried consolidated limestone (former coral bommies) scattered throughout the SRA.

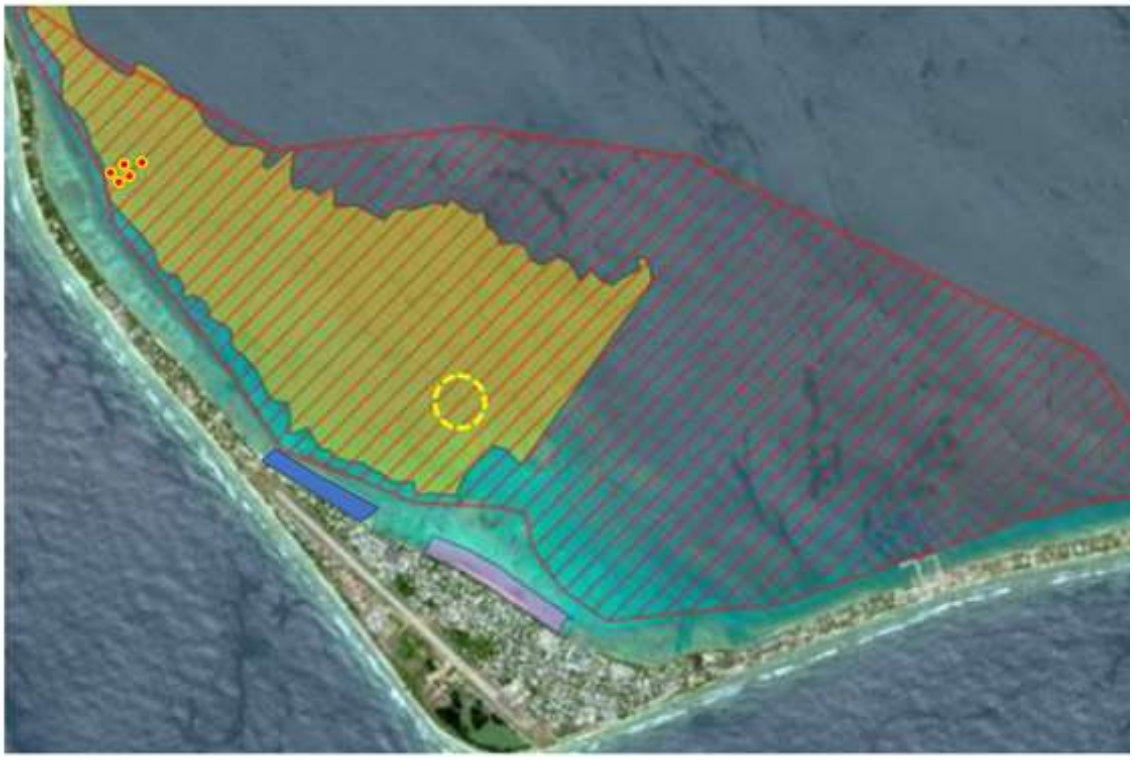

Figure 13 Established Funafuti sediment resource (yellow area), TCAPI (pink polygon) and TCAPII (blue polygon) sites.

Dredging will be done using a suction dredge, similar to the Amity that was used for TCAP (Figure 14). Such dredges suck material by means of specialised sand pumps and discharge through a floating pipeline which terminates at the deposit area. During dredging, the vessel remains fixed in the same location using spuds and/or anchors while the dredge arm swings sideways, and the suction head removes the sand. Figure 14 shows an example of a typical suction dredge, while Figure 15 shows a pipeline coming ashore from the dredge vessel. Due to the weight of such pipelines, heavy machinery is often required to reposition them on land.

Figure 14: Example of suction dredge with dredge pipe off stern. Photo: P.Hawes

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Figure 15: Dredge pipeline being moved onshore. Photo: P.Hawes

Two sediment size classifications will be required the Funafuti reclamation components:

- Reclamation fill material: ≥90% passing 75 mm sieve, 300 mm maximum particle size
- GSC, GMC unit fill: 100% passing 26.5 mm sieve.

Once dredged, the sediment will be sieved to ensure its suitability for filling of structural units.

3 POLICY, LEGISLATIVE AND REGULATORY FRAMEWORK

3.1 INTRODUCTION

The policies, legislation, regulations, and environmental standards of the GoT that pertain to this development, along with all applicable DFAT and UNDP safeguard policies and standards, have been assessed to ensure this project complies with all legal requirements.

The Ministry of Environment (MoE) has the responsibility for administering the Environmental Protection Act (2008) and the Environmental Protection (Environmental Impact Assessment) Regulations (2012). Within MoE, the Department of Environment (DoE) has the responsibility, under the legislation, for reviewing, assessing, and monitoring projects.

For all development projects on Tuvalu, projects that have potential to have significant impacts are required to prepare a full ESIA to support the Development Application. Due to its scale and range of potential impacts, TCAPII, the DoE determined that a full ESIA is needed for the proposed works.

This EIS fulfills DFAT and UNDP policies, as well as applicable national laws and will be used as the basis for the Development Approval request submission to the DoE.

3.2 APPLICABLE TUVALU POLICIES, LEGISLATIONS, REGULATIONS AND STANDARDS

3.2.1 Environmental Protection Act 2008

The Environmental Protection Act (EPA) is the principal law governing the protection and management of the environment. This Act defines the GoT's role in relation to all environmental management and decision-making processes. In relation to this ESIA, one of the principal roles of the EPA is outlining the requirements and making provisions for an ESIA and monitoring of environmental impacts.

Under the EPA, the DoE is also responsible for ensuring the proper regulation, monitoring, and control of solid wastes to minimise its impact on environmental quality. The DoE is mandated to regulate waste collection and disposal systems and set operational standards by applying guidelines for waste management operations within Tuvalu.

The Act authorises the Minister to make regulations relating to pollution control, waste management, hazardous wastes and substances, and other matters. Section 16 of the Act permits the Kaupule[5] on each island to set up an Island Environment Committee whose functions are to identify priority environmental concerns, liaise with the DoE or the Minister, and participate in programs undertaken by the DoE.

3.2.2 Environmental Protection (Environmental Impact Assessment) Regulations 2012

The regulations detail the required content of an ESIA and this ESIA has been developed according to these stipulations. In brief, the regulations require a full assessment to contain (a) a summary of the development proposal and its consequences; (b) a description of the development proposal and objectives; (c) a description of the development proposal including technical description, site boundaries and justification for the proposal; (d) review of the alternatives; (e) a description of the affected environment; (f) analysis of environmental consequences. In addition to these requirements

[5] The Kaupule is an elected body that acts as the executive arm of the Falekaupule which is a traditional assembly of elders with legal powers and functions to govern their respective islands of origin.

listed under Regulation 21, a full assessment of baseline conditions and a schedule of compliance monitoring will be included in the ESIA.

The Regulations state that after review of the full assessment, the DoE may issue instructions for the proponent to undertake consultations and may provide full details for the proposed consultation process.

3.2.3 Waste Operations and Services Act 2009

This Act, in combination with the EPA, gives the DoE responsibility for waste management in Tuvalu and the collection and disposal of solid waste and other wastes related operations. The DoE is also responsible for implementing the international conventions relating to the management of hazardous wastes. Additionally, the regulatory control of waste dumps and waste disposal sites shall be exercised by the DoE in relation to environmental impact assessment and the imposition of standards, and the designated waste management operators relating to the management of wastes.

The Act states that waste dumps and waste disposal sites shall be managed by each Kaupule or the Solid Waste Agency (SWA), if the need exists for additional technical and operational capacity for the proper disposal of wastes. In the context of TCAP II, as the project is taking place on Funafuti, the SWA will be an important stakeholder in the waste management plan. The storage and disposal of hazardous wastes shall be undertaken in consultation with the SWA.

3.2.4 Employment Act 2008

This Act outlines the obligations of employers towards their staff. In the context of the TCAP project there are several aspects that are noteworthy. Firstly, the employer requires a recruitment license when: (a) the employer employs more than 25 people at one time; or (b) the workers are to be recruited from more than 25 miles (40km) from the place of work. The issuance of this license is to enable the GoT to consider the impact of removing a number of adult males from their home area for the duration of employment. The application for this license requires detailed information on the health, safety and welfare of the employees.

Secondly, section 43 of this Act states that no person shall recruit a worker under the apparent age of 18. The Commissioner may grant permission to employ persons from 15 years of age with parental or guardian consent for employment in Tuvalu for light work duties.

The Act also stipulates the maternity arrangements for female employees, including 12 weeks paid maternity leave with at least 25% of her regular salary. The Act also makes provisions for the allowance of twice daily breaks to breastfeed any nursing babies. This Act also protects women from dismissal for absences relating to pregnancy complications, unless this absence exceeds 12 weeks.

Part XI of the Act provides for the care of workers and details the legal requirements governing the following: rations, water, sanitary arrangements, housing, medical care and treatment, hospital maintained by the employer, conveyance of workers by sea and reporting of deaths.

3.2.5 Laws of Tuvalu Act Cap. 1.06

To complement the Constitution and Acts of Parliament, this act declares other sources of law that apply in and may be enforced by the courts in Tuvalu. One such source is “customary law” that is defined as “the customs and usages, existing from time to time, of the natives of Tuvalu”. These are referred to in some laws as the “aganu” of Tuvalu. The basic rule is customary law shall have effect as part of the law of Tuvalu, unless it is inconsistent with a written law or its application is likely to cause injustice or is not in the public interest.

Schedule 1 of this Act provides guidance for the determination and recognition of customary law. Clause 4 of this schedule says that in relation to civil matters, customary law may be applied or recognized in selected matters such as:

(a) the ownership by custom of or of rights in, over or in connection with land owned by a native or natives (in this Schedule referred to as "native land") or –

(i) anything in or on native land; or

(ii) the produce of native land, including rights of hunting on, or gathering, or taking minerals, from, native land; or

(b) the ownership by custom of rights in, over or in connection with any area of the territorial sea or any lagoon, inland waters or foreshore, or in or on the seabed, including rights of navigation, fishing or gathering.

(c) the ownership by custom of water, or of rights in, over or to water; or

(d) the devolution of native land or of rights in, over or in connection with native land, whether –

(i) on the death or the birth or the adoption of a person; or

(ii) on the happening of a certain event; or etc.

The relevance of this law is that customary rights over coastal waters and resources (such as fishing rights), foreshore and land areas are recognized by the law and should be respected and appropriately acknowledged in order to ensure that the local communities buy-in and support the project.

3.2.6 Public Health and Safety Regulations (Revised 1990)

These regulations set out the required standards in and around villages for maintaining public health. In relation to TCAP, the following regulations are applicable:

- No stagnant water shall be allowed to lie in such lands for more than 24 hours unless treated to the satisfaction of a sanitary inspector by efficient drainage or with petroleum or other suitable oil.
- No tins, bottles, or receptacles capable of holding water shall be allowed to remain upon any such premises or land.
- All tanks, vats and vessels used for retaining water shall be efficiently covered with mosquito proof gauze or shall be treated with petroleum or other suitable oil to the satisfaction of a sanitary inspector.
- No person shall deposit or cause to be deposited any empty tin, bottle or other receptacle in any street road or public place.
- Every house or building in daily occupation shall be provided by the owner thereof with latrine accommodation approved by the sanitary inspector and,
- All garbage and rubbish which can be readily destroyed by fire shall be destroyed; and all other garbage and rubbish shall be placed in tins and covered with flyproof covers, and such tins shall be placed daily in positions convenient for collection.

3.2.7 Foreshore and Land Reclamation Act (1969)

Under this Act the State owns the foreshore and the seabed. This is subject to public rights of navigation, fishing and passing over foreshore as well as any private rights which may exist. "Foreshore" is defined as "the shore of the sea or of channels or creeks that is alternately covered and uncovered by the sea at the highest and lowest tide". In short, this refers to the intertidal zone. The Act further states (4(1)) that the Minister may, in accordance with this section, authorise the reclamation of land over and upon the foreshore or the seabed irrespective of the ownership of land bordering on or of whether any land borders on such foreshore or seabed.

Conditions of this Ministerial authority (Subsection 4(2)) are subject to:

- Notification of the proposed reclamation shall be published:

  (a) in two successive issues of a government publication.

  (b) by being broadcast on two successive days over the Tuvalu radio: and

  (c) by posting at each police station on the island where the land is to be reclaimed.

- Notification under subsection 4(2) shall:

  (a) describe the proposed reclamation and give the approximate area to be occupied in connection therewith; and

  (b) call upon all persons having objections to the reclamation or any claims of private right in respect thereof to submit to the Lands Officer before the expiration of such period, being not less than 6 weeks, as may be specified in such notification, such objections or claims in writing specifying the nature thereof and giving an estimate of any loss which it is alleged would be incurred by reason of the extinguishment of any private right.

3.2.8 Other Relevant Acts

- *Biosecurity Act 2017* – an Act to establish the biosecurity administration for the safe importation and monitoring of animals, plants and their products into Tuvalu.
- *Wildlife Conservation Act 2008* – provides for the conservation of wildlife.
- *Climate Change Resilience Act 2019* - to build the resilience of Tuvalu's infrastructure, built environment and communities through effective adaptation and disaster preparedness actions; to manage Tuvalu's natural resources, environment, ecosystems and biodiversity to promote their resilience to the impacts of climate change; to protect specific needs, taking into consideration special circumstances of Tuvalu and its vulnerability to the adverse effects of climate change; to promote and support Tuvalu's islands, industries and communities to adjust to the changes and impacts arising from reducing greenhouse gas emissions across the economy; coordinating planning efforts on climate change adaptation initiatives.
- *Quarantine Act 1931* – measures for the inspection, exclusion, detention, observation, segregation, isolation, protection, treatment, sanitary regulation and disinfection of vessels, persons, goods and things in order to prevent the introduction or spread of diseases or pests.
- *Workmen's Compensation Act 1949* – makes provision for compensation for injured workers.
- *Marine Pollution Act 1992* – and Act to make provision for preventing and dealing with pollution of the sea, and to enable effect to be given to the international conventions for the prevention of marine pollution and protection of the marine environment.

- *Petroleum Act 1990* – regulates the importation, storage and sale of petroleum and provides for matters relating and incidental thereto.

3.3 INTERNATIONAL TREATIES AND ORGANISATIONS

3.3.1 International Labour Organisation

The primary objective for the ILO Office for Pacific Island Countries is to assist Government and Employers' and Workers' Organisations of the Pacific Island Countries in their efforts to reduce Decent Work deficits (as part of a global goal) and to pursue development for dignity through the achievements of rights at work, employment, social protection, and social dialogue. Tuvalu joined the ILO in 2008 and since that time has ratified one convention, the Maritime Labour Convention (2006)

3.3.2 Convention on Biological Diversity (CBD) (1998)

The CBD is a multilateral treaty with three goals:

1. Conservation of biodiversity
2. Sustainable use of its components, and
3. Fair and equitable sharing of benefits arising from genetic resources.

The convention was opened for signature at the Earth Summit in Rio de Janeiro in 1994 and was ratified by Tuvalu in 2002. As part of its obligations to the CBD, Tuvalu has developed a National Biodiversity Strategies and Action Plan (NBSAP) in which the GoT identifies cross-cutting issues under the CBD. When considered in relation to this project, Cross-Cutting issue 2: Sustainable Development and Environmental Management is the most applicable. Objectives that have been highlighted and which relate to this project include:

- All development activities regardless of its nature and magnitude must be first subject to an ESIA; and,
- Consolidate all national efforts and activities under international conventions related to the environment to meet Tuvalu's obligations and thus strengthen its position to attract international assistance.

3.3.3 Convention for the Protection of the World Cultural and Natural Heritage

This convention founded the UNESCO World Heritage Site List (the List). To be a site on this List, it must be a place of special cultural or physical significance. The programme catalogues names and conserves sites of outstanding cultural or natural importance to the common heritage of humanity.

Tuvalu became a signatory to this convention in 2004. It does not have any approved sites on the List but does have two tentative items for consideration for the List, neither of which are in the geographic range impacted by this project.

3.3.4 Waigani Convention

The objective of the Convention is to reduce and eliminate transboundary movements of hazardous and radioactive waste, to minimize the production of hazardous and toxic wastes in the Pacific region and to ensure that disposal of wastes in the Convention area is completed in an environmentally sound manner.

The Waigani Convention is modelled on the Basel Convention and constitutes the regional implementation of the international hazardous waste control regime. Tuvalu became a signatory to the Waigani Convention in 2001 and is therefore obliged to undertake the following:

- to take all appropriate measures to ban the import and export of hazardous waste to and from the Convention area (Art. 4.1).
- to prohibit dumping of hazardous wastes and radioactive wastes in the Convention Area (4.2).
- to ensure that within the areas of its jurisdiction the generation of hazardous wastes is reduced (art.4.4); and,
- to ensure availability of adequate treatment and disposal facilities for the environmentally sound management of hazardous wastes in the Convention Area (4.5)

3.3.5 Other Applicable Agreements

Tuvalu is signatory to several international agreements that will need to be considered by the Contractor, particularly when using vessels to bring goods into the country. These agreements are as follows:

- Protocol to The International Convention for the Prevention of Pollution from Ships 1978
- International Convention on Standards of Training, Certification and Watchkeeping For Seafarers 1978
- International Plant Protection Convention 1979
- United Nations Convention on The Law of The Sea 1983
- Convention for The Protection of The Ozone Layer 1985
- Convention for The Protection of The Natural Resources and Environment of The South Pacific Region 1987
- Protocol for The Prevention of Pollution of The South Pacific Region by Dumping 1986
- United Nations Framework Convention on Climate Change 1992
- Convention on Persistent Organic Pollutants 2001
- International Convention on The Control of Harmful Anti-Fouling Systems on Ships 2001
- International Convention for The Control and Management of Ships' Ballast Water and Sediments 2004
- Paris Agreement under the United Nations Framework Convention on Climate Change 2016

3.4 UNDP Social and Environmental Standards

At the project level, UNDP SES Standards[6] support the implementation of the UNDP's commitments to promote respect for human rights, gender equality, and environmental sustainability. The Standards set out specific requirements relating to different social and environmental issues. During the project development phase, the proposed TCAP works on Funafuti were screened against these Standards and triggered screening criteria were identified.

[6] https://www.undp.org/publications/undp-social-and-environmental-standards

Table 1: UNDP SES Standards applicable to the TCAPII Funafuti works.

Standard	Triggered Criteria
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management	The project involves changes to land/resources (reef areas and lagoon floor) could potentially cause adverse impacts to habitats (e.g. modified, natural) and/or ecosystem and ecosystem services
	The project involves harvesting of aquatic organisms (coral) as part of proposed EbA.
	The project does pose risk of introducing invasive alien species
Standard 2: Climate Change and Disaster Risks	The project area is subject to extreme weather events, such as cyclones, that could impact the project
	The outputs of the project are potentially sensitive/vulnerable to impacts of climate change or disasters.
Standard 3: Community Health, Safety and Working Conditions	The project involves large-scale infrastructure development.
	The project has the potential to create dust, noise, vibration, traffic, injuries, physical hazards, and poor surface water quality due to runoff.
	The project involves the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. UXO, fuel).
Standard 4: Cultural Heritage	The project involves significant excavation (dredging)
Standard 5: Displacement and Resettlement	The project will result in impacts of (future) customary rights to land/tenure rights.
Standard 6: Indigenous Peoples	Tuvaluans are all considered indigenous; therefore, the project is taking place in an area claimed and utilized by indigenous people.
Standard 7: Labour and Working Conditions	The project presents occupational health and safety risks due to physical, and psychosocial hazards (including violence and harassment) during the project life cycle
Standard 8: Pollution Prevention and Resource Efficient	The project potentially results in the generation of waste (both hazardous and non-hazardous)
	The project includes activities that require significant consumption of raw materials, energy and/or water

Note regarding UNDP Standard 6 – Indigenous Peoples

For purposes of the SES, UNDP identify distinct collectives as "indigenous peoples" if they satisfy any of the more commonly accepted definitions of indigenous peoples, regardless of the local, national and regional terms applied to them:

- Self-identifies as indigenous
- Has pursued their own concept and way of human development in a given socio-economic, political and historical context

- Has maintained a distinct group identity, languages, traditional beliefs, customs, laws and institutions, worldviews and ways of life
- Exercises control and management of the lands, natural resources, and territories that they have historically used and occupied
- Existence pre-dates colonization

Based on the above, the population of Tuvalu can be considered indigenous and Standard 6 applies.

For Projects that may affect indigenous peoples, mitigation and management measures are typically contained in an Indigenous Peoples Plan (IPP), the IPP acts like an ESMP focussed on IPs. However, as almost all the population of Tuvalu can be considered IPs, then the requirements of an IPP can be met through the Project Document and associated safeguard documents in particular the safeguard documents: ESIA, ESMP, Gender Action Plan, Stakeholder Engagement Plan and Grievance Redress Mechanism.

3.5 DFAT Environmental and Social Policy

The Department of Foreign Affairs and Trade (DFAT) is committed to promoting sustainable economic development through the Australian aid program. DFAT's Environmental and Social Safeguard Policy (policy) outlines the organisations approach to managing the environmental and social impacts of its aid investments. The policy assists DFAT to meet its obligations under Australian laws which apply to aid investments, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Work Health and Safety Act 2011* (WHS Act) and the *Work Health and Safety Regulations 2011*.

DFAT has several complementary policies and strategies, including on gender equality, disability-inclusive development, climate change action, humanitarian assistance, and indigenous peoples. These policies set out DFAT's priorities and objectives for these key development issues and ways to ensure the effective design and implementation of investments.

DFATs safeguard principles consist of the following:

Principle 1: Do no harm

- Seek to protect the rights, health, safety, and livelihoods of people including, children, women, indigenous peoples, and other vulnerable or disadvantaged groups. Maintain the health, diversity and productivity of the environment.

Principle 2: Identify, assess and manage environmental and social impacts

- Identify potential environmental and social risks and impacts early in the investment design process, to ensure they are adequately assessed and managed in investment concepts, designs, and implementation.
- Avoid, or where avoidance is not possible, minimise, mitigate or as a last resort, offset or compensate for negative impacts.
- Assess and manage direct and indirect environmental and social impacts of the investment in a way that is proportional to potential impacts.
- Manage risks and impacts of the investment through management plans and monitor and report on their delivery.
- Consider how the environment or different people groups are affected, including children, people of different genders, indigenous peoples and other vulnerable or disadvantaged groups. The assessment and management of potential impacts must consider these different needs.

Principle 3: Engage effectively with stakeholders

- Be transparent about the investment, its risks and impacts in a way that is timely, accessible, and culturally and socially suitable for the affected people.
- Engage with affected parties and other stakeholders early in identifying and managing risks and impacts and continue this throughout the investment.
- Ensure consultations include affected parties, are inclusive, free of external manipulation, interference, coercion, or intimidation, and enable meaningful participation.
- Provide accessible and culturally appropriate grievance redress mechanisms and ensure that grievances are handled promptly, transparently, and without retribution or cost to the party that raised the concern.
- Disclose information about the social and environmental performance of aid investments in accordance with DFAT's aid transparency commitments.

Principle 4: Work effectively with partners

- Comply with partner country safeguard laws and policies and where possible build partners' capacity to develop and implement environmental and social governance systems.
- Work with multilateral, bilateral, NGO and private sector development partners to ensure environmental and social impacts are managed in a way that is consistent with this policy.
- Work with partners to manage safeguard risks to maximise the use of country systems and avoids duplication or unnecessary safeguard assessment and management planning requirements.

Principle 5: Promote improved environmental and social outcomes

- Where possible, promote improved environmental and social outcomes by integrating ecologically sustainable development into aid investments. Improve the implementation and outcomes of aid investments by effectively identifying and managing risks.

4 NATURAL ENVIRONMENT BASELINE

4.1 INTRODUCTION

This section provides the baseline data on the physical and biological characteristics of the environment as they relate to the proposed TCAP works on Funafuti. This baseline data set will provide a benchmark for future monitoring. The area considered for assessment of baseline conditions covers all physical project sites and is inclusive of an extended potential "area of impact". This will be large enough in extent to capture all potential direct and indirect impacts from the proposed projects.

All baseline data were obtained through a combination of desktop studies, consultations (stakeholders and communities) and site visits i.e. both primary and secondary sources.

4.2 LOCATION AND SETTING

Tuvalu is an archipelago and consists of three reef islands: Nanumaga, Niutao, Niulakita and six true atolls: Funafuti, Nanumea, Nui, Nukufetau, Nukulaelae and Vaitupu. Its small, scattered group of atolls have a total land area of approximately 26 km^2 making it the fourth smallest country in the world in land area. Tuvalu lies approximately halfway between Australia and Hawaii (Figure 16) and about 1,000 km northeast of Fiji. It stretches from the latitude of 5°S to 10°S and longitude of 176°W to 180°W and encompasses approximately 900,000 km^2 of EEZ waters.

Figure 16: Geographic context of Tuvalu with Funafuti highlighted

The islands of Tuvalu are very low lying with average land heights less than 1 meter above sea level. Like other coral atolls and islands, the soil is derived from limestone that has been formed as a result of coral formation over thousands of years. Tuvalu is geologically very young, with most of its islands having poorly developed sandy or gravel soils.

Funafuti is the largest atoll and comprises 29 separate islands with a total land area of 270 ha (2.7 km^2) These lay around the central Fogafale lagoon (Figure 17), which is approximately 25.1 km by 18.5 km in an east–west direction. The Fogafale lagoon occupies an area of about 205km^2 and is up to 55m deep; the surrounding atoll rim is cut by several deep passages on the western side and a single deep passage to the southeast. These passages permit ship access to the lagoon and to the only deep-water wharf in the country. The distance between the atoll's eastern and western sides narrows in the south, where the lagoon is 2-3km wide and very shallow, with large areas of sand and reef exposed at low tide.

Of the Funafuti Islands, only four have areas greater than 1 ha, and five greater than 5 ha. Most of the land extends as a chain of islands that run along the eastern side of the atoll rim. The islands are very narrow, typically about 100 m wide and elongated in shape. The greatest width (650m) is at the very centre of Fogafale, which is the largest Island in Funafuti and together with Tegako Island (to which it is connected via a causeway) accounts for 60% of the total land area of the atoll.

Fogafale is the most populated island and is also the administrative capital of Tuvalu, housing the capital buildings, the main town, and the international airport. Fogafale is a long narrow (reverse) L-shaped island divided into three geographical areas: the south arm, the central area and the north arm. The proposed TCAP II reclamation site is situated on the lagoon shore of the southern central area and extends to the southern arm, as shown in Figure 17.

Figure 17: Funafuti atoll with the main island Fogafale and Islands surrounding Fogafale Lagoon. Funafuti is indicated by white-bounded box (left). Funafuti showing main area of development, runway and TCAPII project site in red box (right).

The site encapsulates approximately 800m of the nearshore area from the south of the Queen Elizabeth II Park Reclamation Area (QEII Park).

The lagoon shore in the area is comprised of both public and government housing, including the current Australian Navy compound and the Tuvalu Governor General's residence. There is a small public exercise facility located at the southern end of the site between the southern extremity of the Funafuti International Airport Runway and the lagoon shore which provides public access from the road to the lagoon.

4.3 PHYSICAL ENVIRONMENT

4.3.1 Meteorology

The climate of Tuvalu is tropical throughout the year and is divided into two predominant seasons: a wet (November to April) and dry (May – October) season; however, rainfall averages more than 200mm each month of the year in Funafuti (Figure 18). This is due to the location of Tuvalu near the West Pacific Warm Pool, where thunderstorm activity occurs year-round.

Annually, the average rainfall for the period 1942-2005 was 2875mm[7]; however, rainfall varies from 3500mm/year in the southern islands to 2700mm/year in the northern islands. Dry spells and droughts are relatively uncommon but do occur. Rainfall in the southern Tuvalu atolls is high and reliable throughout the year, but less so in northern atolls. Sixty percent of the rain falls in the November to April period, known as the wet season. There is a significant inverse relationship between rainfall and the El Nino/Southern Oscillation Index leads the rainfall response by several months.[7]

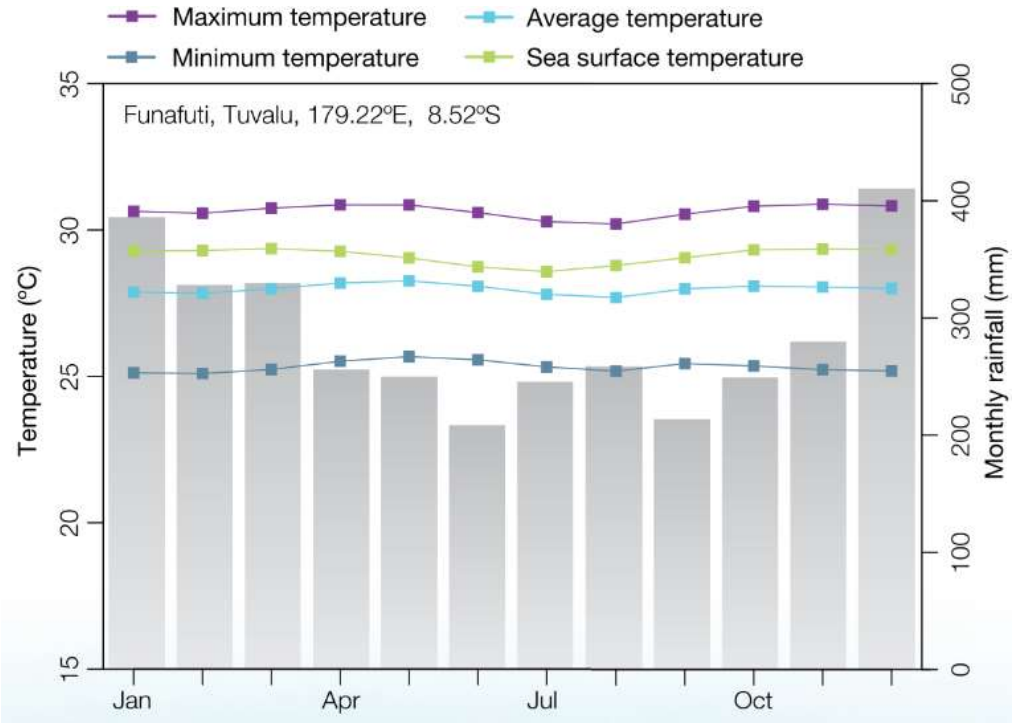


Figure 18: Seasonal rainfall and temperature in Funafuti[8]

Tuvalu's wet season is affected by the movement of the South Pacific Convergence Zone (Figure 19 - the arrows show near surface winds, the blue shading represents the bands of rainfall convergence zones, the dashed oval shows the West Pacific Warm Pool and H represents typical positions of moving high pressure systems). This band of heavy rainfall is caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. The West Pacific Monsoon can also bring heavy rainfall to Tuvalu during the wet season. The Monsoon is driven by large differences in temperature between the land and ocean, and its arrival usually brings a switch from dry to wet conditions.

[7] http://informet.net/tuvmet/climate.html
[8] BoM & CSIRO 2011 Climate Change in the Pacific: Scientific Assessment and New Research. Volume 2: Country Reports. Australian Bureau of Meteorology and CSIRO, 2011.

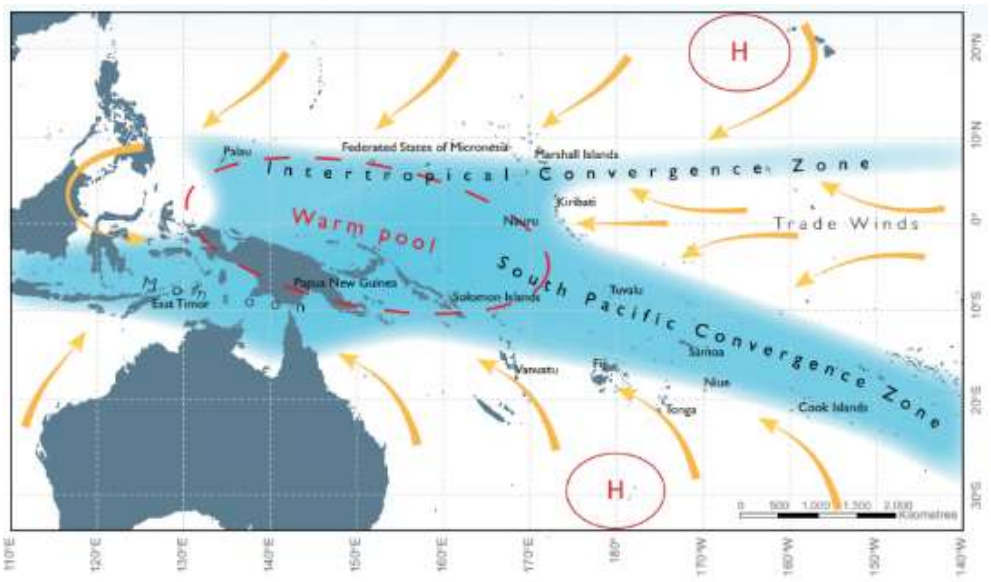


Figure 19: The average positions of the major climate features in November to April (Bom & CSIRO 2011)

In Funafuti, there is little variation in temperature throughout the year (Figure 18). The maximum temperature is between 31-32°C and the minimum temperature between 25-26°C all year round. Air temperatures are strongly tied to the ocean temperatures surrounding the islands and atolls of the country, hence the stability of temperatures.

The prevailing winds on Funafuti are dominated by the easterly trades that blow throughout the year but are generally stronger in the dry season. Wind data from Funafuti shows surface winds are predominately from the east, southeast, and northeast (Figure 20). Winds from the north, northwest, and west are more common in December to February, the summer months. Mean monthly wind speeds range from 7 to 12 knots, and there is a distinct maximum from June to September. Strong westerly and northwest winds occur at times during the summer, and these sometimes reach gale force. Tropical cyclones occasionally begin to develop close to Tuvalu, but it is rare for them to develop into true tropical cyclone rated winds while in the area. Damaging storms associated with tropical cyclones do nonetheless occur in Tuvalu.

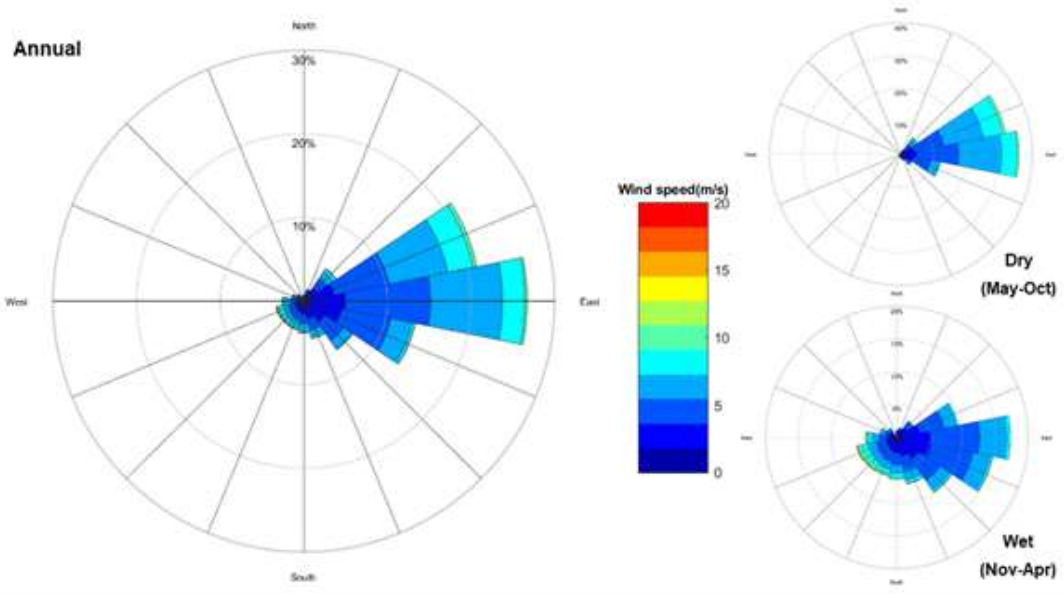


Figure 20 Annual, wet season and dry season wind roses for Funafuti (Lewis 2024)

4.3.2 Geology and Soils

Fogafale is located on the Tuvalu Seamount Chain, a submarine chain of extinct volcanos on the mid-Pacific plate, orientated roughly NW-SE between the Gilbert Ridge and the Samoan hotspot. The islands making up the atoll are low-lying accumulations of reef-derived sediment. The island morphology (or shape) controls the pattern of the longshore currents on the lagoon side, which transport sand from both the northeast and southwest towards the central area, resulting in the formally well-established beaches in the central area, which become narrower moving towards the south.

The atoll soils of Tuvalu are young, shallow, and alkaline like the original core limestone parent material. They range from 250mm to 1m in depth and consist of a variable layer of organic material, coral sand, and rock fragments overlaying a limestone platform. The chemistry and structure of the atoll makes scarce trace elements such as iron, manganese, copper, and zinc even less available to plants soil microorganism activity is limited, soil water holding capacity is low, and the groundwater is can often be saline.[9] It has long been understood that atolls are among the most limited in the world in respect to soil fertility and agronomic potential.

4.3.2.1 Sand Resources in Fogafale Lagoon

There have been multiple studies of the geological resources within the Fogafale lagoon, and this section provides a review of those studies as they related to the dredging works proposed for TCAP II.

The proposed TCAP II reclamation will require approximately 280,000m³ of fill material. In line with the proven methodology utilised during previous projects in Funafuti (including TCAP, the Tuvalu Borrow Pits Project and Queen Elizabeth Park Reclamation), TCAP II intends to source the required fill material via dredging submarine aggregate from the lagoon. Three previous studies have mapped lagoon aggregate resources within the vicinity of the proposed TCAP II reclamation works.[10] [11] [12]. The results of these three studies, along with recent experience on TCAP confirming these studies, form a comprehensive dataset to inform the proposed TCAP II reclamation works.

Gibb (1985) conducted a study to determine the presence and qualities of reclamation materials in the Funafuti Lagoon. The study involved the collection and analysis of seismic, bathymetric and sediment data over a broad area of the lagoon. The study concluded that "for use as general land reclamation material, a medium to fine calcareous sand deposit varying in thickness to 25m and generally in depths of water wherein excavation by dredging is practicable (2-4m thick) blankets virtually the whole lagoon bed in water over 10 m deep".

Smith (1995) conducted a detailed study in the lagoon adjacent to Fogafale Island to map in detail the quantities and qualities of sediment available for reclamation purposes in this area of the lagoon. The study incorporated and built upon previous data collected by Gibb (1985). The study involved the collection of bathymetric, seismic, and sediment data. Particle size distribution testing and composition analysis was conducted on sediment samples. The study identified a primary resource area (Figure 21) with a sediment volume of 24 million m³. The volume of sediment required for the TCAP II reclamation (281,000m³) only accounts for just over 1% of the total identified resource in this area. The extent of the identified primary resource area was defined based on the following criteria; the north eastern extent of the resource area was terminated based on the presence of extensive patch reefs in this area in 1995 (Figure 21), the eastern extent was terminated by the 5m isobath, based on an exclusion zone to mitigate against potential coastal erosion associated with dredging, and the western extent was terminated by the 25m isobath based on practical limitations of dredging beyond this depth. The sediment is typically characterised as Halimeda-rich gravelly sand and sandy

[9] Lane, J. 1993. Tuvalu: State of the Environment Report. SPREP 1993
[10] Gibb, A (1985), Tuvalu Lagoon Bed Resources Survey Report. Australian Development Assistance Bureau (Volume 1-2).
[11] Smith, R (1995), Assessment of Lagoon Sand and Aggregate Resources Funafuti Atoll, Tuvalu. SOPAC Technical Report 212.
[12] Smith, R (2015a), Sand Resources and UXO Survey, Funafuti Lagoon, Tuvalu. SPC Geoscience Division Technical Report PR209

gravel, with occasional localised areas of foraminifera-rich sand. The sediment typically contains only traces of silt, which is a favourable characteristic in terms of reducing the potential for turbidity and sedimentation associated with dredging.

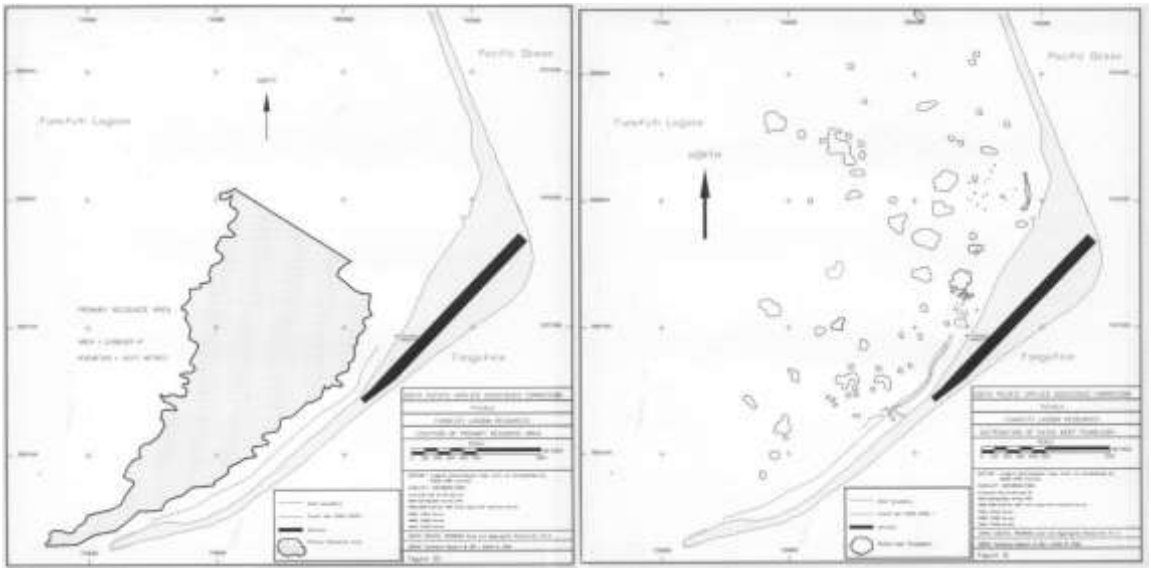


Figure 21: Primary sediment resource area (l) and patch reefs (r) identified by Smith 1995. Coral patch reef features were used to delineate the northeastern extent of the primary resource area

A map showing a combination of the lagoon sediment resources mapped by Gibb (1985) and Smith (1995) was generated by Kaley and Peacock (2014) as part of an environmental and social study for the Tuvalu Borrow Pits Project (Figure 22).

Kaley and Peacock (2014) also mapped a 'zone of dead coral and eutrophication' in the vicinity of the mapped sediment resources (Figure 23).

Figure 22: Lagoon sediments available near Fogafale Island as mapped by Gibb (1985) and Smith (1995). Source: Tuvalu Borrow Pits EIA.

Figure 23: Zone of dead coal and eutrophication. Source: Tuvalu Borrow Pit EIA

4.3.2.2 Unexploded Ordinance

Unexploded ordinance (UXO) or remnants of war (ERW) have been found in the lagoon, including near the proposed TCAP II site. The UXO is a result of military actions during World War II American occupation of Funafuti. During the occupation up to 174 vessels were moored in the lagoon, and Funafuti was subjected to bombing on 9 separate occasions (JICA 2011).

A magnetic survey undertaken for the QEII Park reclamation) covered the area being proposed for dredging for TCAPII. The results of that survey indicate a scattering of magnetic anomalies (potential UXO) in the lagoon immediately offshore of the TCAPII site (Figure 24).

Note magnetic anomaly detection does not mean all detections are UXO's, it means metallic artefacts have been detected. Previous visual inspections of areas showing magnetic anomalies showed that a large amount of debris from moored vessels etc exist in this nearshore heavily populated area of Funafuti lagoon.

An internal Australian Navy report was presented to the TCAP 2023 following lagoon clearance activities, the report cleared the Funafuti Lagoon of major UXO threats. The dredging undertaken for TCAP included UXO risk mitigation measures and dredging of a similar scale to that proposed for TCAPII was completed without incident. None the less, TCAPII will follow closely the methods and protocols established in TCAP I to carefully manage any risks posed by UXOs during the proposed reclamation works.

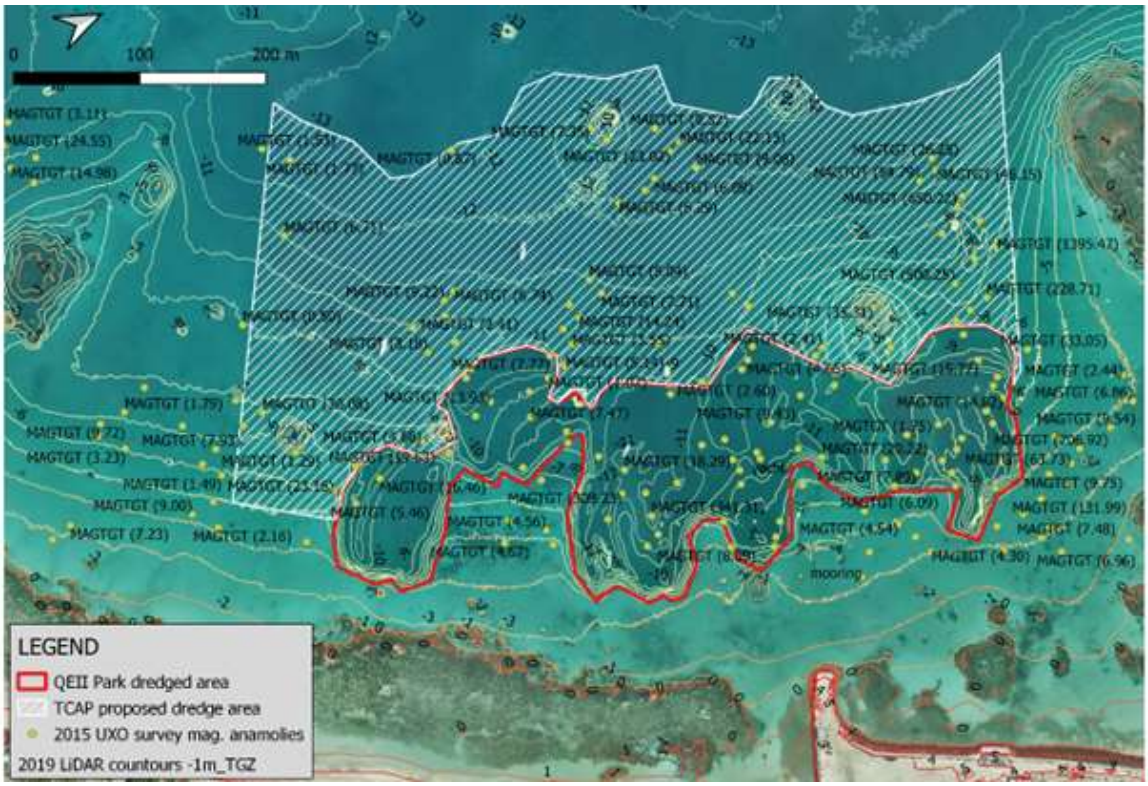


Figure 24: Magnetometer survey results for area offshore of proposed TCAP II site.[13]

4.3.3 Topography and Coastal Geomorphology

The reef islands of Funafuti are comprised of unconsolidated biogenic sediments formed by the physical abrasion (under wave action) and biological breakdown of calcium carbonate–secreting organisms that dwell on the adjacent coral reef system. Waves and currents deposit coral sand and rubble onto the islands. The location, planform configuration, size, and elevation of islands reflect both the interaction of oceanic swell with reef structures and the availability and grade of sediment for island building (Masselink et al ,2020).

Historical survey, satellite imagery, LiDAR survey and aerial photography have been used to define the geologic structure of Funafuti Atoll as well as the proposed project site on Fogafale Island's Southern Arm. Figure 25 shows a map of the topography and cross-sections through both Funafuti Atoll and the southern arm of Fogafale Island where the proposed TCAP II reclamation site is located.

[13] Smith, R. (2015b)

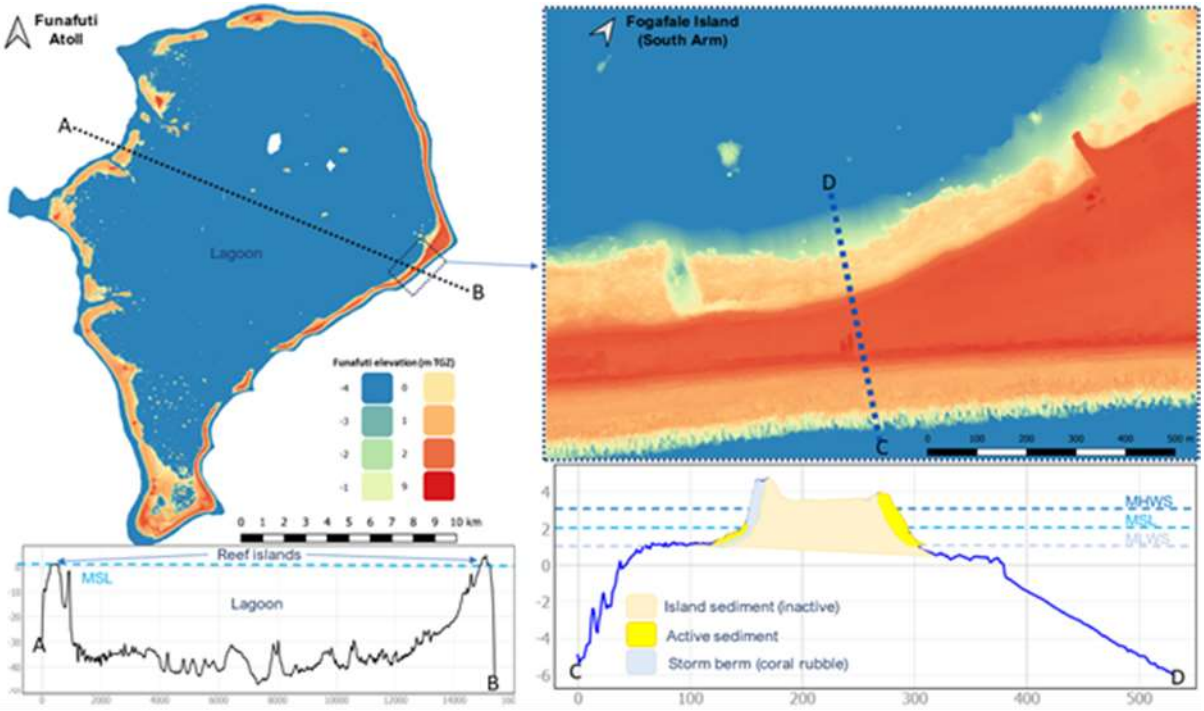


Figure 25 Funafuti morphology and structure; inset is proposed TCAP II location. (Lewis 2024)

The largest island of Funafuti is Fogafale on the eastern side of the atoll. It is permanently connected to the island directly to the north, Tegako, by a concrete causeway, initially built by the Americans in during World War II.

Fogafale Island is a long and narrow strip of extremely low elevation with a broad “V” shaped outline. On the ocean-side fringe of the Island there are coral rubble berms up to 3 m above mean sea level, marking the highest points of the Island. Other areas are below 2m above mean sea level over a large portion of the Island.

On the ocean side, both the active beach and ridge are made up of coarse coral rubble that often includes slab fragments and large blocks up to 1 m in diameter. The ocean-side ridge crest is commonly quite narrow and is frequently located right at the vegetation-beach edge. The ridge form is asymmetrical with a steep seaward slope and gentler backslope inclining toward a central depression, to the interior flat, or to the lagoon. This kind of simple single ridge with a steep crest is associated with the elongated Islands of the eastern side of Funafuti.

The ridge is constructed of reef materials initially emplaced during exceptional storms and reworked during quiet periods. Incremental build-up of a single high ridge may result from wash-over during several storm–fair weather episodes. Alternatively, each episode may result in the formation of a new ridge seaward, thus enlarging the Island. The ocean-side ridge mapped on Funafuti coincides with what is called the 'outer hurricane bank'.

The centre of Fogafale Island comprises a landform termed the ‘central depression’. This forms an almost continuous trough, which varies from an open V-shape, at the inland meeting of the opposing ocean and lagoon ridge backslopes, to a wider trough with a concave profile. Typically, the central depression has the lowest land elevation on the island and is the area most likely to be inundated by a rise in water level.

The lagoon-side ridges of Fogafale and Tegako are less pronounced than the older ocean-side coastal ridges, which protect them from ocean swell and storm waves. The ridges are lower, typically extending 1-2m above lagoon reef flat level, the absolute elevation varying dependent on exposure and lagoon fetch length. Whether bank-like or mound-like, the ridges are typically built of foraminifera or algal sand and mollusks derived from the adjacent lagoon, together with some coral fragments and gravel. On Fogafale and Tegako the ridges are very linear and may include cemented beach rock outcrops in the intertidal zone. At the northern end of Tegako, it was assessed that the lagoon shoreline was undergoing erosion (McLean and Hosking, 1992).

The topography of Fogafale Island is closely tied to its history. Fogafale Island was used as a military base by the United States during WWII. An airfield, a naval base, and other related facilities were constructed in 1942. Senior residents remember that there was a long, low-gradient, sandy beach prior to WWII. Modifications of the lagoon side of Fogafale Island during WWII include a 2.3 km long piece of reclamation with wood and coral rock seawall, a long borrow pit (ship passage) beside the seawall was made by excavating reefs, and other channels normal or parallel to the seashore.

These developments changed the shoreline and sedimentation patterns. The seawall was placed at about the former low tide line and suffered erosion after it was built. The borrow pits (or channels) have been filled with sand transported by wave and long-shore currents and with sand and/or gravel eroded from the reclaimed land.[14]

These changes can also be seen in the series of aerial photographs in Figure 26, which focus on central Fogafale, just north of the project site. In 1941, Fogafale had little development and no airstrip. At that time, the Fogafale shore was a broad sandy beach some 40m wide from its seaward edge to the vegetation line. By 1943 (Figure 26), immense disturbance has occurred with the filling of low-lying inland areas to build the airstrip and most of the Fogafale lagoon shore has been subject to dredging and reclamation. A makeshift seawall can be seen as a dark line along the lower edge of the beach all the way down the shore. The 1971 image shows the still moderate rate of development on Fogafale as there is little development on the eastern side of the runway and large areas of coconut woodland still exist between the lagoon side village and the runway. By 2014, huge changes can be seen, and these characterise much of the island today. Housing and development cover practically all available land. Likewise, the level of development on the eastern side of the runway has been dramatic. In the 2019 image the QEII Park reclamation can be seen, and the 2023 image shows the near completed TCAP reclamation north of QEII Park.

Due to the massive change brought about by the WWII military build-up, today there is no part of Fogafale's lagoon shore that remains undisturbed, and the central part of Fogafale's lagoon shore (including the project area) was comprehensively destroyed through reclamation, dredging, and other engineering in the 1940s.

Prior to the 1940s, longshore sediment transport was the predominant mechanism that delivered sand to the Fogafale lagoon shore. Engineering in the 1940s comprehensively destroyed this natural system, and closure of an ocean/lagoon passage in the northern part of Fogafale (also in the 1940s) also reduced sediment supply onto this shoreline. Otherwise, wave energy is the main mechanism by which sediments are redistributed on this shore. However, until the recent nourishment projects, "sediment redistribution" was simply perceived as loss and erosion.[15]

[14] JICA (2011b) Study for Assessment of Ecosystem, Coastal Erosion and Protection / Rehabilitation of Damaged Area in Tuvalu: Vol II. Rep Volume II: Main Report, 1-412, Kokusai Kogyo Co. Ltd & Fisheries Engineering Co. Ltd.
[15] Hawes, P and Webb, A. 2019. TCAP Fogafale Lagoon Shore Reclamation, Tuvalu: Preliminary Environmental Assessment

Figure 26: Changes to Central Fogafale over time from 1943 to 2023

In recent years, there have been further engineered changes to the lagoon foreshore, most notably the development of the QEP reclamation in front of the main government office and hotel. This covers approximately 250m of shoreline and is 100m wide, with a surface area of about 2.5Ha. The seaward edge of the reclamation is hardened revetment, and the rest is bordered by sand-filled, stacked geotextile bags.

The area immediately to the north of QEII Park is the recently completed TCAP I reclamation.

Engineering such as QEP and TCAP I as well as earlier efforts by the Japanese Government and others have consistently found that there are essentially no natural sedimentary processes working on this shoreline that offer scope to produce a natural protective shoreline system. This was almost entirely lost in the early 1940's during WWII military activities and thus the drawbacks of engineering additional areas of this shore are very few, if any and the benefits of providing enhanced protection to the peri-urban community of Fogafale are huge, particularly in-light of sea level rise[16]

4.3.4 Bathymetry

The Funafuti lagoon is characterized by a wide (18km) and deep (maximum 54.7m depth) basin in its northern part and a very shallow basin in its southern part. Figure 27 shows the bathymetry of the Funafuti atoll. The reef flat on the ocean side is about 100m wide in front of storm ridge. Outside the reef edge, water depth increases rapidly and is over 1,000m deep within 1-1.5km from shore. The lagoon-side reef flat is 55-350m wide, including a 15-25m wide beach.

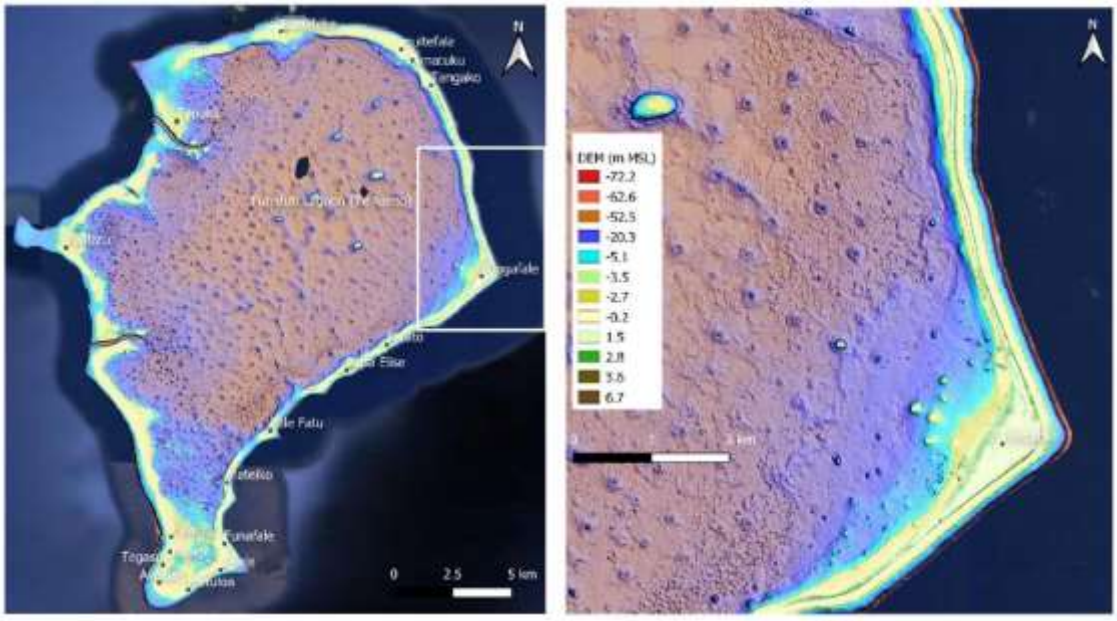


Figure 27: Left: Funafuti digital elevation mode. Right: Close up of Fogafale Island. Source: TCAP Concept Design Report, 2020

Figure 28 shows the nearshore bathymetry of the proposed TCAP II site. The reef flat extends between 50 – 100m from the current shoreline for approximately 800m south of the QIEII Park reclamation. The reef flat to be used for the TCAPII reclamation is bounded by an artificial channel dredged by the Americans that has entrances to the north and south and runs along the shoreline. The reef flat lies between 1m to 0mTGZ or 1-2m below mean sea level before rapidly dropping into deeper water of the lagoon.

[16] Hawes, P and Webb, A. 2019. TCAP Fogafale Lagoon Shore Reclamation, Tuvalu: Preliminary Environmental Assessment

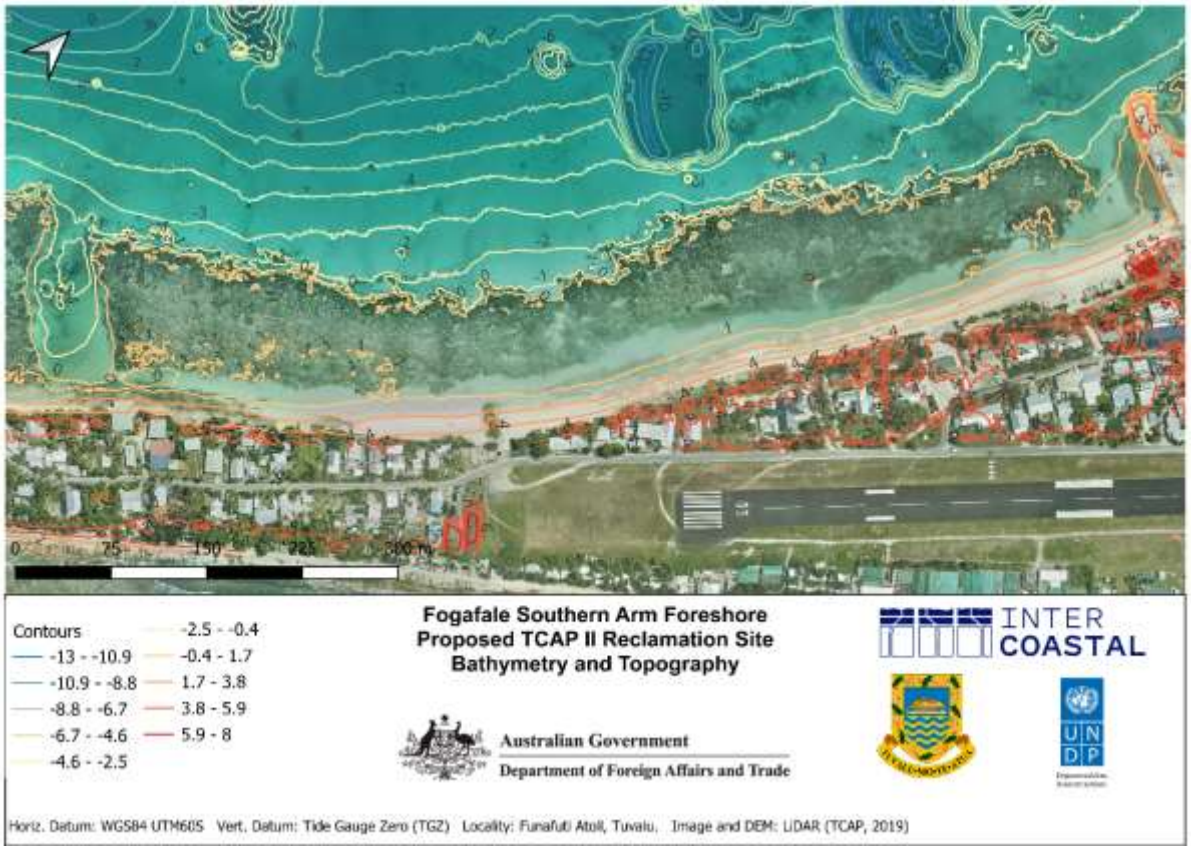


Figure 28Figure 28 also clearly shows the pits left by previous dredging campaigns.

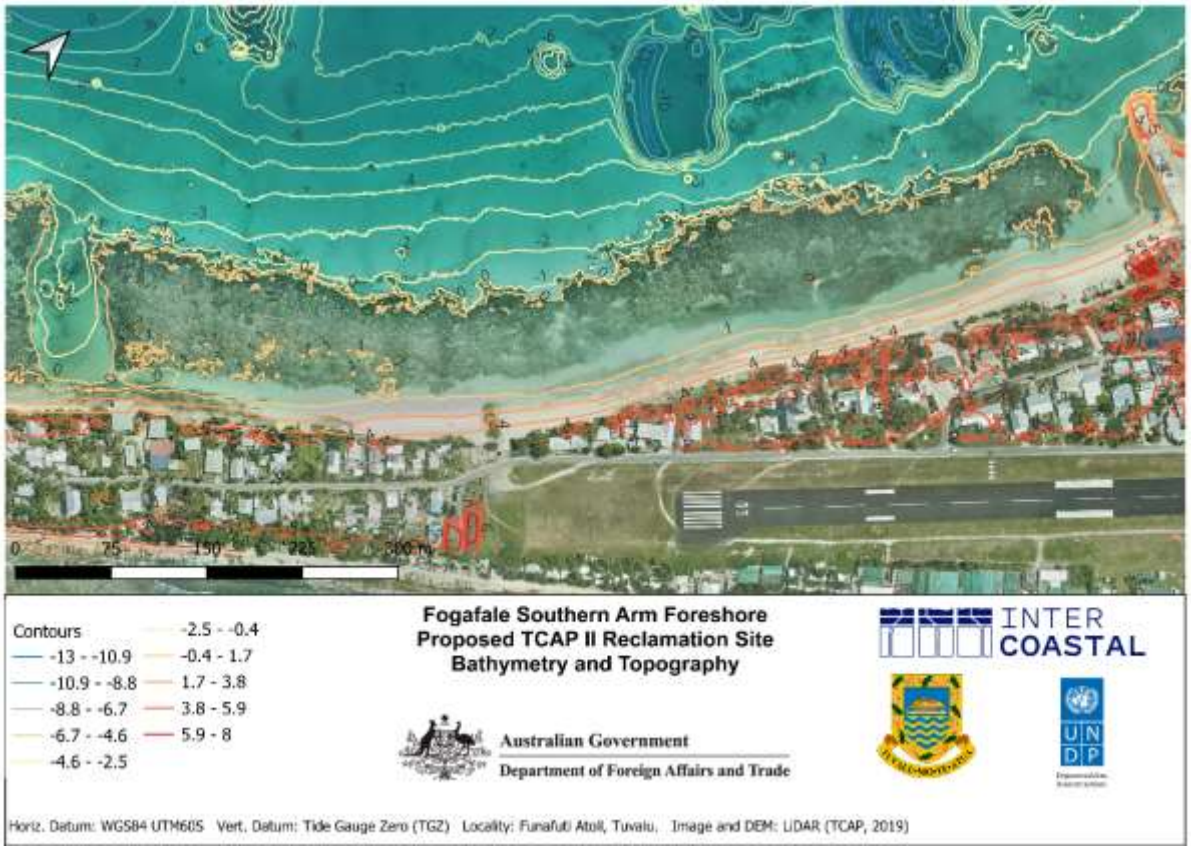


Figure 28 Nearshore bathymetry of the proposed TCAP II reclamation site (Lewis 2024)

4.3.5 MetOcean Conditions

4.3.5.1 Waves

Fogafale is affected by two wave regimes; ocean (deep water) waves hitting the outer atoll coasts and wind-generated waves generated within the lagoon.

Lagoonal Wave Climate: The Funafuti Lagoon is protected on all sides from oceanic swell by fringing intertidal reef flats and 29 islands with only five small navigable passes.

The wave climate within the lagoon for most of the year is generally limited to that which can be generated across the relatively small 20km north-south and 16km east-west fetches. However, under higher water levels and energetic wave events, offshore wave penetration into the lagoon is evident across several lagoon shores (Lewis 2024).

The largest waves offshore of Funafuti Atoll primarily occur in the wet season and arrive from the west, the north-west and the north and are the result of tropical cyclone action in the southern hemisphere (latitudes 8°-12°). Preliminary wave modelling of these events was undertaken during the original TCAP design phase and have been furthered through the SPC Portal work.

Extreme Wave Conditions: To determine the wave climate on the ocean side of Fogafale's eastern shore, a regional wave hindcast model was used. Average significant wave height is 1.8m with the largest waves occurring in the dry season attributed to Southern Ocean swells travelling from the southwest. The dry season also sees a high frequency of waves generated along the east and south trade fetch attributed to the strengthening and predominance of the trade winds during those months.[17]

The wet season sees less frequent (and less intense) waves generated from the southerly sector, with a greater frequency in waves arising from the north. These waves are most likely attributed to large events in the Northern Pacific. The largest waves can be seen to occur from the north and northwest and are most likely attributed to the passage of tropical cyclones in the region.[18]

These cyclone-driven wave impacts on the oceanside of Fogafale can be so severe that they cause flooding across the whole islands. TC Bebe in 1971 saw a catastrophic level of wave overtopping with water depths up to 1.5m of fast-moving water over the main runway and through much of the settled area of Fogafale.[19] The SPC Marine Science Team carried out modelling for TCAP to determine the potential return period for catastrophic cyclone landfall at Funafuti which determined that events like those experienced during TC Bebe were estimated to be a 1 in 100 year event. However, this return frequency does not account for climate change and thus the frequency is expected to increase.

4.3.5.2 Tides and Currents

Tuvalu has diurnal tidal cycle consistent with other island nations in the Pacific. In Funafuti, the mean tidal range is 0.7m during neap tides and 1.7m during spring tides, with a maximum range of 2.5m.

Of importance, the highest spring tide (called king tides in the Pacific) can have a significant impact on the local infrastructure through overtopping and flooding. The height of a king tide is affected by the warm-water effect. Tuvalu can be severely affected by king tides. The tides of February 2011 reached within about a meter of the level of the national government building, on the central lagoon ridge at about 4.2m above the lowest astronomical tide.[20]

[17] Tuvalu Coastal Adaptation Project Draft Concept Design Report (2020)
[18] Tuvalu Coastal Adaptation Project Draft Concept Design Report (2020)
[19] Hawes, P and Webb, A. 2019. TCAP Fogafale Lagoon Shore Reclamation, Tuvalu: Preliminary Environmental Assessment
[20] Lin, C. C., Ho, R., and Cheng, Y, H (2014) "Interpreting and analysing King Tide in Tuvalu", Natural Hazards Earth System Science, 14, 209–217

Tidal cycles produce the bulk of ongoing water exchange in the reclamation site, and water current data associated with this site[21] shows that tidal signals are the dominant variable changing water direction and speed. That said, the velocities recorded are very small. The highest recorded peak velocity was under 0.2 m/sec, otherwise, for the majority of the time and over all states of tide, velocities remained lower than 0.05 m/sec. Generally, sand-sized sediment particles (~1mm diameter) require velocities of 0.3 – 0.4 m/sec to even begin mobilization.

The current regime is generally north to south directed surface flows for both ebb and flood periods during spring tides. Wind driven currents dominate during neap tides: 342°-55° winds cause a southwest-directed longshore current along the south arm, 55°-122° winds result in no/very low lagoon side current directed southwest, other wind directions do not affect the south arm.

4.3.6 Natural Hazard Vulnerability and Risks

Cyclones and Storm Surge Potential: Historical cyclone tracks have been extracted from the International Best Track Archive for Climate Stewardship (IBTrACS) database from 1950 to 2019 to understand the exposure of the islands to the passage of tropical cyclones. Figure 29 shows that there have been 4 cyclones passing within a 300km radius of the islands since 1950. This equates to one cyclone every 17.5 years passing in their direct vicinity. It is expected, however, that the islands would still experience the effects of large waves from cyclones generated in the South Pacific passing outside the 300km search radius, due to the remoteness and exposure of Tuvalu's islands to wind and waves in all directions.

The Global Facility for Disaster Risk Management (GFDRM) classes the risk in Tuvalu to flooding from storm surges as high. This means that potentially damaging waves are expected to flood the coast at least once in the next 10 years.

While direct passes from cyclones are rare on the islands, storm surges and large waves from distant cyclones have caused devastating damage in recent years. These cyclones are not reflected in Figure 29 due to their tracks being greater than 300km from Funafuti, but caused the following devastation to the islands:

i. Tropical Cyclone (TC) Bebe in 1972, a Category 3 cyclone, which knocked down 90% of the houses on Funafuti and resulted in flooding because of sea water coming up through the coral to a depth of 1.5m.

ii. In March 2015, Category 5 TC Pam resulted in 3-5m high waves causing significant damage to agriculture and infrastructure on most islands; however, Funafuti escaped the worst of the damage. The impact of TC Pam was compounded in Tuvalu by previous flooding from king tides that peaked at 3.4m on 19th February and caused considerable road damage across Tuvalu.

iii. Category 4 TC Ula affected Tuvalu in early 2016 with 3-4m-high waves affecting all islands. [22]

iv. In January 2020, Category 3 TC Nino heavily impacted Funafuti with damaging storm surges resulting in significant inland inundation, coastal erosion, and vessels being washed onto the shore.

[21] Damlamian, H (2008) Hydrodynamic Model of Funafuti: Water Circulation and Applications. SOPAC Technical Report 133.
[22] ADB Tuvalu Outer Island Maritime Infrastructure Project Initial Environmental Examination, Cardno 2016

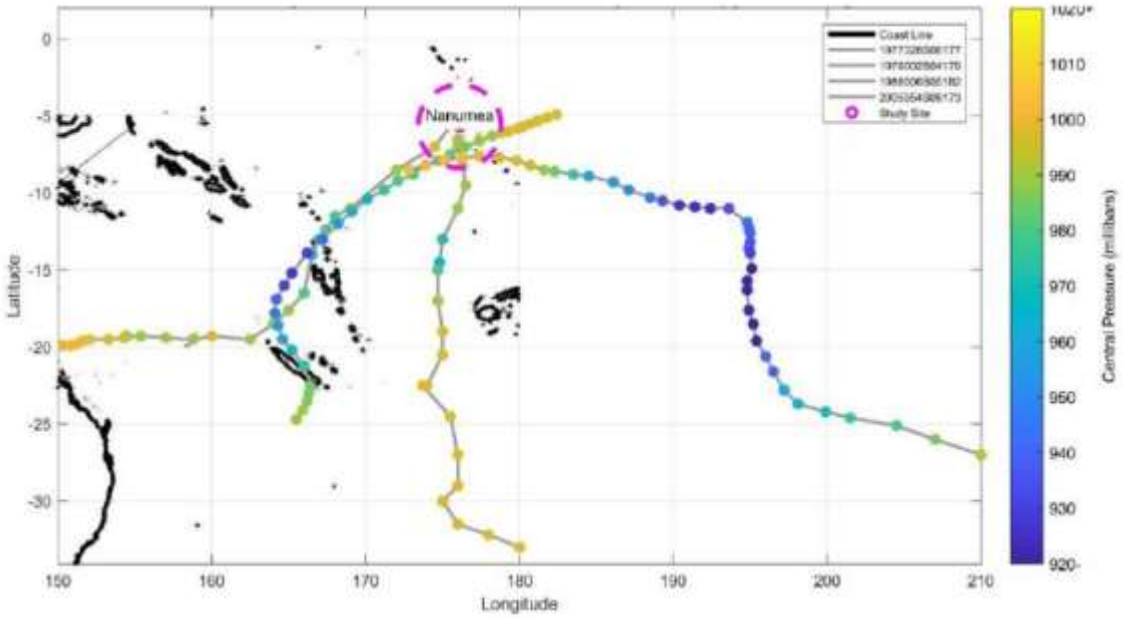


Figure 29: Cyclone tracks showing active storms found within 300km radius of Nanumea and relevant to Funafuti for the period 1950-2019.

Earthquakes: 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. According to the GFDRM, Tuvalu is classified as "very low risk" based on the information that is currently available. This means that there is a less than 2% chance of a potentially damaging earthquake in the project area in the next 50 years. Based on this information, the impact of an earthquake need not be considered in the different phases of the project, particularly during design and construction.[23]

Tsunamis: Tsunamis are long period waves generated by disturbance in the water column and may be caused by tectonic movement, underwater landslides, volcanic eruptions, or meteor impacts. An assessment in 2009 indicated that Tuvalu has the third lowest tsunami hazard of the Pacific countries assessed, with a maximum tsunami amplitude of 1.6m for a 2000-year return period (comparatively, the highest is 5.2m for PNG, and the lowest is 1m for Nauru).[24]

Looking at the islands of Tuvalu, the assessment found that most of the energy originating from Tuvalu's major source of risk (the New Hebrides trench) is likely to be directed towards the southern islands of the archipelago due to the orientation of the trench. Subsequently, the maximum tsunami amplitude (2000-year return period) is lower for the northern islands when compared to the national maximum of 1.6m in Nukulaelae (the most southern island) however, this would be relevant for Funafuti.[25,26]

4.3.7 Climate Change

Global climate modelling suggests that climate change is expected to affect the frequency and intensity of tropical cyclones (CSIRO & SPREP, 2021). A recent study by Knutson et al. (2020) assesses

[23] Global Facility for Disaster Risk Management: http://thinkhazard.org/en/report/252-tuvalu/EQ
[24] Thomas, C and Burbidge, D (2009). A Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations. Geoscience Australia Professional Opinion. No. 2009/02
[25] Lee, G., Roqica, D., Sovea, T. and Momoivalu, V. 2020. TCAP Preliminary Geotechnical Investigation Report: Nanumea Island, Tuvalu. Pacific Community (SPC)
[26] Lee, G., Roqica, D., Sovea, T. and Momoivalu, V. 2020. TCAP Preliminary Geotechnical Investigation Report: Nanumaga Island, Tuvalu. Pacific Community (SPC)

the impact of a 2°C global warming on TC activity around the southwest Pacific region with the following key summations:

- High confidence that TC frequency will decrease over the coming century.
- Low confidence in the changes in frequency of category 4-5 TCs.
- High confidence that sea level rise will increase TC-related storm surge events.
- Medium to high confidence in an increase in TC rainfall rates.
- Medium to high confidence in the increase in average TC intensity.

The projected increase in average TC intensity, combined with sea level rise and increased rainfall rates would increase TC impacts.

The incidence of drought is expected to decrease over the 21st century. It is predicted that mild drought will occur approximately eight to nine times every 20 years by 2030 under all emission scenarios, decreasing to six to seven times per 20 years by 2090. The frequency of moderate to severe drought is projected to remain approximately stable from 2030 through the 21st century at once or twice and once every 20 years, respectively.

Mean sea level is projected to continue to rise over the course of the 21st century with a very high confidence (Figure 30). The models predict a rise of approximately 5-15cm by 2030, with increases of 20-60cm indicated by 2090 under high and medium emission scenarios.

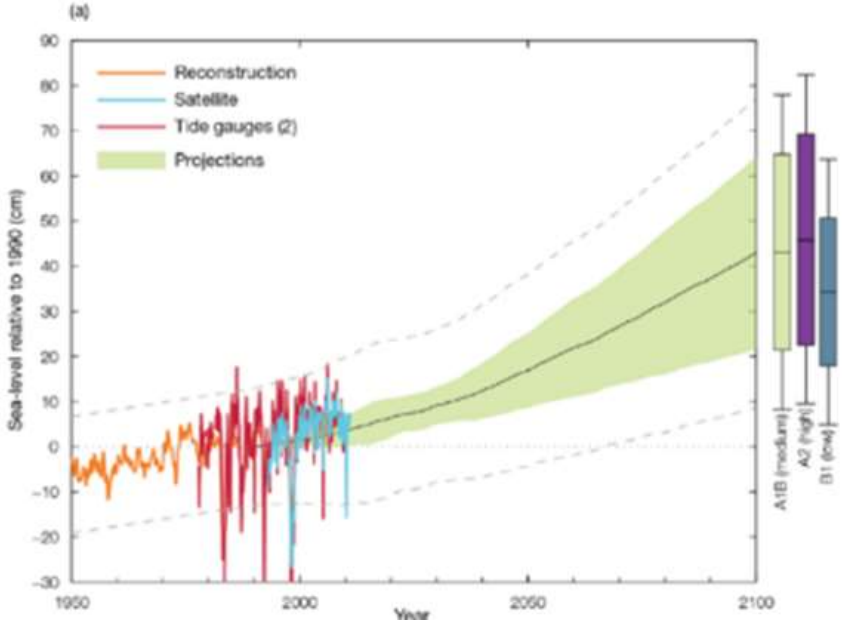


Figure 30: Observed and project relative sea-level change near Tuvalu[21]

4.3.8 Lagoon Water Quality

As previously noted, the capital, Fogafale Island on Funafuti Atoll, is the most densely populated island in the country with more than half the nation's population residing there.

Fujita et al. (2013)[27] assessed anthropogenic impacts on water quality of the lagoonal coast of Fogafale Island by conducting field surveys sampling water quality at six points and measuring water temperature, electrical conductivity, salinity, dissolved O2, pH, redox potential, and *E. coli* levels.

[27] Fujita, M, Suzuki, J, Sato, D, Kuwahara, Y, Yokoki, H, and Kayanne, H 2013, Anthropogenic impacts on water quality of the lagoonal coast of Fongafale Islet, Funafuti Atoll, Tuvalu, Sustain Sci 8:381–390

The study found that sediments on Fongafale's lagoon coast had "2.7x104 more microbial biomass, significantly different microbial community structure, and low microbial diversity, when compared to an undisturbed natural coastal sediment", indicating that pollution of this site is chronic. At low tide, *E. coli* numbers were found to range from 3.2x103 to 2.7x104 MPN/100 mL (most probable number of *E. coli* bacteria per 100 mL of sediment – referring to the statistical probability of the number of organisms present) at several sampling sites, and at high tide ranged from 5.5x102 to 1.2x103 MPN/100 mL.

The primary source of this pollution is likely to be domestic wastewater. There is no centralised sewage treatment system. Although septic tank construction specifications require them to be sealed, it appears that most (if not all) septic tanks constructed in Tuvalu are 'bottomless' and therefore able to leak into the surrounding substrate. During ebb tides, wastewater leaking from septic tanks and pit toilets flows into lagoon waters. Additional sources of pollution may include animal waste from piggeries, detergents and chemical fertilisers (Newland 2018).

The Australian Government's Guidelines for Managing Risks in Recreational Water (2008) notes that raw sewage has E. coli concentrations of 106-107 MPN/100 mL and classifies water with more than 5x102 MPN/100 mL as "D" (having a significant risk of high levels of illness transmission).

More recently, water quality surveys and analysis were conducted in 2018 as part of the R2R project (Newland 2018). Water quality samples were taken at 13 sites including 10 within Fogafale lagoon, and analysed for turbidity, dissolved oxygen, nitrogen (nitrates, nitrites and ammonia), phosphorus (phosphase), and E. coli. The study found elevated levels of N-Nitrate, P-Phosphase, N-Ammonium, and *E. coli*, particularly at sites close to the most densely populated parts of Funafuti (Letasi). The average N-Nitrate concentration at Letasi was 0.348mg/L, about 100x greater than the guideline value of 2-8ug/L specified by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000).

4.3.9 Groundwater

The demise of the Fogafale freshwater lens began in the early 1940's when the US Military essentially land-formed the surface of the island, filled taro gardens and swamp areas, reclaimed the lagoon foreshore, dredged deep navigation channels and built the runway. The viability of the freshwater lens has been very limited ever since (Webb, 2007). Otherwise, with the prevalence of flush toilets and septic tanks across the densely populated island, any freshwater formation on Fogafale is today very contaminated and essentially no potable groundwater resource exists (JICA, 2011).

On Funafuti, the domestic sewage (faecal and non-faecal wastewater) is currently seeping into the groundwater, either untreated or only after simple treatment or being moved into coastal waters. The JICA study found that nitrogen and phosphorous concentrations are higher than water quality criteria and threshold values of eutrophication near the coast on lagoon side.

4.3.10 Seismic Activity

The tectonic setting of the region is very complicated. Seismicity in the region can be attributed to crustal earthquakes on known faults, large subduction interface earthquakes, large subduction earthquakes, such as normal faulting intraplate and outer rise events, and shallow background and deep seismicity.

The earthquakes, volcanoes, ground deformation and tsunamis that can cause destruction in the region all result from the interaction of four major plates (Figure 31): The Pacific (PA), Australia (AU), Philippine Sea (PS) and Sunda (SU) plates. In Figure 31Error! Reference source not found., the red arrows in the inserted map show the plate motions relative to Sunda (SU) plate. Colored dots in the main map are historical earthquakes (M≥6.0) from 1900 to 2008. Colors represent epicenter depth ranges and circle size shows the magnitude ranges.

Tuvalu has experienced only one significant event in the past 100 years (Rong et al 2010).

A regional seismicity model has been developed for the SOPAC region (Rong et al. 2010). Tuvalu earthquake hazard is classified as very low[28]. This means that there is less than a 2% chance of potentially damaging earthquake shaking in the project area in the next 50 years. Impact of earthquake therefore is not a significant consideration in the design of the project infrastructure.

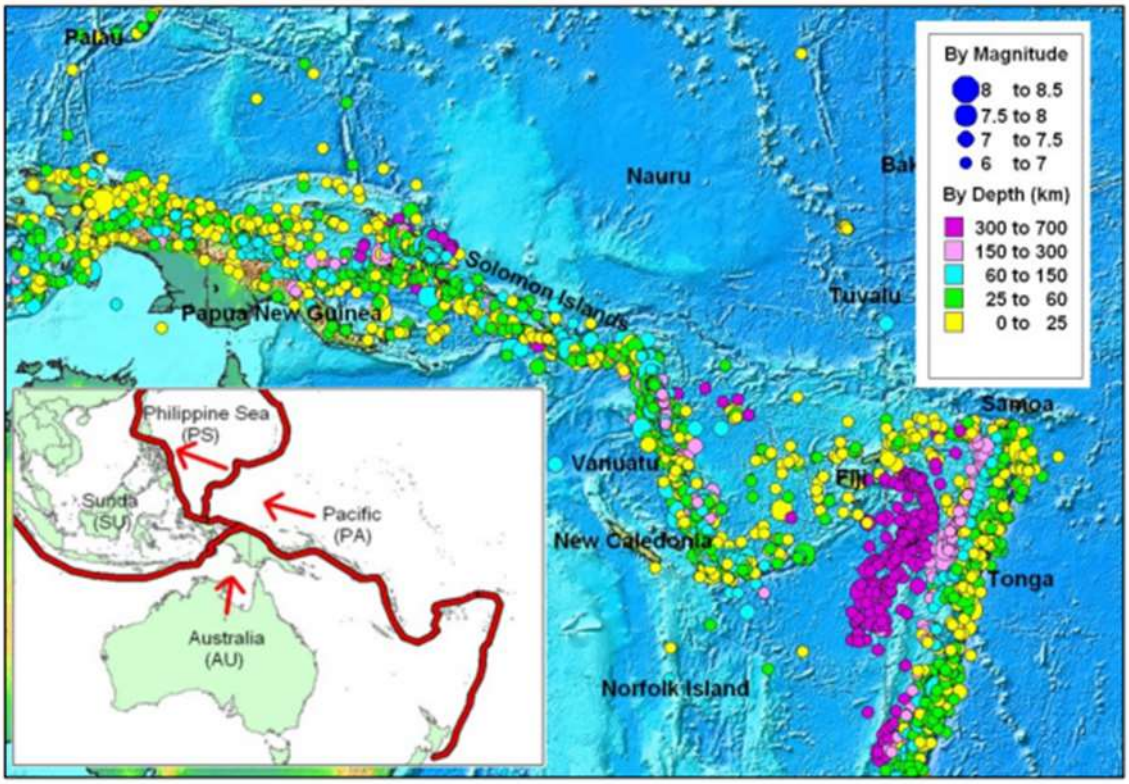


Figure 31 Regional tectonic setting and seismicity in the SOPAC region (Rong et al 2010)

4.3.11 Ambient Noise

Noise pollution sources in Tuvalu are limited and noise levels are low compared to most other places with similar or even lower population densities. Dominant noise sources are surf, aircraft noise (scheduled flights currently only four times per week), vehicle movements (motorcycle, cars, trucks and boats), construction noise (periodic and site specific), general urban/rural sounds (music, voices, chickens etc).

4.3.12 Air Quality

Air pollution is not a significant issue in general sense in Tuvalu, but there are situations where some individuals may be affected. Generally, such cases will simply be nuisance rather than significant health risk.

Common emission sources include motor vehicles, cooking fires and stoves. Odour nuisance can occur from waste, sewage, and animal feedlots. Two notable sources of odour on Funafuti are the burning of waste at the rubbish dump at the northern end of the island, and the piggeries along the eastern margin of Fogafale.

[28] http://thinkhazard.org/en/report/252-tuvalu/EQ

4.4 Biological Environment

4.4.1 Terrestrial Ecology

The indigenous vegetation of Funafuti is highly disturbed and now dominated by introduced exotic species.[29] There are no endemic plant species unique to Tuvalu, and almost all of the indigenous plants are widespread, easily dispersed pantropical, Indo-Pacific, or pan-Pacific coastal species that are adaptable to environments with loose shifting sands, high salinity, strong sunlight, periods of drought, and poor soil development.

The total recorded flora of Funafuti is about 349 species, only 16% of which are indigenous. Introductions of new species to the islands has been ongoing since original settlement of the islands 2,000 years ago. Introductions increased with European contact during WWII, and later after independence through population expansion, shipping, and introductions of crops by FAO and others since the 1970s.[30] The post-independence era also saw the selective removal of indigenous species for growth of settlements, construction and use for firewood, medicines and handicrafts. Further damage to the native flora resulted from the introduction of invasive weeds.

The most common trees found on all islands are coconut (*Cocos nucifera*) stands, hibiscus (*Hibiscus tiliaceus*), papaya (*Carica papaya*), pandanus (*Pandanus tectorius*), salt bush (*Scaevola sericea*), *Premna serratofolia*, *Tournefortia samoensis*, zebra wood (*Guettarda speciosa*), kanava (*Cordia subcordata*) and terminalia (*Terminalia samoensis*). Indigenous broadleaf species, including *Calophyllum inophyllum*, make up single trees or small stands around the coastal margin.

No birds or terrestrial species found on Funafuti are considered endangered or critically endangered.

Little to no vegetation removal is expected to be required as part of the TCAPII works.

4.4.2 Marine Environment

4.4.2.1 Reef Flat

An ecological assessment of the impacts of a previous dredging operation in Funafuti lagoon undertaken between 1991 and 1994 found that the area of reef close to the main settlement was already heavily impacted, with higher levels of algal cover and higher number of invertebrates and fish associated with algae or sediments than in other areas of the lagoon which were more dominated by live corals.[31]

Cover by corals in Funafuti Lagoon is highly site-specific, with very low cover adjacent to Fogafale. The dominant corals are *Pocillopora* sp., *Acropora* sp. and *Porites* sp[32] (Figure 32). As can be seen in Figure 32 there is little to no coral on the reef flats and only 1-5% on the margin of the reef flat. Ground truthing in late 2023 indicated that this pattern continues along the TCAP II site, where the reef flat is depauperate of coral, with only sparse occurrences along the reef-flat drop off (Figure 33).

Algal cover, in particular *Sargassum polycystum* now dominates the nearshore reefs and occupies approximately 70+% of the reef top and slope on the lagoon side (Kaly & Peacock 2014). Recent observations (November 2023 and February 2024) recorded forests of Sargassum in the nearshore zone of the TCAPII site.

Work by Andrefouet *et al* (2017) and De Ramon et al (2014) documents the extent and proliferation of now persistent eutrophication associated macroalgae outcrops in the nearshore Fogafale area. This highlights how chronic water pollution, resulting from domestic wastewater, is affecting the

[29] Kaly, U & Peacock, C. 2014. Tuvalu Borrow Pits Project Phase II Design: Environmental and Social Impact Assessment (EIA)
[30] Kaly, U & Peacock, C. 2014. Tuvalu Borrow Pits Project Phase II Design: Environmental and Social Impact Assessment (EIA)
[31] Kaly, U & Peacock, C. 2014. Tuvalu Borrow Pits Project Phase II Design: Environmental and Social Impact Assessment (EIA)
[32] JICA, 2011, Study for Assessment of Ecosystem, Coastal Erosion and Protection/Rehabilitation of Damaged Area in Tuvalu: Vol III. Rep Volume III: Supporting Report, 1-412, Kokusai Kogyo Co. Ltd & Fisheries Engineering Co. Ltd.

ecology of the lagoon close to the densely populated areas of Fogafale. This underlines the more contemporary level of human impact over water quality and ecological shift at this location. As Kaly and Peacock (2014) indicate corals simply do not occur in this zone anymore.

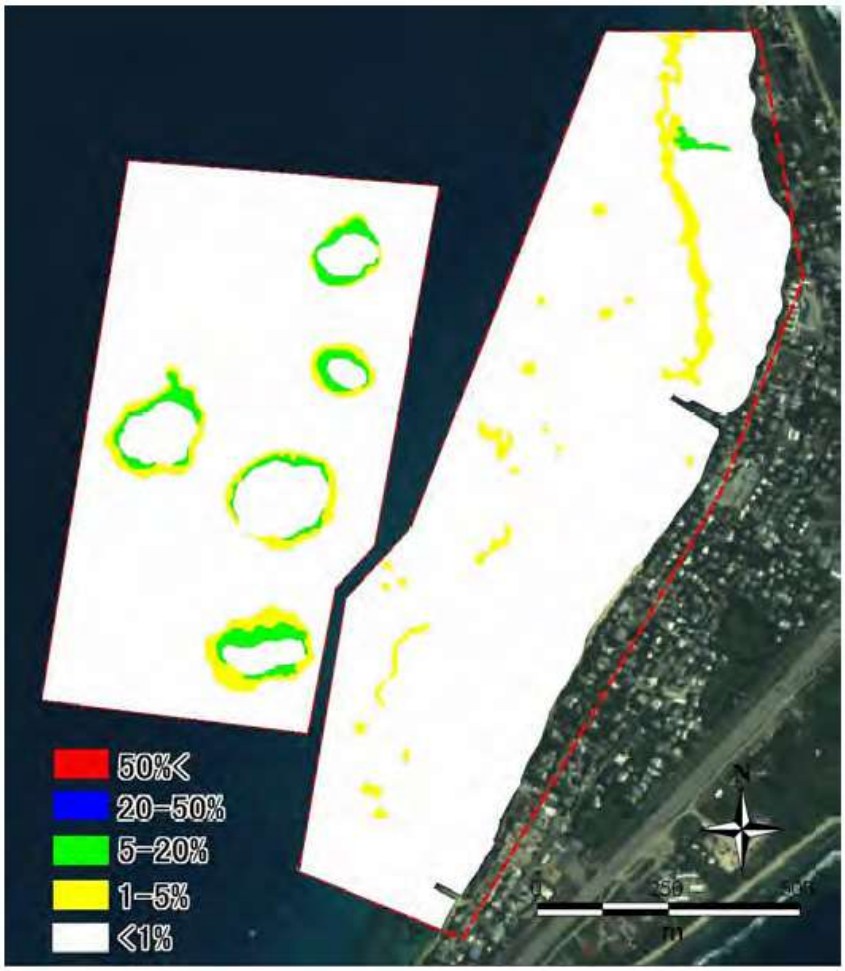


Figure 32: Coral distribution and degree of cover adjacent to Fogafale immediately north of the TCAPII site
Source: JICA 2011

Figure 33 Typical habitat present along outer edge of reef flat at TCAPII site (photo: P.Hawes Feb 2024)

In an ecological assessment of the impacts of a smaller scale dredging operation in Funafuti lagoon undertaken between 1991 and 1994, (Kaly and Jones, 1994) found that the area of reef close to Vaiaku, the main settlement were already heavily impacted with higher levels of algal cover and more invertebrates and fish that are associated with algae or sediments than in other areas of the lagoon which were more dominated by live corals. Further, fish diversity and abundance were found to be generally low in the Fogafale area compared with other areas (JICA 2011c). This can largely be explained by the poor habitat as a result of pollution and the loss of coral.

Water pollution is affecting the ecology of Funafuti lagoon close to the densely populated areas of Fogafale. The pollution is chronic and is resulting from domestic wastewater, particularly from septic tanks and pit toilets[33]. Production of corals and forams (that create sand) has been greatly reduced in the vicinity of Fogafale. This has also resulted in the loss of beach-building mechanisms along the lagoon side Fogafale coast.

4.4.2.2 Sand Resource Area (SRA)

The lagoon floor in the target sand resource area is predominantly simple sandy substratum with patches of *Halimeda* algae (Figure 34) (JICA 2`011).

[33] JICA, 2011. Study for Assessment of Ecosystem, Coastal Erosion and Protection/Rehabilitation of Damaged Area in Tuvalu: Vol II. Rep Volume II: Main Report, 1-412, Kokusai Kogyo Co. Ltd & Fisheries Engineer Co. Ltd.

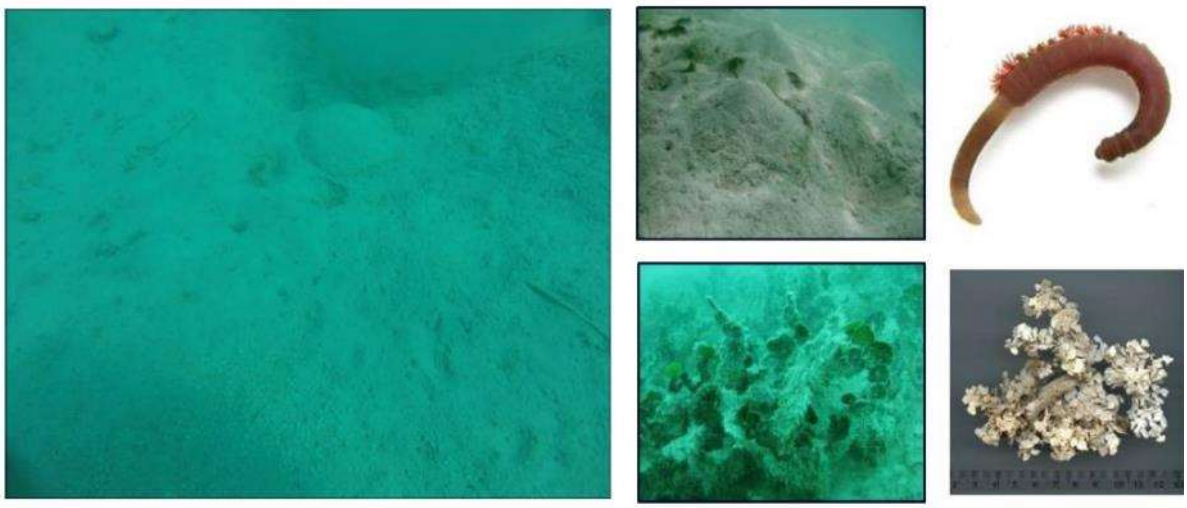


Figure 34: Lagoon substratum and common benthos (source: JICA 2011)

These habitat types are very well represented throughout the broader Funafuti lagoon and, along with simple bioturbating organisms and epifauna (e.g. sea cucumbers), typically recover quickly following physical disturbance.

Coral bommies are rare at the surface in the SRA, although they do occur Figure 35. During dredging operations for TCAPI it was discovered that lumps of consolidated limestone, from previous coral bommies that had been buried by sand, are sparsely scattered within the sand body forming the sand resource. These bommies are easily broken up by the dredge head and represent a coarser gravel/cobble resource.

Figure 35 Coral bommie within the SRA (west of QEII Park).

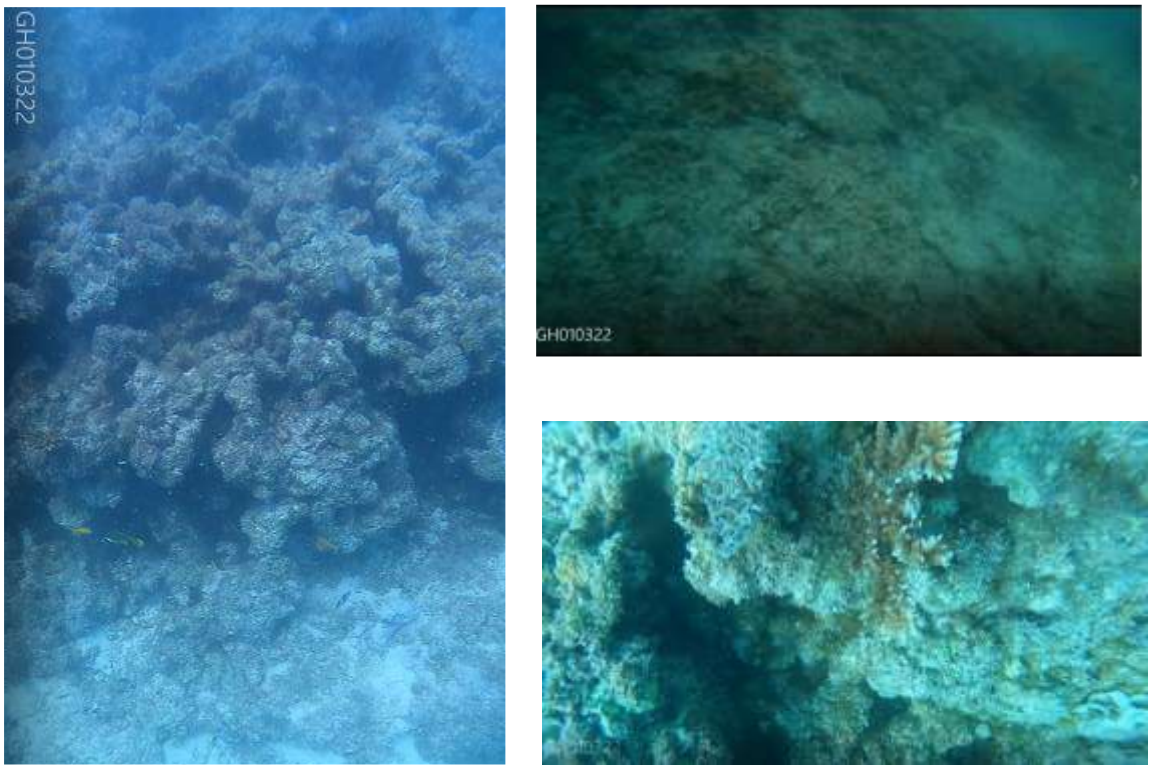


Figure 36 Images of coral bommie shown in Figure 35 (photos: Hall Feb 2023)

4.4.3 Protected Areas

A single large, protected area – the Funafuti Conservation Area (FCA) – was established in Funafuti in 1996[34] and covers 40 km^2 of the western portion of Funafuti lagoon, including six small islands. Its boundary is defined by a line 50m seaward of the ocean-side reef crest, and the 30 m depth contour on the lagoon side (Figure 37). Its boundaries encompass about 20% of the total coral reef area of the lagoon and are home to many of the 400 species of fish and 36 species of coral that are known from Funafuti lagoon[35].

Despite only including a small land area, the islands of FCA include about 40% of the total area of threatened native broadleaf forest found on Funafuti atoll, home to 22 species of seabirds and shorebirds, two species of land birds (mostly using the islands for nesting or roosting)[36]. In addition, coconut crabs can be found on these islands, and sea turtles are known to nest on The FCA is at least 10km away from the TCAPII proposed dredging site and therefore is not considered at risk from the project.

Figure 37: Funafuti atoll and the location of the Funafuti Conservation Area (source: NASA)

[34] Tuvalu State of Environment Report 2022
[35] Berdach, J 2003, Case Study: The Funafuti Conservation Area, Funafuti Atoll, Tuvalu, Drawing Lessons for Future Marine Conservation Planning and Management, Pacific Region Environmental Strategy, Asian Development Bank
[36] Watling, D 1998. Funafuti Marine Conservation Area, Tuvalu. Report of the Bird Survey. Environmental Consultants Fiji, Ltd. Suva. Fiji

4.4.4 Vulnerable and Endangered Species

As of June 2020, a total of 1,451 taxa known to occur in Tuvalu have been assessed by the IUCN Red List of Threatened Species™ (the Red List). Of these, 1,428 taxa are animal species, and 23 are plants.[37]

Of the taxa assessed, 126 taxa have been assessed as threatened, the majority of which are corals. That is, their conservation status falls into one of the Red List's three threatened categories – Vulnerable (VU), Endangered (EN), or Critically Endangered (CR)[38]. Of the threatened species found in Tuvalu:

- Three are CR – Beck's petrel (*Pseudobulweria becki*), oceanic whitetip shark (*Carcharhinus longimanus*) and Tuvalu forest gecko (*Lepdoctylus tepukapili*)
- 20 are EN, including green turtle (*Chelonia mydas*), whale shark (*Rhincodon typus*), longfin mako (*Isurus paucus*), phoenix petrel (*Pterodroma alba*), pineapple sea cucumber (*Thelenota ananas*), black teatfishes (*Holothuria nobilis* and *Holothuria whitmaei*)
- 103 are VU, including thorny seahorse (*Hippocampus histrix*), white-winged petrel (*Pterodroma leucoptra*), blue marlin (*Makaira nigricans*), ocean sunfish (*Mola mola*), leatherback turtle (*Dermochelys coriacea*) and seventy species of coral.

Due to the highly degraded nature of the proposed reclamation site and dredging site, it is not expected that any of these vulnerable or endangered species will be encountered.

4.4.5 Invasive and Alien Species

According to the Global Register of Introduced and Invasive Species (published by the IUCN Species Survival Commission's (SSC) Invasive Species Specialist Group (ISSG)) a total of 83 IAS are found in Tuvalu, comprising 14 animal species, 68 plant species, and one virus (banana bunchy top virus)[39].

The NBSAP[40] highlights the following threats and impacts from species both on the native biodiversity and the economy:

Agricultural Pests: The coconut scale insect (*Aspidiotus destructor*) has severely infested the coconut palms, breadfruit, papaya, bananas, and pandanus and slightly affects the principal root crops (giant swamp taro and taro) and other cultural trees such as frangipani and *Premna serratofolia*. Chemical control, through spraying of soap, kerosene, and malathion, and the cutting and burning of infested plant materials, has been unsuccessful.

Other notable agricultural pests include pink mealybug, black mirid garden fleahoppers, aphids, and the delphacid planthopper, all of which cause leaf deformation and yellowing due directly to the pests or pest acting as vectors of plant viruses.

Of recent concern is the threat posed by fruit flies of the genus *Bactrocera* that have cost millions of dollars in the Pacific region in lost fruit export income and control costs. The neighbouring islands of Fiji, Wallis and Futuna, Niue, Tonga, Rotuma, Samoa, Cook Islands, Nauru, American Samoa, French Polynesia, and the Queensland region of Australia are all home to economically damaging *Bactrocera* spp.

Invasive plants: Wedelia or trailing daisy (*Sphagneticola tribolata*), a plant native to the Caribbean, has spread throughout villages, along roadsides, and into open lots. It has also colonized outer beach vegetation, where it outcompetes important medicinal plants and other native species of cultural

[37] Tuvalu State of Environment Report 2022
[38] ttps://www.iucnredlist.org/search/list?landRegions=TV&searchType=species accessed Jan 2024

[39] Tuvalu State of Environment Report
[40] Tuvalu 5th National Biodiversity Strategy and Action Plan, Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour, 2016

importance. It is considered one of the world's 100 worst invasive species. Once established, it is almost impossible to eradicate, and it is slowly replacing many of Tuvalu's most important low-growing herbaceous species along beaches and roadsides, and it inhibits the growth of seedlings of threatened trees and plants.

Yellow Crazy Ant: Alien ants are considered one of the greatest threats to biodiversity, and the yellow crazy ant (YCA) (*Anoplolepis gracilipes*), which was probably introduced with infested timber or sea cargo, was reported present in the early 2000s and is now causing serious problems in Tuvalu. The YCA, which forms dense, multi-queen super-colonies and releases an acid that burns on contact, preys on a wide range of plants and invertebrate and vertebrate animals, including birds, crabs, and insects. YCAs have wiped out crabs in infested areas and affected birds, geckos, plants, and organisms on many islands, such as Christmas Island in the Indian Ocean. On Funafuti, the YCA has destroyed crops and attacked animals such as chickens, land crabs, hermit crabs, and coconut crabs, and it threatens seabird populations.

Invasive seaweeds: The rapid spread of a non-native brown seaweed (*Sargassum polycystum*) in Funafuti lagoon especially adjacent to Fogafale, began in 2011, and is now a major concern with its dense coverage reducing sunlight, outcompeting corals, and making fishing difficult. It is suspected that the seaweed was introduced via international shipping (through ballast waters, hulls, or anchors), possibly from Wallis and Futuna, where it is present. It seems to have become established following the prolonged drought of 2011 and has responded to localised nutrient enrichment in Funafuti lagoon.

5 SOCIAL & BUILT ENVIRONMENT BASELINE

5.1 LAND USE

Funafuti has 33 islands surrounding the lagoon [41]. Fogafale Island holds the main village settlements of Lofeagai, Teone, Fakaifou, Senala, Alapi, Vaiaku and Kavatoetoe, from the northern to the southern point of the island respectively. Amatuku and Funafala are the two other islands that have established village settlements. As shown in Figure 38, Funafuti has a total land area of 2.8km^2. The entire island was characterized by coconuts and other woodland before it was rapidly and dramatically disturbed in the 1940's to make way for the World War II engineering and infrastructure including the airstrip, foreshore reclamation and navigation channels. There are also patches of mangroves in Funafala and to the eastern side of Fogafale surrounding the brackish Tafua Pond. A large portion of the land is covered by the country's only airstrip and expanding residential and commercial buildings, roads, and other infrastructure.

Figure 38: Land use map of Funafuti. Source: Lands Department Maps (Mapinfo), Funafuti Island Profile

5.1.1 Land Tenure and Rights

There are several land tenure arrangements in Tuvalu: private land, government acquired land, leased land, crown land, public land, communal land, village land, and Tuvalu Church land. Tuvalu has retained its traditional land tenure system by merging its traditional setting into the Land Codes that govern the use of land today. The traditional land tenure system is primarily based on kinship. Tuvalu

[41] Kaupule Funafuti, 2016, Moeakiga o Malefatuga II: Funafuti Strategic Plan 2016-2020.

is a patriarchal society where men inherit land. Land will only be passed to a daughter if there are no sons, she is the only child, or the only surviving child.

Most of the land in Funafuti is privately owned and there is a significant area of leased land associated with its function as the country's capital. Land use of Fongafale Island is either residential area or governmental land (leased from private landowners). All areas of Alapi Village, the oldest village on the island, are residential; Fongafale's main institutions are located in Senala Village, such as the Funafuti Council (Kaupule), Conference Hall of the supreme decision-making body (Fale Kaupule), a church, a hospital, and a primary school. Buildings of the Tuvalu Government are concentrated in Vaiaku Village, and also the Prime Minister's house. The south-eastern side of the airstrip is designated as government land. There are no residential houses, but a power plant, a prison, public works department, and meteorological bureau buildings.

Land tenure and rights within modern and customary laws will need to be considered and carefully navigated for the success and sustainability of this project in the longer term. The project's footprint will be on the lagoon floor (for dredging) and on the foreshore and areas seaward of the foreshore (for the reclamation). The GoT does not own land other than that as defined as 'foreshore,' although it leases land from the native owners, usually via the Kaupule.

Section 2 of the Tuvalu Land Reclamation Act defines the foreshore as "the shore of the sea or of channels or creeks that is alternately covered and uncovered by the sea at the highest and lowest tides". Land beyond the foreshore is either held as *kaitasi*, land that is used and controlled for, and on behalf of, the extended family or *vaevae*, which is a division of lands amongst the *kaitasi* – generally smaller sub-units of the extended family.

Government and other corporate companies like the Tuvalu Electric Corporation have acquired lands through lease tenancy agreements with the respective land-owning units. Recently, a Native Lands Trust Board has been established to oversee the leasing of native lands as in the case of Funafuti, where majority of the lands on Fogafale are under lease.

The Government leased the majority of the lands on Fogafale for infrastructure, schools, and housing for civil servants. The lease contract had expired, and a tenure leasing agreement was renewed in 2019 with the revised conditions that there was an increase in leasing fees. Based on the 2012 census, 57% of the households in Funafuti owned the land they were living on, while 38% are leasing from government or renting from private individuals or public corporations.

The Funafuti Kaupule have made an agreement with the Government for this development to go ahead and for the resultant land to belong to the Government. This is in line with the Foreshores and Reclamations Act.

5.2 DEMOGRAPHICS

No countries in the Pacific region have experienced more recent or more rapid population migration and urbanization than Tuvalu. At the end of the 19th century, Funafuti Atoll was one of the least populated atolls in Tuvalu with a population of only 251, representing 7% of Tuvalu's total population (Yamano et al 2007). Fogafale, as the capital and Tuvalu's main business center has seen outer island populations steadily migrating to Funafuti for economic and education prospects. In 1979, Funafuti's population size was 2120 and had increased to 5274 by 2011. The highest proportion change, from 1979 to 1991 Figure 39), was due to Tuvalu becoming independent from the UK administered Gilbert (now Kiribati) and Ellice Islands colony. At this time people moved back to settle in Funafuti, where the required infrastructure (airport and deep-water anchorage) existed and subsequent housing, etc. was being developed.

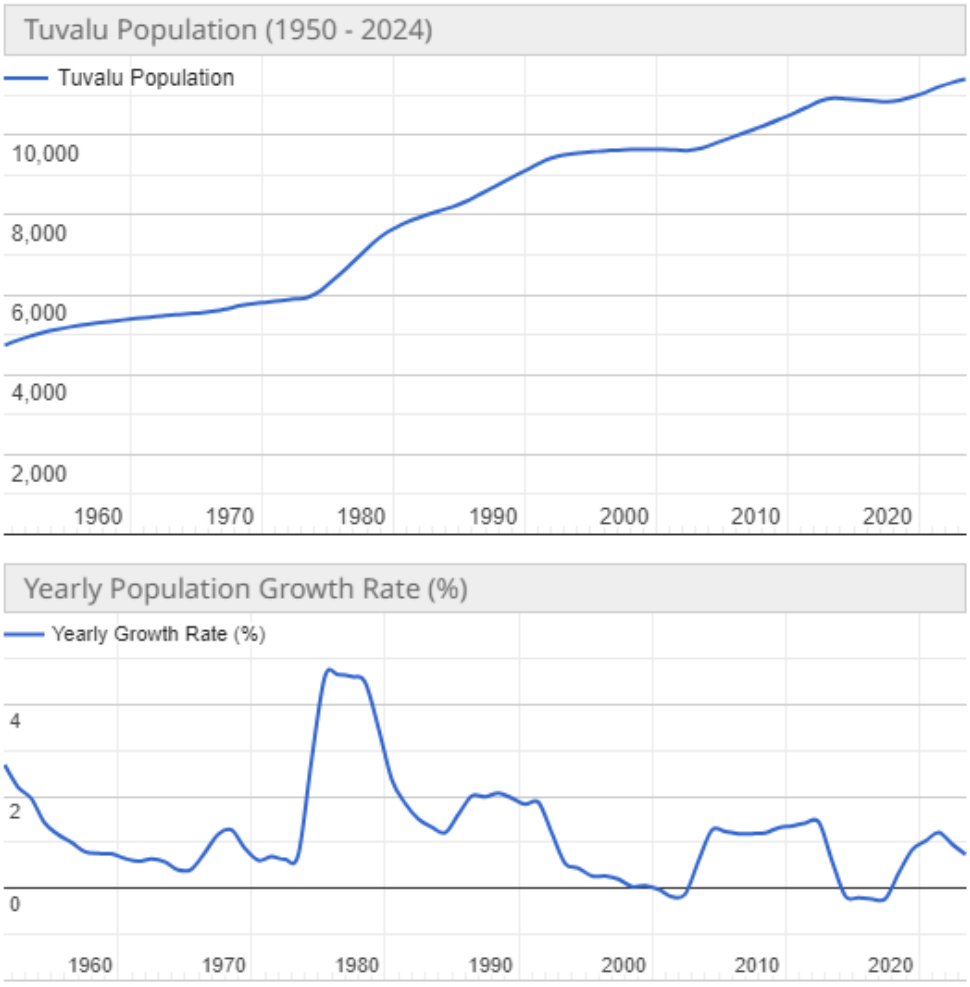


Figure 39 Changes in population in Tuvalu between 1950 and 2024[42]

Data for the 2022 census is not yet available, however the 2017 put the population of Tuvalu at 11,192, while the latest estimates from the Tuvalu Central Statistics Division estimated that the 2023 population was 10,099[43], which is lower than the United Nations estimate of 11,443.[44]

The population of Tuvalu is primarily of Polynesian ethnicity, with approximately 5.6% of the population being Micronesian. Funafuti's people originated from Samoa. The ancestors, after one of which the atoll is named, first settled on Funafala island before shifting to Fongafale. During that time people from Kiribati and Tonga raided Funafuti and a number of people of mixed ancestry were born. There were also later arrivals from Samoa, Uvea and Futuna bringing with them pulaka roots which they planted in swamps to increase the food supply. Feuding among the people led to the formation of two groups, one on the island of Mulitefala and another on Fongafale. Disputes over land boundaries and redistribution occurred until the coming of the Samoan pastors who brought the chiefly (aliki) system to an end (McLean and Hosking, 1992).

The Tuvaluan language and English are the national languages of Tuvalu. Tuvaluan is of the Ellicean group of Polynesian languages, distantly related to all other Polynesian languages. Tuvaluan is spoken by almost everyone, while English is not spoken in daily use.

Funafuti's population structure and composition for 2021 is shown in Figure 40. As can be seen, most of the population is below the age of 40, with the median age in 2020 being 24.9 years old (Figure 41)

[42] https://www.worldometers.info/world-population/tuvalu-population/
[43] https://stats.gov.tv/category/population-and-social/ accessed 1/6/24
[44] https://www.worldometers.info/world-population/tuvalu-population/ accessed 28/1/24

and women make up just over half the total population. In 2020[45], about 82% of households were headed by males and 18% were headed by females.

The elderly population is defined as those aged 60 years and above and it has continued to increase over the years. In 1991 there were 249 elderly; then, in 2002 it increased to 289; in 2011, it increased to 352 people, and in 2021 increased to 697. The sex ratio shows that there are more females then males from 1991, 2002 and 2012 (Figure 41).

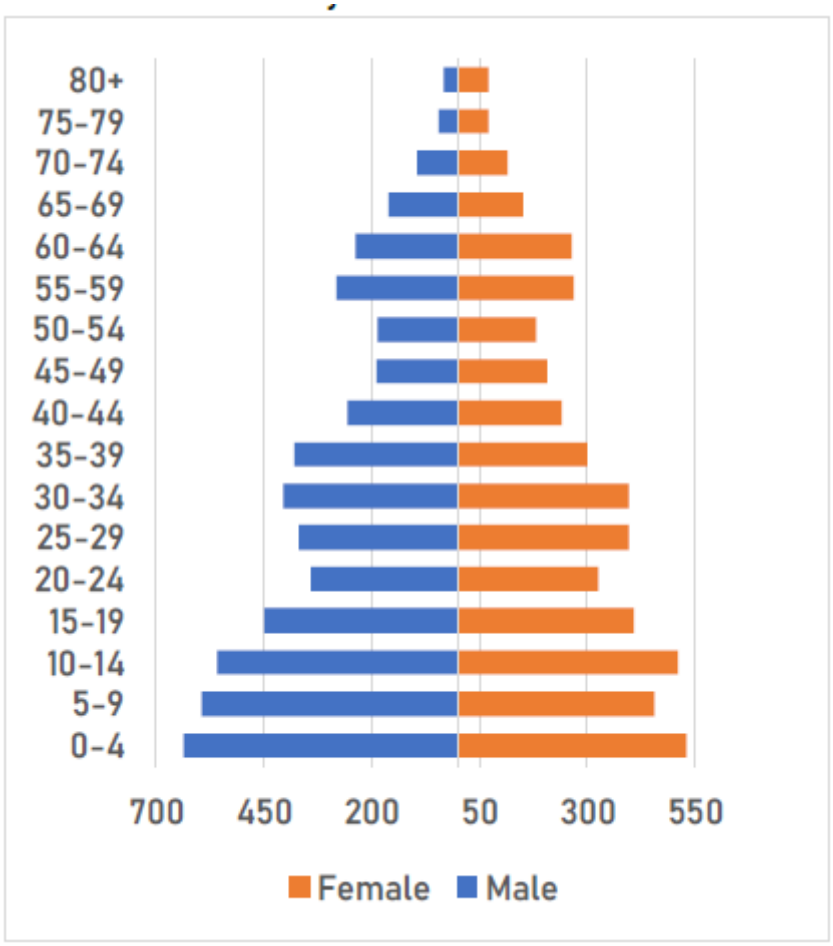


Figure 40: 2021Funafuti population structure by age and gender[46]

[45] https://asiapacific.unwomen.org/sites/default/files/2022-12/UN_WOMEN_TUVALU.pdf
[46]Tuvalu Central Statistics Division, Social Statistices Release – Vita, Migration and Population Estimates, Release 2-2024

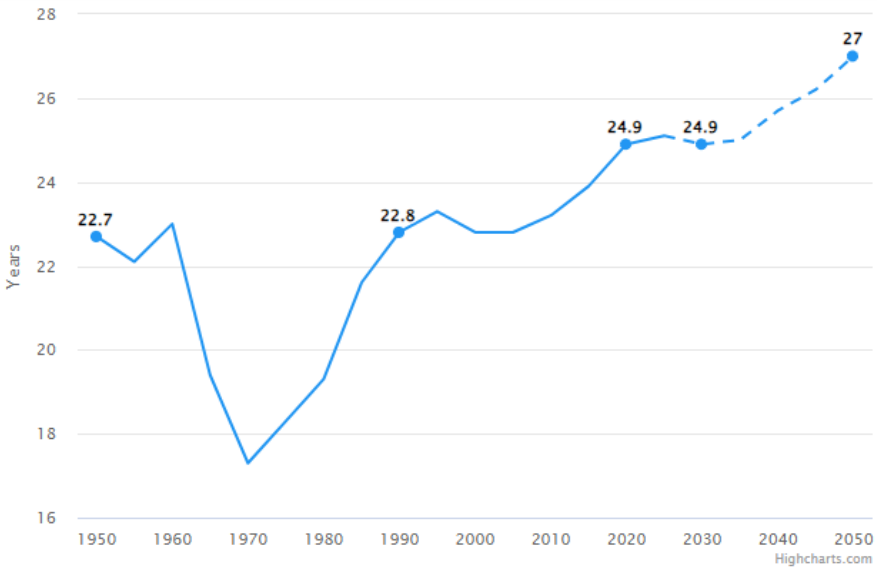


Figure 41 median age of total population (1950-2050)[47]

5.3 Gender Equality and Empowerment of Women

Tuvalu, although primarily a patriarchal and patrilineal society, has evidence of matrilineal practices. A traditional society is under the leadership of the *ulu aliki* (chief) supported by the *matai,* which are the heads of family units (Oxfam in the Pacific, 2020). Traditionally, women are responsible for domestic duties and child rearing, while men tend to work outside the home in areas such as fishing and subsistence farming. Traditionally, it is not common for women to hold positions of *ulu aliki* or *matai*; however, with recent developments in gender empowerment, women have taken up leadership roles as *matai*, Kaupule members, and Kaupule presidents or Pule Kaupule(s) (OIP,2020).

In terms of population proportions, women have been under-represented in parliament since independence in 1978. In the 2017 Mini Census Preliminary Report, 48.6% of the total population were women and, so far, there have only been three female parliamentarians at different periods, with very low numbers of electoral candidacies. In the 2010 elections, no women were elected, but following a bi-election due to the death of a member of parliament, Hon Pelenika Isaia was elected.

Tuvalu has been progressive in its efforts to improve gender equality by ratifying the Convention on Elimination of all Forms of Discrimination against Women in 1999. Immediately after ratification the GoT developed its first National Women Policy in 1999, which in 2014, became the Tuvalu National Gender Policy. A Strategic Action Plan with five key areas was also developed to support the implementation of the policy and climate change and environmental issues – gender was one of them. Integration of gender into budgets and annual plans is mandatory across all ministries. (Oxfam in the Pacific, 2020).

The Government of Tuvalu continues to support women's empowerment and seeks to increase levels of participation of women in all aspects of community life. Culturally, Tuvaluans continue to fall in line with traditional family systems, with the mother responsible for caring for the children and domestic duties and the father tending to the subsistence farm or other types of work outside the home.

The laws of Tuvalu allow equal eligibility to men and women to enter parliament, however representation remains low. Since independence, only three women have been elected to the National Parliament. In the 2015 elections, 3 of the 29 candidates who stood for elections were women. There were only three women candidates (10%) – Dr Puakena Boreham and Pelenike Tekinene Isaia, who were both vying for the two seats of the Nui Electoral District, and Hilia Vavae

[47] https://www.population-trends-asiapacific.org/data/TUV

from the Nanumea Electoral District. Dr Puakene Boreham was the only woman who won her seat, being the one woman in a 15-member parliament. Dr. Boreham was again the only woman MP following the 2019 elections, where 3 of the 29 candidates that ran were women. However, in the recent 2024 elections, Dr Boreham was the only female candidate, but failed to get re-elected.

Funafuti has a women's association known as "Malosiga" for 18- to 60-year-olds. The Malosiga supports community development under the leadership of a President (Pelesitene), Secretary (Failautusi), and Treasurer (Teu Tupe). Apart from the normal domestic duties, members of the association execute decisions made by the Falekaupule that concern women's roles and division of labor in society. Their roles revolve around cleaning and preparing the meeting hall, catering for community functions, weaving mats to floor the Maneapa, and preparing meals for community builders and workers tasked with maintaining the water cistern, maneapa, and multi-purpose court. Women of Funafuti and all women from other islands are known for leading community fundraising drives.[48]

Women on Funafuti, including those that have migrated from the outer islands, glean the reefs for shellfish (seashells) for handicraft[49] as well as weave mats for commercial purposes. Making of garlands and selling food are other common subsistence activities. The Malosiga Association is central to community development in Funafuti.

5.3.1 Gender Based Violence

Like many patriarchal societies, domestic violence is common to everyday life in Tuvalu. Forty percent of women have experienced physical and/or sexual violence in their lifetime (Pacific Women 2017). Eight percent of women experienced physical violence during their pregnancy. Most cases of violence towards women reported are caused by a current spouse or intimate partner (90%), and others are due to sibling hostility (8%). Almost one in five women (21%) have experienced sexual violence, with 13% of women attesting that their first sexual encounter was involuntary.

5.3.1.1 Sex Work and Trafficking

There is currently limited documentation on sex work and none on trafficking on Tuvalu. However, anecdotal, and documented evidence suggest that sex work, driven by poverty, may be occurring, especially among foreign as well as local seafarers who reside on Funafuti and while trans-shipping. Associated risks to sex work may be emotional and/or physical violence, sexually transmitted diseases (STDs), unwanted pregnancies and associated unsafe abortion, and social stigmatization, although there is currently no documented evidence of such phenomena in Tuvalu.

Although there is no evidence of human trafficking in Tuvalu, the Attorney General's office is in the process of signing an international convention on human trafficking to address this issue 'in theory' and ensure that legal frameworks would cover this case if there were issues.

5.4 EDUCATION

As an atoll island with limited resources, capacity, and options, the GoT has prioritized education to enable its citizens to acquire knowledge and skills that may make them employable to international and regional labour markets. The country allocates about a fifth of its national annual budget to the education sector.

[48] Kofe, S, and Taomia, F. 2007. Advancing Women's Political Participation in Tuvalu. A Research Project Commissioned by the Pacific Islands Forum Secretariat (PIFS). Accessed 20 August 2019 from https://bit.ly/2NnDLEs

[49] Government of Tuvalu, 2017, Te Palani Tuatua mo Mea Ola ite Papa o Funafuti: Funafuti Reef Fisheries Stewardship Plan Accessed on 10th August from https://www.tuvalufisheries.tv/wp-content/uploads/2017/12/FRFSP-231117-web.pdf

There are two primary schools; one is administered by the government and the other by the Seventh Day Adventist Church. Compared to the rest of the group, Funafuti has the highest teacher–pupil ratio and also recorded a 95% average student attendance.

Funafuti hosts one of Tuvalu's two secondary schools, and this is operated by the Ekal EIA Tuvalu, Church of Tuvalu (EKT) as well as being subsidized by the Government of Tuvalu. From 2004–2014, an Augmented Foundation Program was operated from the University of the South Pacific (USP) Tuvalu Campus, bridging sixth form students to enter tertiary education outside Tuvalu. In 2014, this special education project was discontinued and relocated to Motufoua Secondary School on the Island of Vaitupu.

The University of the South Pacific is the only regional institute for tertiary education that is accessible and available to the public. The institute provides education for Form 7, Foundation, Certificate, Diploma, and Degree level.

5.5 HEALTH

The Princess Margaret Hospital in Funafuti is the country's only hospital and is the primary provider of medical services for all islands of Tuvalu. The hospital is located about 1.3km north from the center of Fogafale. The hospital has 50 beds and offers basic routine medical, surgical, obstetric, and gynaecological services.

There are no private formal medical services on Funafuti. NGOs such as the Tuvalu Red Cross Society, Fusi Alofa (for the care and rehabilitation of disabled children), the Tuvalu Family Health Association, and the Tuvalu Diabetics Association all have offices in Funafuti.

Non-communicable diseases (NCDs) [50] are a common and major health issue in Tuvalu. In the 2012 census, Funafuti recorded 15.5% NCD cases across all islands, higher than the national average of 11.1%. Lifestyle was the most common link to NCDs (24.1%). Injuries and accidents also made up 15.8% of illnesses. Funafuti also has the highest percentage of communicable disease (CD) cases nationally, making up 19.4%. Most CD cases (76.9%) were skin diseases, with the majority being septic sores, skin rash or abscess.

Tuvalu did not have community outbreaks of COVID19 until September 2022, when the country lifted its strict travel restrictions.

5.6 ECONOMY AND EMPLOYMENT

Tuvalu's economy is highly dependent on foreign earnings and official aid. Foreign earnings include interest received from the Tuvalu Trust Fund (TTF) and the Falekaupule Trust Fund (FTF), fisheries licensing, .tv, remittances from migrant labour and Tuvaluans residing abroad. Official aid is from Australia, China, EU, Japan, New Zealand, World Bank, ADB, UN agencies, Pacific regional development agencies, and others. Gross National Income (GNI) is considered to be a more useful measure to economic activity in Tuvalu compared with gross domestic product due to this high dependence on foreign earnings. GNI per capita averaged US$7,2310 in 2022 (an increase of 5.56% from 2021) has been recognized as an Least Developed Country (LDC) since 1986. There are few career-oriented opportunities outside the government with slow growth in the private sector.

Within the monetary-based economy a significant portion is from public sector employment, although other sources of cash income are sourced from rent, land lease, and pensions as well as remittances, self-employment or ad-hoc businesses. According to the 2017 PHMCP report,10 71.43 per cent (7,143) of the total population (10,645) were in the working age group (15 years old and above). Of

[50] Common types of NCD are body aches and pains which relates to headache, backache, toothache, unspecified abdominal pain, lifestyle diseases (diabetes, hypertension, arthritis/gout, obesity and heart disease)

this, 3,518 were economically active, 2,517 were in some form of employment, and 1,001 were unemployed. In 2016 Tuvalu's total labour force participation has been around 55 per cent with 70.5 per cent men and nearly 39 per cent women actively employed.[51]

The government is the main employment provider in Funafuti employing approximately 45% of the employed population. Businesses in the private sectors employ 20% of the employed, followed by public corporations and NGOs at approximately 10% each.

There is a growing interest in self-employment, with many having graduated into successful entrepreneurs. These ventures, including canteens, bike hire, shops, printing, fuel, construction and other. Other self-employment schemes include handicraft designers, freelance workers (consultants, agents, media), food and textiles, mechanics, carpenters and commercial fishers.

5.7 Subsistence

Traditional subsistence activities on Fogafale are very limited, mainly because it is largely an urban settlement with a relatively high population, most of whom have migrated from the outer islands. Therefore, access to land for agricultural purposes and other subsistence activities is very limited. Most of the relatively limited subsistence activities related to livestock rearing (mainly piggeries), fishing, vegetable or crop gardening, toddy cutting and handicraft making.

Farming or home gardening for subsistence purposes is being practiced at a minimal rate due to the shortage of available land. Livestock farming (pigs, chicken, ducks) is a more common subsistence activity.

5.8 Island Structure and Governance

Decision-making structure and governance are uniform across the islands of Tuvalu. Tuvalu is a unitary constitutional monarchy with two spheres of government: national and local. The legal basis for Tuvalu local government is the Falekaupule Act 1997.

The governance system, as it applies in Funafuti, is shown in Figure 42. The Act constitutes the "Falekaupule," a traditional assembly, as the ultimate decision-maker. It is defined as the "traditional assembly that is composed according to the local customs of each island." The local government structures consist of three main bodies: the Falekaupule, the Kaupule that is the executive arm of the Falekaupule, and the Falekaupule Assembly.

All island affairs are discussed and debated at the Falekaupule Assembly, a consultative forum which includes everyone above the age of 18. The assembly is operated under the leadership of the "aliki" or "pule fenua" and the "matai(s)" of the island. The Falekaupule normally holds its meetings monthly, where they are briefed on minutes of the Island Kaupule meetings and on issues that concern the community.

[51] https://publications.iom.int/system/files/pdf/powering-past-the-pandemic_1.pdf

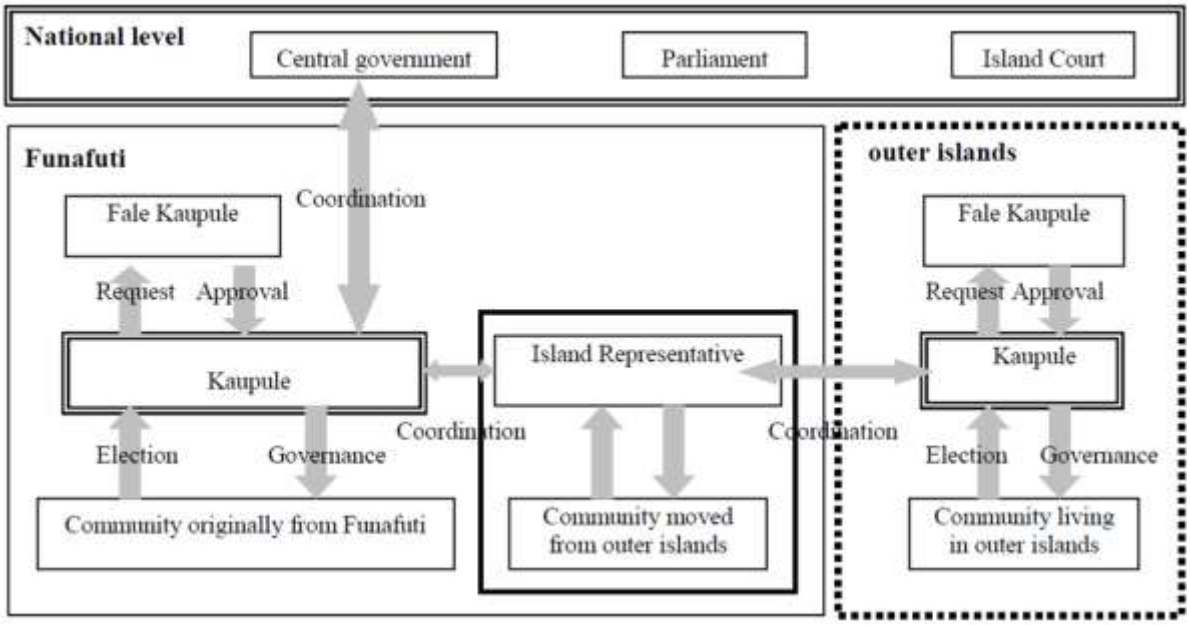


Figure 42: Governance system in Tuvalu

In accordance with the Act, the Falekaupule assembly is obliged to convene a meeting once every three months to discuss traditional and development matters. The current practice is that meetings are conducted monthly and whenever there is an urgent matter to discuss before the monthly meeting. From the meeting minutes, all the motions agreed upon will be executed by the Kaupule.

The Kaupule is operated with the support of staff and executives or Kaupule members remunerated by the Government under the MHARD. Funafuti Kaupule, the executive arm, is the mediator between the traditional Falekaupule and the government through Ministry of Home Affairs, Rural Development (MHARD) for all development initiatives on the island. The operation of the executive arm and Funafuti's developments are also supported by their Falekaupule Trust Fund.

Funafuti's Kaupule arrangement is unique from the rest of the islands. The members of the Kaupule are selected not only by the registered Funafuti people, but by all the people residing on Funafuti. There are six members altogether, including the Pule Kaupule, Chief Executive.[52] Each Kaupule is assigned to look after the different developmental sectors. Since the government's main infrastructure and ministries are located on Fogafale, the Funafuti Kaupule and Falekaupule are privileged to information, projects, and other aid assistances. At times, the jurisdictions of the two, Funafuti Kaupule and government, clash, creating confusions amongst the residents. This can be an issue in governing and managing developments in Funafuti.

5.9 Community Services

5.9.1 Solid Waste Management

The Tuvalu Department of Environment advocates good waste management practices. The preferred hierarchy and principles for achieving this are: (i) waste avoidance (avoiding using unnecessary material on the project); (ii) waste re-use (re-use material and reduce disposing); (iii) waste recycling (recycling materials such as cans, bottles, etc.); and (iv) waste disposal (all other waste to be dumped at approved landfills).

[52] Corbett, J & Fraenkel, J, 2015, Tuvalu.

In Funafuti, approximately 75% of households have their waste collected by the Island Kaupule. The households who don't use the collection service dispose their waste either in their own backyards/sea/dump; by burning; burying their waste; or recycling / composting their waste.

Figure 43 shows that households located within the main village area such as Tekavatoetoe, Vaiaku, Alapi, Senala, and Fakaifou have the most households with waste collected by the Island Kaupule. However, households that are located at the far end of the island and outside the main village mostly dispose of their waste in the vicinity of their homes.

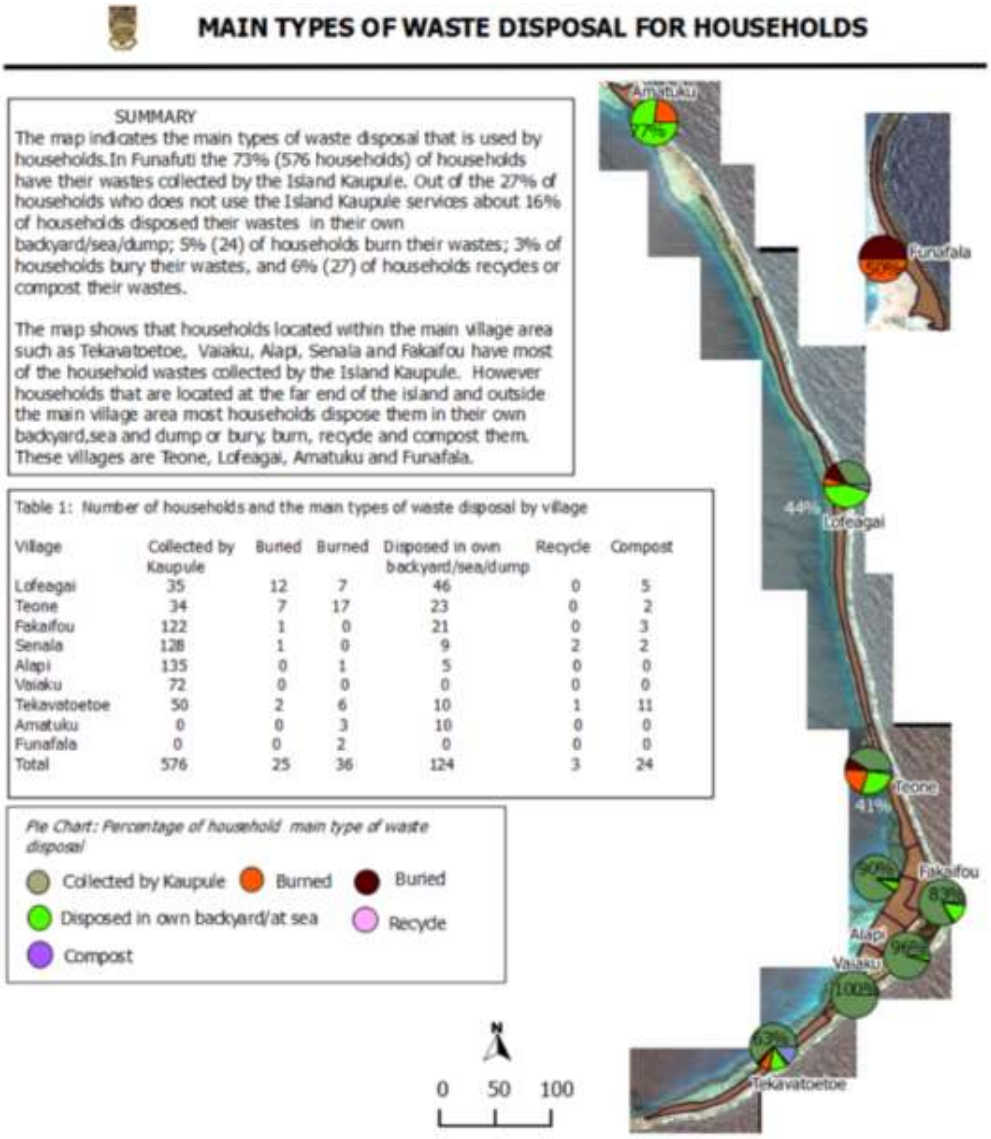


Figure 43: Main types of waste disposal by household in each village

5.9.2 Water

As identified in their Island Strategic Plan 2016-2020[53], accessing and having sufficient safe clean water is a priority for Funafuti and demand has increased with population expansion. Prior to the 2011 severe drought, the Australian Aid Agency, in collaboration with the European Union, funded the distribution of one 10,000L water tank to each household on Funafuti. This did not meet the demand of the residents during the drought era, and, under a state of emergency, the government

[53] Kaupule Funafuti, 2016, Moeakiga o Malefatuga II: Funafuti Strategic Plan 2016-2020

rationed each household with 20 litres of water per day.[54] Consequently, other projects such as Tuvalu Waste, Water and Sanitation supplied second water tanks to each household. The PACC and PACC+ projects also built communal cisterns for communities in Kavatoetoe and Lofeagai as adaptation initiatives.

Apart from the household water storage facilities, there are a few communal water cisterns built and managed by the Falekaupule, churches and government. Total storage capacity amounted to 1,254,387 gallons according to the 2012 census. During the drought events and particularly the 2011 catastrophe, the Funafuti Kaupule has been effective in rationing from its reserves to meet community needs.

According to the 2012 census, there are 788 households in total, 66% of which have water tanks, 28% have both a water tank and a water cistern, 2% just have a water cistern and the other 2% have neither. A contributing factor to shortage of safe clean drinking water is due to a significant proportion of households having inadequate rainfall catchment systems or lack proper maintained guttering and down pipes. Of the 788 households, 235 reported catchment/guttering problems.

5.9.3 Energy Sources

Tuvalu aims to achieve 100% renewable energy by 2025.[55] The government-owned Tuvalu Electricity Corporation operates a large diesel power station (2000kW) and as well as solar arrays (approximately 750kW). At present, renewables have a penetration of approximately 19%. The main source of energy for Funafuti is via a diesel generator that requires 110, 400 litres monthly, equating to 1,324,800 annually.

Electricity is accessible 24 hours to all subscribed households.

5.9.4 Transportation

Tuvalu's usual forms of transport are small pickup trucks, motorcycles, and bicycles. Motorbikes are the most common form of transport used on the island. There is a small road network on Funafuti. Cargo and private vessels are used between the islands and islands.

Figure 44 highlights the speed of change in modes of transport, with the rapid uptake of motorbikes and cars continuing today.

[54] Kaupule Funafuti, 2016, Moeakiga o Malefatuga II: Funafuti Strategic Plan 2016-2020
[55] Tuvalu Climate Change Portal available at https://www.pacificclimatechange.net/country/tuvalu

PERCENTAGE OF LAND TRANSPORTATIONS THAT IS USED ON THE ISLAND BY VILLAGE AND TYPE.

Table 1: Total number of land tranportation by type and by village

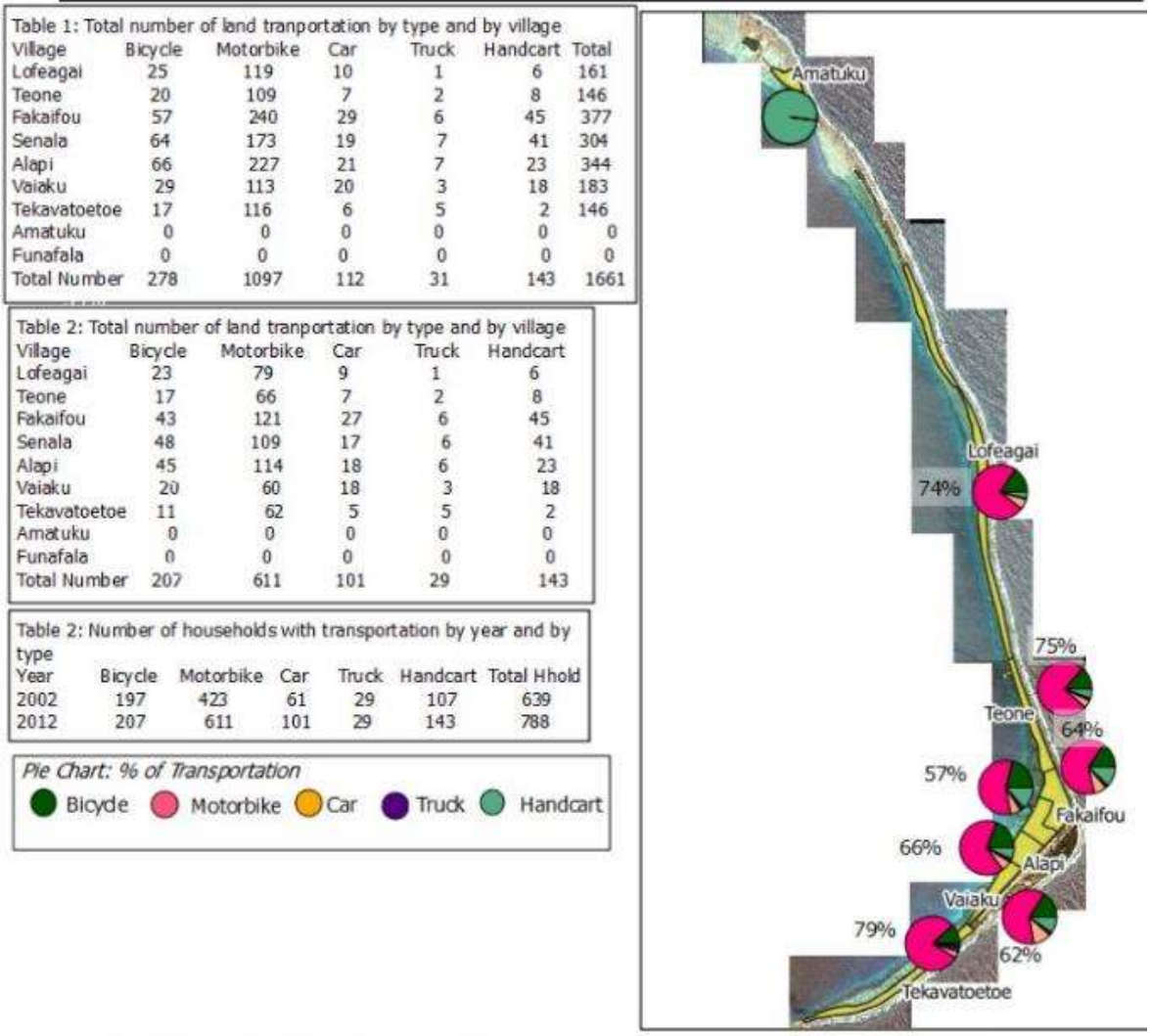
Village	Bicycle	Motorbike	Car	Truck	Handcart	Total
Lofeagai	25	119	10	1	6	161
Teone	20	109	7	2	8	146
Fakaifou	57	240	29	6	45	377
Senala	64	173	19	7	41	304
Alapi	66	227	21	7	23	344
Vaiaku	29	113	20	3	18	183
Tekavatoetoe	17	116	6	5	2	146
Amatuku	0	0	0	0	0	0
Funafala	0	0	0	0	0	0
Total Number	278	1097	112	31	143	1661

Table 2: Total number of land tranportation by type and by village

Village	Bicycle	Motorbike	Car	Truck	Handcart
Lofeagai	23	79	9	1	6
Teone	17	66	7	2	8
Fakaifou	43	121	27	6	45
Senala	48	109	17	6	41
Alapi	45	114	18	6	23
Vaiaku	20	60	18	3	18
Tekavatoetoe	11	62	5	5	2
Amatuku	0	0	0	0	0
Funafala	0	0	0	0	0
Total Number	207	611	101	29	143

Table 2: Number of households with transportation by year and by type

Year	Bicycle	Motorbike	Car	Truck	Handcart	Total Hhold
2002	197	423	61	29	107	639
2012	207	611	101	29	143	788



Disclaimer: Map created by SLG II Project with data sourced from IPS 2011/12 and Census 2002. Geographical boundarys are not exact/legal areas but are based on census boundaries.

Figure 44: Percentage of land transport that is used on the island by village

Sea Transport: The map and date presented in Figure 45 indicates the types of sea transportation used in households. There has been an increase in households that have a means of sea transportation since the 2002 census.

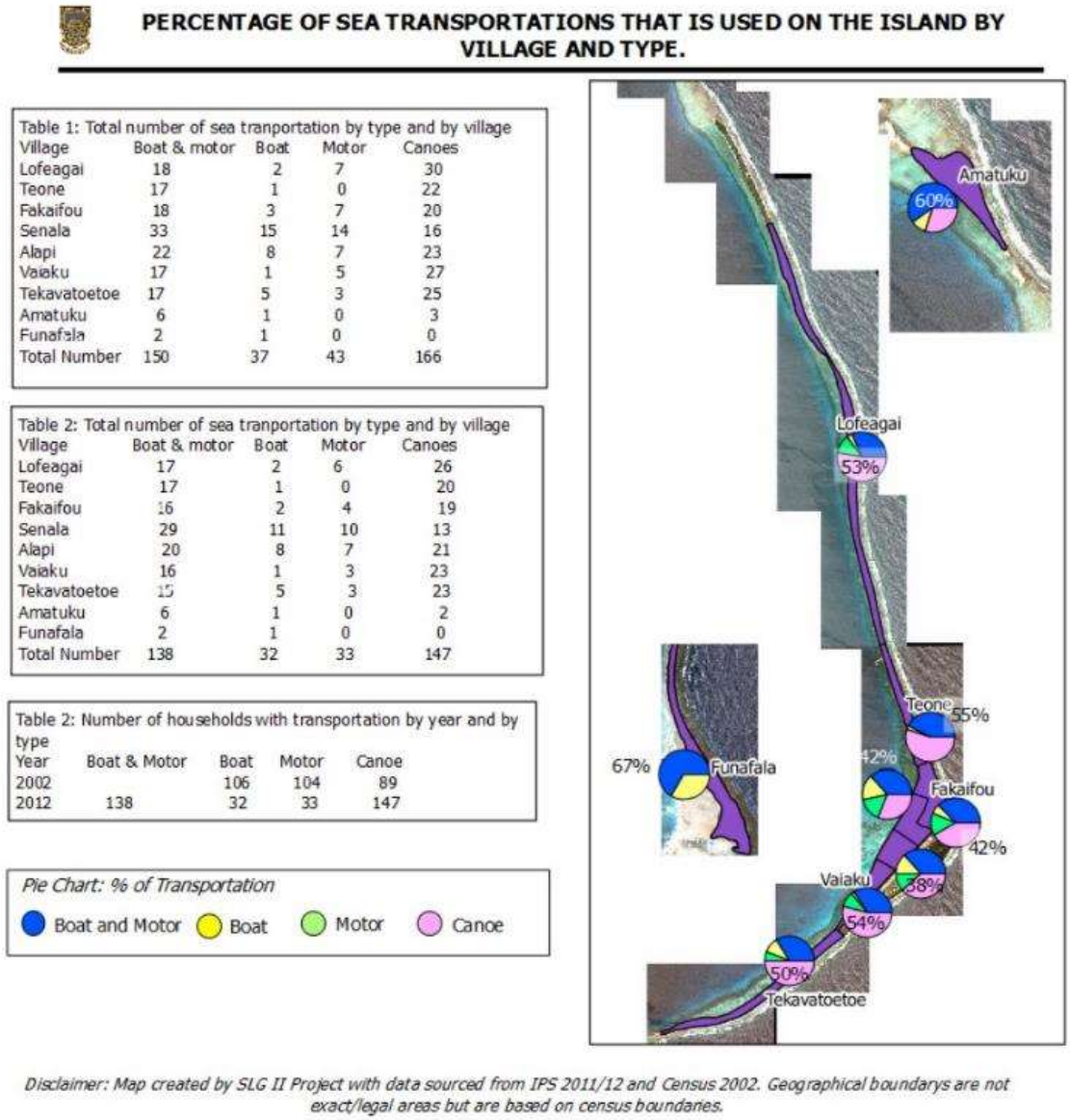


Figure 45: Percentage of sea transport that is use on the island by village

5.9.5 Communication

The communication industry in Tuvalu is a government-owned monopoly via the Tuvalu Telecommunication Corporation (TTC). Connectivity within Funafuti and with the outer islands has changed significantly since the TTC upgraded the country's internet infrastructure to fourth generation broadband cellular network technology (4G) in late 2018. Since the upgrade, mobile phones have become a key medium of communication and information access in Funafuti. TTC services include internet, fax, telephones, and emergency satellite phones. The Tuvalu government has a contract with a satellite broadband internet provider Kacific, which has a geostationary satellite.[56] It is anticipated that Starlink will also become available within Tuvalu in the future.

Communications and information sourcing has shifted significantly towards the use of mobile phones to access the internet and social media, particularly Facebook, with the use of Messenger, Viber and

[56] https://kacific.com/news/tuvalu-government-signs-agreement-with-kacific-for-wide-ranging-suite-of-connectivity-services/

Skype increasingly used to communicate with relatives and friends within Funafuti, with the outer islands as well as with family, friends and business associates and networks overseas.

5.10 Cultural Heritage Resources

Culture shapes the way people live and thrive in Tuvalu's atoll environment. Tuvalu's culture is generally characterized largely by communal values, whereby extended family and kinship networks channel the flow of knowledge and resources within and between islands as well extending to relatives abroad. Shaped largely by a history of atoll life and journeys, Tuvalu's communal culture has been a source of community resilience in times of pressure stemming from disasters, climate change, and other pressures.

Tuvalu is rich in tangible cultural and natural heritage (e.g. monuments, artistic creations) and intangible (practices, stories, dances, expressions, knowledge, and skills) cultural heritage. The 2003 Convention for the Safeguarding of Intangible Cultural Heritage (ICH) specifies the interdependencies between the types of cultural heritage and the importance of the latter to cultural diversity and driving sustainable development[57]. Some of the more significant examples of ICH are the fatele (traditional song and dance performance), alofa (presentation of performing arts and gifts such as mats and handicrafts to conclude visitors' welcome events), and traditional craftsmanship such as mat-weaving, fan-making, and shell necklace-making[58]. Other key elements of ICH include pulaka (giant swamp taro) agriculture, traditional community fishing practices, canoe-building, and Te Ano games (cross between volleyball and murderball) played on communal malae (ground), all of which support wellbeing and livelihoods.[59] [60]

The outer island communities present in Funafuti each have their own mwaneaba and function as a cohesive social unit as such. The mwaneaba is where the respective fatele and alofa is performed and where communal decisions and planning is done in a way that is supplementary to the functions of the Kaupule based in their home islands.

Traditional canoes and fishing are still evident in Tuvalu, although not as visible in Funafuti as in the outer islands. The outrigger canoes are made from local trees that are now hard to find in Funafuti. The fetau tree (*Calophyllum inophyllum*) is mostly used for the main hull (vaka) and outrigger beams (kiato), whereas the lighter-weight puka (*Hernandia nymphaeifolia*) is used for the outrigger (ama). The few traditional canoes present in Funafuti are sourced from the outer islands, Nanumea in particular. The declining number of fetau trees for canoe building in the outer islands may determine the continued transmission of this cultural heritage in Funafuti.

[57] https://resources.riches-project.eu/glossary/tangible-and-intangible-cultural-heritage/#:~:text='Tangible%20Cultural%20Heritage'%20refers%20to,transmitted%20intergenerationally%20in%20a%20society.

[58] Government of Tuvalu, 2018, Tuvalu National Culture Policy Strategic Plan 2018-2024, Published by the Government of Tuvalu (http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Apia/pdf/265528e_compressed.pdf)

[59] https://blog.tepapa.govt.nz/2013/10/01/a-cross-between-volleyball-and-murderball-te-ano-national-game-of-tuvalu/

[60] file:///D:/Users/dumaru_p.LAUCALA/Downloads/TRAD8_20_Passfield.pdf

6 STAKEHOLDER ENGAGEMENT AND CONSULTATION

Building on the community consultations already undertaken by TCAP, major engagement activities are yet to commence for TCAPII. This section will summarise the engagement activities prior to completion of the final ESIA.

6.1 STAKEHOLDER GROUPS

Stakeholder groups applicable to TCAP II are described below.

6.1.1 National Government Authorities

National authorities are defined as those agencies of the GoT who have the power to regulate or influence the Project in terms of granting permits or other approvals for the Project, and monitoring and enforcing compliance with GoT law throughout the project implementation cycle. Productive ongoing dialogue with these national authorities will be had throughout project implementation. Key Ministries for TCAPII will include:

- Ministry of Finance
- Ministry of Public Utilities and Environment
- Ministry of Transport, Energy and Tourism
- Ministry for Local Government and Agriculture
- Ministry for Health, Social Welfare and Gender

6.1.2 Local Government

The Kaupule Island Administration: The Kaupule will be particularly critical for mediating local issues and consultations with the wider community.

6.1.3 Project Affected Communities and Individuals

This group includes all people who may be directly or indirectly affected by the TCAPII, especially households, fisher folk and boat owners that live adjacent to the proposed reclamation area. This community comprises both Funafuti landowners and settlers from the outer islands.

Women's Groups: The Tuvalu National Council of Women (TNCW) is an NGO that was set up in the late 1970's to direct and manage women's affairs and their issues. The council consists of elected women and are the formal link between Government and women's communities. TNCW has provided support in the area of women's political participation, women's handicrafts, legal literacy and trainings on gender-based violence and child abuse and exploitation.

All women above the age of 18 years become part of their respective island's women's organization, which has office bearers consisting of the president, treasurer and secretary who serves a 2-year term before there is an election for the next office bearers. The women are presented at the Kaupule via the women's community officer, whose role is to ensure development activities and funding is channelled to support women's needs and interests.

Churches, Schools, and Health Clinics: The majority of church members on Funafuti are members of the Christian Church of Tuvalu, with smaller numbers of the Seventh Day Adventist, Jehovah's Witnesses, and Baha'i faiths. Like many Pacific Island societies, churches are a central part of communal and cultural life, with most community members attending Sunday services as well as weekday prayer and fellowship group activities. It will be important for the TCAPII to initiate engagement with the main faith-based institutions of each island as they will provide opportunities to

effectively communicate and disseminate information about the TCAPII activities in a way that is sensitive to community beliefs and world views.

6.1.4 Civil Society and NGOs

This group includes smaller groups in society who may have an interest in the TCAP and its social and environmental aspects. On Funafuti, there exists an umbrella organisation of NGO's called the Tuvalu Association of NGOs (TANGO).

TANGO was established in 1986 and has a membership of approximately 48 members. TANGO's core role is to provide a policy voice within government and provide information and communication to its members and the local community. Other activities include capacity building, project and program coordination, fundraising and resource mobilization.

The Tuvalu National Council of Women (TNCW) is a Non-Governmental Organisation (NGO) set up to manage women's affairs and their issues. TNCW continues to provide support in the area of women's political participation, women's handicrafts, legal literacy and training on gender-based violence and child abuse and exploitation.

Disability Persons Organisations (DPOs) will be consulted throughout the TCAP lifecycle. Fusi Alofa is the only DPO currently located in Tuvalu.

6.2 The Stakeholder Engagement and Consultation Program

The SEP maps out the stakeholders to be consulted over the duration of the project and the mechanisms/mediums to be employed to engage with them. This ESIA builds upon previous consultations by the TCAP team, the SEP incorporates activities already undertaken as well as planned future consultations. The SEP will be updated and refined throughout the lifecycle of the Project. During this process, the focus and scope of the SEP will change to reflect the varying stages of project implementation and to encompass any changes to project design.

6.2.1 Engagement Mediums

Table 2 below lists the recommended engagement mediums that are appropriate for SEP activities proposed as part of the implementation plan components in Table 10.

The mode of consultation will vary according to the sub-project and the participants, but in all cases will promote participation by ensuring that the venue is accessible, the timing convenient and the manner of conduct of the consultation is socially and culturally appropriate. Consultations will be announced to give sufficient notice for participants to prepare and provide input to project design.

Table 2: Recommended Engagement Mediums for TCAPII Project Stakeholders

Medium	Description
Stakeholder Meetings	
Focus Group Meetings	The aim of a focus group is to pull together stakeholders with the same interest into a single meeting to discuss issues. Meetings usually have a very specific objective which is aligned with the expectations and interest of the stakeholders' present.
Community based consultations	These consultations are focused on identifying and discussing stakeholder concerns or to provide feedback using detailed information. These consultations should, wherever feasible, be held within the community environment.
Written / visual communications	
Project Information Bulletin	This needs to be a short and concise document provided in jargon-free information describing the project actions, the potential social and environmental impacts, the need for the project and the contact details for the project team.
Notice boards	Notice boards (community and work site entrances) are a good tool to use for communication of up-to-date project information such as timing and duration of works, upcoming consultations, project progress and other relevant project information.
Letters	Formal method of communication usually intended to convey very specific messages. Alternatively, it is used as a formal method for request of information.
Emails	Using emails for in-country stakeholders can pose a challenge because of limited internet access due to insufficient telecommunications and/or supporting IT infrastructure. NGOs and most of the Government Ministries do have access to email which can be utilised for communications but arranging of formal community consultations is best arranged through other methods of communication.
Media	
Internet	With 4G internet access, the public may have better access to knowledge and information about the project via the TCAP website, Facebook page and Twitter account. The website and social media accounts may be used to update the public on implemented and planned activities as well as announcements.
Radio	In Tuvalu, radio is the primary medium for raising awareness and prepare stakeholders for larger events or refined communication to take place.
Other	
PMU	PMUs will be the 'familiar faces' of the project and will, for many stakeholders at the community level, represent the most direct channel to the project.
Telephone	Use of the telephone / mobile phone is still regarded as the preferred method for communication because of accessibility and speed. Having a discussion over a phone in order to ensure mutual understanding between two parties is quicker and easier compared to sending an email, waiting for reply.

6.2.2 Implementation Plan

The Implementation Plan (Table 3) for the TCAP Project lifecycle constitutes the following components:

- **Activity**: the various operational consultation activities that will be undertaken as part of the SEP
- **Objective:** the target that each activity needs to reach
- **Stakeholder:** the various stakeholders to be targeted during implementation of the SECP activity; and
- **Medium:** the method by which the engagement or consultation will be done.

Table 3: Preliminary Stakeholder Engagement and Consultation Implementation Plan

No	TCAP Project Activity	Timetable	Objective	Stakeholders	Medium
A: Physical Investments (Funafuti)					
A1	Proposed site, preliminary design, and early ESIA works	From Project initiation through to tendering.	Bring stakeholders into the decision making around the site and design. Discuss potential impacts and mitigation measures.	All identified	Community Consultations Focused group meetings Public meetings Website and social media Emails and letters
A2	Disclosure of updates to the ESIA	Prior to works starting (development of C-ESMP)	To disclose ESIA	All identified	Website and social media Hardcopy on public display
			Advise stakeholders of final design, construction methods and updated mitigation and management plan. Stakeholder awareness of GRM	Communities Site occupants (State owned enterprises. Government agencies) Site users with focus on boatowners (if different from above)	One-on-one meetings Community consultations Executive Summary
A5	Commencement of Works	Week before commencement of works.	To advise all stakeholders of commencement of civil works.	All identified stakeholders	Radio Social Media Email

No	TCAP Project Activity	Timetable	Objective	Stakeholders	Medium
				Site occupants (State owned enterprises. Government agencies)	One on one meetings
			To reconfirm ongoing consultation, feedback and complaints processes	Community Site occupants (State owned enterprises. Government agencies)	Community Notice Boards Social media Community consultations Website

6.3 Resources and Responsibilities

The PMU will take the lead role in the implementation of the SEP and will be responsible for arranging and facilitating the meetings. The PMU will also be the focal point for all stakeholder queries and contacts in relation to the implementation of the SEP.

6.4 Public Consultations to Date

Extensive stakeholder engagement was undertaken as part of TCAP and included many of the same stakeholders as TCAPII will, therefore this could be considered an extension of that consultation.

It was as a result of the successful completion of the TCAP reclamation works that the Government of Tuvalu commenced discussions with donor agencies, in particular DFAT, regarding the possibility of a second stage: TCAPII.

Once the Australian government indicated that it would provide significant funding for TCAPII, work on concept designs and early impact assessment commenced – this work has drawn heavily from the experiences of TCAP, including the early design discussions where the community indicated their concerns and the features that they would look for in a reclamation.

As part of the ESIA development, in line with UNDP SES requirements, formal consultation with key stakeholders has been undertaken. The purpose of the consultation was to:

- Provide stakeholders with an understanding of the scope of the proposed TCAPII Funafuti Reclamation
- Describe the design and baseline work undertaken to date
- Describe the ESIA process
- Provide an overview of the ESIA findings to date
- Obtain feedback and input from the stakeholders regarding the project
- Make stakeholders aware of the draft ESIA that is available online
- Make stakeholders aware of their ability to continue to provide feedback to the project team, in particular during the formal exhibition period of the ESIA by DoE as part of the legal process, but also at any time.
- Ensure that stakeholders are aware of the Grievance Redress Mechanism and how they can access it.

Informal consultations were held during site visits in February 2024, this included conversations with homeowners, boat owners, and fitness park users who were encountered during the site visits.

Four formal community and stakeholder sessions held were between 6 May and 10 May 2024. These sessions were held at the Tomasi Puapua Convention Centre (TPCC).

Over 60 people attended the sessions in total. The sessions included the following groups of stakeholders:

- Landlords and residents
- Personnel from the Australian High Commission
- Australian Defence Operation
- Department of Public Works
- Department of Lands and Survey
- Department of Climate Change
- Department of Fisheries
- Boat owners
- Members of the Funafuti Kaupule
- Department of Education

Attendees indicated their appreciation of the sessions and the opportunity to be briefed on the proposal and the process going forward. Overall, the attendees supported the project and welcomed the opportunity to raise questions and make suggestions for enhancing the project. The following section summarises the themes raised by attendees.

6.4.1 Summary of Queries Raised During Consultation:

The following themes and queries were raised by participants during the consultation sessions:

- Project naming and ownership
- Approval timeline and responsible authorities for TCAP II.
- Building of local capacity
- Potential for scholarships focusing on climate change adaptation and coastal protection.
- Consider inclusion of boat ramps at either end of reclamation, with northern end presenting opportunity to for large ramp (capable of accepting barges/landing craft) and the formation of a multi-agency boating facility
- Consider inclusion of a breakwater to create a harbour sheltered from westerly winds and inclusion of infrastructure for people living with disability
- Future use of new land and need for planning and obtaining future funding
- Inclusion of coral transplanting in project
- Flooding and drainage
- Construction of boat landing areas on the new reclamation land for safe lagoon access.
- Consideration of creation of a multi-agency boat facility at northern end of reclamation.
- Site access for utilities and emergency services as well as for people living with disability

- Potential to enhance addressing gender issues (eg facilities for women, safety, education opportunities for women.
- Site safety during construction
- Safety routes for boat arrivals from islets.
- Design and maintenance of sandbags for sustainability

6.5 Complaints Register

A complaints register will be established to record any concerns raised by the community during construction. Any complaint will be advised to the UNDP and DoE promptly upon receiving the complaint. The complaint will be investigated and following the investigation, if it relates to a significant incident, the matter will be referred to the UNDP for commentary and/or advice.

6.6 Grievance Redress Mechanism

During the construction and implementation phases of any project, a person or group of people can be adversely affected, directly or indirectly due to the project activities. The grievances that may arise can be related to social issues such as eligibility criteria and entitlements, disruption of services, temporary or permanent loss of livelihoods and other social and cultural issues. Grievances may also be related to environmental issues such as excessive dust generation, damages to infrastructure due to construction related vibrations or transportation of raw material, noise, traffic congestions, decrease in quality or quantity of private/ public surface/ ground water resources during irrigation rehabilitation, damage to home gardens and agricultural lands etc.

Should such a situation arise, there must be a mechanism through which affected parties can resolve such issues in a cordial manner with the project personnel in an efficient, unbiased, transparent, timely and cost-effective manner. To achieve this objective, a grievance redress mechanism has been developed and is being implemented as part of the project.

A Grievance Redress Mechanism (GRM) was developed for TCAP and will be extended to include TCAPII.

The Grievance Redress Mechanism is not a substitute for the legal process. The Grievance Redress Mechanism will as far as practicable, try to resolve complaints and/or grievances on terms that are mutually acceptable to all parties. When making a complaint and/or grievance, all parties must always act, in good faith and should not attempt to delay and or hinder any mutually acceptable resolution.

All complaints and/or grievances regarding social and environmental issues can be received either orally (to the field staff), by phone, in the complaints box or in writing to the TCAPII project team, UNDP, DoE or the Construction Contractor. A key part of the grievance redress mechanism is the requirement to maintain a register of complaints and/or grievances received at the respective project site offices. All complainants shall be treated respectfully, politely and with sensitivity.

7 DETERMINATION OF POTENTIAL IMPACTS

7.1 INTRODUCTION

The planned works have the potential to create a variety of impacts through their implementation. These impacts can be either positive (e.g. improved coastal protection for community members) or negative (e.g. loss of beach access for recreation and fishing) depending on the activity and receptors involved. The potential impacts of the project will be assessed as part of the final ESIA preparation.

The EISA will focus on environmental and social components that could be most affected by the Project and those that are a concern to governments, community members and stakeholders. The components are called Environmental and Social Indicators (ESI). Below are the indicators that have been identified for this Project to date, and the specific factors that will be considered for each in order to undertake the impact assessment.

Table 4: Environmental and Social Indicators and parameters to be considered under each indicator during the impact assessment.

Environmental and Social Indicator	Factors to be considered
Water Quality	• Water quality of coastal marine environment • Management of surface water • Turbidity in marine environment
Erosion, Drainage and Sediment Control	• Sedimentation in coastal marine environment • Management of surface water run off
Coastal Hydrodynamics	• Changes in current regime • Changes in littoral drift • Changes in wave regimes
Air Quality	• Dust generation • Air pollution
Noise and Vibration	• Noise nuisance in sensitive areas • Vulnerability of property to damage from vibration • Noise impacts in marine environment
Flora and Fauna	• Loss of vegetation within the direct project footprint • Degradation of marine habitats • Introduction of new invasive marine or terrestrial species
Waste Management	• Waste production and minimisation • Disposal arrangements of solid project and construction waste

	• Management of hazardous waste • Treatment and disposal of wastewater (black and grey) • UXO/ERW
Chemical and Fuel Management	• Storage and handling of hazardous substances • Contamination of soils and water from spills
Community Services and Infrastructure	• Fishing boat mooring availability • Solid and hazardous waste generation • Vehicles and machinery • Labour influx • Health and other service requirements/demands
Land and Resource Use	• Access to coastal resources • Landscape and land use change
Social Environment	• Gender and social inclusion • Community perceptions and expectations • Employment
Community Health and Safety	• Gender-based violence • Human trafficking • Worker and community safety

8 DESCRIPTION OF POTENTIAL IMPACTS AND MITIGATION MEASURES

8.1 IMPACTS DURING WORKS (CONSTRUCTION)

8.1.1 Terrestrial ecology

The proposed reclamation has limited direct interaction with the terrestrial environment or resources of Fogafale Island beyond the immediate shoreline. The reclamation would overlap with the existing lagoon shore over a length of some 800 m. It is likely that along this "overlap" zone a small amount of sand may spill over (perhaps 2 or 3 m landward) over the existing shoreline environments. As most of the reclamation material will be pumped directly into place, "sand spills" should be minimal, temporary and easy to clean up if they do occur. Vegetation along the upper shoreline should not be significantly impacted bt the works. Any sensitive areas (vegetation or cultural items identified during the ESIA process) would be identified and marked for special care and avoidance.

Importation of materials can represent a potential vector for the importation of unwanted plant or animal pests.

The existing ESMP will be updated based on the findings of the planned ESIA. It will detail any specific requirements for the protection and management of terrestrial ecology issues.

Otherwise, there are no terrestrial negative impacts expected from this proposal given the existing shoreline is already entirely artificial and has been dysfunctional and erosive for decades. Ultimately the provision of new land for safe development can only improve the state of affairs on Fogafale Island where increasingly dangerous and marginal areas are being developed because there is simply no other option.

8.1.2 Marine ecology

Today, live corals are practically absent and dense thickets of macro algal (otherwise unheard of in such atoll environments) dominate and choke the nearshore shallows (Figure 33). These standing crops can cause significant draw down of dissolved oxygen concentrations at night and stress or kill slow moving epifauna.

Beyond the footprint of the proposed reclamation, along the edge of the reef are sporadic patches of individual corals (based on recent site inspections, estimated at <1%). Substantially further out from this shore the substratum is reported by Smith (1995) to be uncharismatic, soft sedimentary environment dominated by *Halimede* algae and lightly bioturbated. These habitats are very well represented across the broader lagoon system, are not ecologically sensitive or rare and recover rapidly from disturbance. Similarly, Kaly and Peacock (2014) indicated the surrounding marine area is heavily impacted and over fished and of little contemporary value as a fishing ground.

Thus, any impacts associated with this reclamation would simply be the physical burial of the already disturbed and low ecological value substratum (namely bear sand and invasive macroalgae thickets) within the footprint of the reclamation, of which over 50% of that footprint is already subject to a litany of pre-existing physical disturbance impacts. Corals outside immediately adjacent to the reclamation may be impacted as a result of the short-term siltation caused by dewatering, or through sand escaping from the bund during reclamation

The dredging contractor will be required to prepare an ESMP for the dredge operations. The management of plumes and dewatering will require detailed documentation. Although unlikely to be a signficant issue given the nature of the sand resource and the low current velocities in the Fogafale part of the lagoon, physical barriers such as bunds may be required if sediment plumes are found to be problematic.

It is proposed to offset the impacts to the small amount of coral that could be impacted through a coral transplanting program as part of the works.

8.1.3 Dredging impacts

8.1.3.1 Tubid water

In respect to impacts, the reclamation proposal presents an opportunity to contain dredge sediment laden water associated with pumping sand. Increased turbidity from sand pumping is generally the main aspect of concern in such operations. The reclamation design allows for the controlled release sediment laden water as the proposal is to pump the sand directly into containment areas behind a new revetment wall, thus providing an area separate from the lagoon for dewatering. A similar approach was taken during TCAP.

During dredging there may be plumes generated that affect significant areas of the nearshore lagoon. However, nearshore consists of pre-existing disturbance regimes that are a combination of WWII dredging and reclamation efforts, extensive reactionary seawall building, Queen Elizabeth Park

reclamation, beach nourishment, groin building, foreshore protection works by JICA (Tausoua Beach Project), and TCAP. Beyond these areas that have been physically disturbed, the nearshore has been described by Kaly and Peacock (2014) as a "zone of dead corals and eutrophication". The nearest sensitive area (Funafuti Conservation Area) is approximately 13 km away (Figure 37).

Past dredging efforts in the Fogafale sediment resource area have graphically shown these sediments are deficient in labile carbon and lack any visible horizontal zoning where greater interstitial concentrations of nutrients or harmful compounds (e.g. hydrogen sulphide) associated with anoxic layers persist. As is commonly found in oceanic atolls, shallow open lagoon systems are naturally oligotrophic (nutrient poor) with low productivity (compared to continental shallows with terrestrial runoff). As a result, no significant water quality risk is expected from dredging these sediments beyond the potential for increased sediment resuspension and turbidity. Even this risk is mitigated by the relatively uncharismatic substratum and absence of, for example, living coral, seagrass, etc. Kaly and Peacock's EIA study completed for the Tuvalu Borrow Pits Project (2014) called this area "the zone of dead coral and eutrophication" and noted "benthic communities have changed from coral-rich to algae-dominated. Given the damage already done to this area, there is little risk of further damage to reefs during the relatively short duration of dredging (1-2 years)". Note in this study the authors considered ongoing dredging over a possible 2-year period. This proposal will complete dredge operations within an estimated 2-to-3-month period because of the relatively modest size and simplicity of the task.

Damlamian (2005) undertook HD modelling of resuspension and sedimentation impacts associated with dredging in this specific lagoon resource area. These models were calibrated using in-situ sediment analysis data (samples collected from the resource area) and water current direction, velocity and elevation data collected over several weeks. It is also important to understand that Damlamian (2005) modelled the impacts of sediment pumping to a floating barge, meaning de-watering occurred at sea with direct release of wastewater 2m above the substratum. On average sediment pump slurry is around a 75:25 ratio of water to solids (so 1 T of sand results in around 3,000 L of sediment laden water). Under these adverse dewatering conditions, sediment desperation did occur in an area of some 4,000m^2, an area well within the sediment resource zone. Outside the resources area, rates of modelled sedimentation were so low as to not present any threat; suspended particles did not exceed 1mg / L whereas normal ambient levels were expected to range up to at least 10mg / L. Likewise, sedimentation rates outside the resources area (0.1mg / cm^2 / day) were far lower than for example tolerance levels of common corals such as Acropora sp.

Ultimately, even modelling the sub-optimum method of dredging considered by Damlamian (2005) did not find significant impacts. TCAPII proposes to pump the sand/water slurry directly to the containment area within the footprint of the reclamation, as was done for TCAP. This will contain the sediment laden water and allow a high percentage of solids to settle and for return water to move back to the lagoon after losing most of its load of sediment. In this way dredge impacts in respect to sedimentation and turbidity can be minimized.

If TCAPII emulates those approaches to ensure any turbidity or sedimentation risks are minimised and managed, no significant negative impacts are expected.

8.1.3.2 Habitat loss

The sand resource proposed has been utilised on four occasions since 1995 for similar dredging projects. In all cases no significant environmental impacts were observed or reported - most recently in 2023, the TCAP dredged 0.6 milli250,000m^3 for the TCAP Funafuti reclamation. The same methodology and safeguards used for TCAP, that were shown to minimize impacts, are proposed for TCAPII. In addition, it is proposed to include a coral transplant/restoration activity within TCAPII.

Thus, although dredging will cause a direct loss of habitat and some loss of organisms (such as polychaetes and crustaceans), the impacts will be far less than it would be for an undisturbed

environment. The contractor will monitor plumes if they develop in areas outside of the designated 'dead coral zone', if necessary (ie corals or other organisms exhibit signs of stress) the Contractor will take steps to reduce the plume (eg temporarily halt dredging, modify the settling cell arrangement, reduce dredge speed, or change dredge location to avoid high fines deposits)

8.1.3.3 Access, public safety

The operation of the dredge could disrupt the movements of fishing boats and other vessels in the lagoon. To mitigate these, the Contractor will clearly communicate the dates and locations of dredging to all.

8.1.4 Contamination and Waste

With the operation of any machinery that utilises engines, fuel, and hydraulics there is the potential for spills of hydrocarbons. These can occur through refuelling, storage of fuels, hydraulic fluid and greases, hose bursts or during maintenance.

Through the application of good industry practices, spills can be kept to a minimum. Contractors will be required to have spill response plans and kits to deal with any spills. Operators are to be trained in dealing with spills.

Other than the excess water that will decant from the dredged material once emplaced into the reclamation area, the project will not generate significant volumes of waste. The discharge water has the potential to be turbid. The reclamation will be designed such that turbidity beyond the reclamation area is minimised.

Minor amounts of solid waste, including domestic rubbish and waste from maintenance activities, will be generated. These will be collected and disposed of as part of the usual island waste management system.

8.1.5 Hours and days of operation and noise

Operating the dredge and other equipment as part of the project could result in disruption to the community through noise and hours worked by local labourers. To reduce impacts the noise generated by machinery should be minimised and machinery well-maintained. Work will typically occur between 6am and 6pm, 6 days per week, but on occasions operations outside these times may be required – if so, such would be negotiated and agreed upon. An agreed work schedule will be communicated to the community. The project grievance mechanism will receive and address all complaints.

8.1.6 Access

Access impacts will be limited as the dredge pipeline will not be required to cross any roads.

If machinery or other equipment has the potential to cause traffic hazard or reduced access, then appropriate signage and traffic controls will be put in place. Residents will be notified prior to works that may create access restrictions.

There is potential for access impacts to boat users, particularly those that currently use the beach. Navigation disruptions could also occur because of dredging operations. Impacts will be minimised through ongoing consultation with stakeholders and clear communication about dredging locations and times.

Boat owners will be consulted prior to works commencing to allow sufficient time for the relocation of vessels.

8.2 IMPACTS POST-CONSTRUCTION (COMPLETED PROJECT)

8.2.1 Loss of Resources

8.2.1.1 Sand Resource

As has been previously described, the available sand resource has been estimated at 24 million m3, whereas the volume required for the project is only 280,000 m^3, so the project will in no way exhaust the available sand resource.

8.2.1.2 Nearshore Fisheries

The footprint of the proposed reclamation and the marine resources within are not high value because of their degraded nature and have little residual fishery value (Kale and Peacock, 2014). Furthermore, most of the reclamation footprint has previously been heavily disturbed through engineering activities and the proposed reclamation accounts for a very small percentage of the total lagoon area of the atoll system.

There may be some impact on fishers who use the current shoreline for boat access.

8.2.2 Land Disputes

The basic law for the coastal zone in Tuvalu is the Foreshore and Land Reclamation Ordinance. The ordinance provides that, “Subject to the public rights of (a) navigation and fishing, and (b) of passing over the foreshore, and to any private fights that may exist in or over the foreshore or the sea-bed, the ownership of the foreshore and sea-bed is vested in the Crown” ((1), 3 Declaration of ownership of foreshore and sea-bed), in which “foreshore” means the shore of the sea or of channels or creeks that is alternately covered and uncovered by the sea at the highest and lowest tides, and “sea-bed” means the bed of all territorial and inland tidal waters.

As the ownership of the foreshore and seabed is vested in the Crown, “any land reclaimed otherwise than under section 11 (1) shall be vested in the Crown” (9 Vesting of reclaimed land), subject to subsection (2). Subsection (2) provides that “Causeways and landing-places constructed by a local government council shall, subject to the right of the Minister to call for their surrender to the Crown at any time, vest in that council.” And “Subject to section 11 (1) the Minister may, in accordance with this section, authorise the reclamation of land over and upon the foreshore or the seabed irrespective of the ownership of land bordering on or of whether any land borders on such foreshore or sea-bed” (4 Minister may authorise undertaking).

However, “Without prejudice to any public or private rights that may be affected thereby, this Ordinance shall not apply to the filling by a landowner of the whole or any portion of the foreshore that borders on his land” (11 Landowner's liberty to fill foreshore not to constitute a right).

Thus, no disputes over ownership of the new land created by the reclamation is anticipated.

8.2.3 Hydrodynamics

Prior to the 1940’s longshore sediment transport was once the predominant mechanism which delivered sand to the Fogafale lagoon shore. As discussed above, engineering in the 1940’s comprehensively destroyed this natural system and closure of an ocean / lagoon passage in the northern part of Fogafale (also in the 1940’s) also reduced sediment supply onto this shoreline. Otherwise, wave energy is the main mechanism by which sediments are redistributed on this shore. However, until the recent nourishment projects, “sediment redistribution” was simply perceived as loss and erosion.

The reclamation will remove the stress of wave action from the current dysfunctional shoreline and transfer that point of contact to the seaward margin of the reclamation. Water depth is around 1.5 m

at this location meaning slightly larger waves can be expected to break on the reclamation foreshore. The proposed design will include an appropriately designed sloping revetment of geo bags to armour the seaward margin of the reclamation. This will be designed to prevent overtopping and marine flooding during stormy conditions.

Otherwise, tidal cycles produce the bulk of ongoing water exchange in this location and water current data associated with this site (Damlamian, 2008) shows tidal signals are the dominant variable changing water direction and speed. The highest recorded peak velocity was under 0.2 m/sec and otherwise the majority of the time, over all states of tide, velocities remained lower than 0.05 m/sec. Generally, sand sized sediment particle size (~1mm Ø) requires velocities 0.3 – 0.4 m/sec to even begin mobilization.

The high-resolution numerical model developed as part of the SPC portal was used to determine hydrodynamic conditions at the site and so enable design water level and wave events for the proposed TCAP II reclamation.

Even though the revetment has been designed to be above the

8.2.4 Groundwater

The project does not require the use of groundwater, nor is it likely to contribute to the already chronic contamination of the groundwater lens at Fogafale.

Early observations from the neighbouring QEP reclamation and subsequent excavation at this site since its completion has found the water table to be quite fresh, suggesting that, within the finer grade sands dredged to build the QEP reclamation, conditions for the formation of a freshwater lens may be favourable.

However, as the project site adjoins the main island and there are already such high levels of contamination in that groundwater, it is unlikely any newly formed freshwater lens would be potable, but it could be used for “second-class” purposes such as toilet flushing, watering gardens, washing down vehicles, etc.

Furthermore, the feature that provides groundwater lens development potential (essentially a body of supratidal lower porosity fine sands) may also, via the same properties, assist to reduce the free movement of contaminated groundwater from Fogafale Island into the nearshore marine environment. In other words, it is likely the proposed reclamation may buffer or restrict the free movement of contaminated ground water from the island to the nearshore lagoon environment. In this way, it may reduce the impacts of ongoing eutrophication in the Fogafale nearshore marine environment.

Therefore, the proposed reclamation potentially has net beneficial effects in respect to groundwater.

8.3 Socio-Economic Impacts

8.3.1 Cultural Resources

It has already been explained that the entire shore and much of the nearshore substratum in the project area has been profoundly disturbed by earlier engineering efforts. It is possible that locations of cultural significance may once have been located on this shore. Discussions with stakeholders have yet to be undertaken to identify any such features (specific to the TCAPII site). In completing the ESIA, the project area will be surveyed, and any cultural resources identified and mapped so that such features can be avoided. Chance find procedures would need to be included in all reclamation contracting.

There are important issues regarding the change or loss of amenity which can occur due to reclamation. Currently there are a number of nearshore properties along this coast which will lose their direct access to the lagoon foreshore as a result of this reclamation proposal. In effect the shoreline will be moved approximately 100m seaward and what was a water side property will become part of the island interior. However, perspectives in the Pacific atoll communities are different. This is particularly so in this environment where this shore has been known for its chronic instability and inability to provide protection from storm waves for decades. In many ways local residents view this shoreline as a liability that has required inter-generational effort to "hold the line" and clean up after overtopping events etc. This is demonstrated by example of community attitudes at the Tausoua Beach (main Funafuti Community Church Compound) site and the TCAP area of works.

The priority in Fogafale is for this shoreline to be secured from current and future storm wave attack and that such effort should incorporate well planned and implemented reclamation to provide safe higher ground. These messages have been the consistent central message from the Government. As such, while the risk of objections from neighboring properties cannot be ruled out, it is considered an unlikely in view of the experience on TCAP.

8.3.2 Land Use

The proposed reclamation is intended for public space and public/community buildings. Work to develop a consultative, land use plan for the area will be part of the project, however it is important to broadly outline the wishes of Government and Community at this juncture. The proposed reclamation is a pragmatic proposal to provide much needed security on this shoreline and new safe public space that is not subject to marine flooding. As a result, there are no simple economic analysis to be explored here regarding socio-economic impacts, positive or negative, of a new single purpose facility such as a commercial wharf. But rather, there is a far more complex and urgent story of the socio-economic cost of failing to implement real coastal adaptation in a densely populated, low lying, cyclone prone atoll environment.

The footprint of the proposed reclamation and the marine resources within are not high value from a marine resource or ecological perspective. As discussed, this area is a deeply degraded environment and there is little, if any, economic or ecological cost to implementing the proposal. Beach tourism is not really relevant in Tuvalu (as it is for example in Fiji or Palau). Any beach tourism which does occur is far more associated with the uninhabited pristine island shores and reefs within the Funafuti Conservation Area (FCA) located some 13 km away on the western reef of the Atoll.

Otherwise, and as discussed in "cultural impacts" above, there will be a loss of amenity or direct lagoon foreshore access for an estimated the households that adjoin the effected shoreline. Surveys during the ESIA finalization will determine exact ownership details. In effect the shoreline will be moved approximately 100 m seaward and what was a water side property will become part of the island interior. Care must be taken not to apply values more typically found in developed countries where water side property is concerned. Perspectives in the Pacific atoll communities are different and this is particularly so where the shore has been known for its chronic instability and inability to provide protection from storm waves for decades.

It is perhaps important to briefly outline the socio-economic implications/impact of not implementing this proposal. As the national capital and the only port of entry (sea and air), Fogafale's population will presumably continue to grow. Even without sea level rise and other climate change impacts, the capacity of the island to provide for this population safely and provide an environment where local development aspirations can be fulfilled is a challenge. However, if sea level rise and the possibility of more intense tropical storms is superimposed over this scenario, life within the foreseeable future will become untenable on this island. Vertical adaptation is the only viable solution in these environments and in the case of well-planned and implemented reclamation, this has the added benefit of affordability, minimal environmental risk and crucially the provision of substantial new areas of safe

land to accommodate sustainable development. There is no other practical and affordable solution to sea level rise in these environments. It follows that the socio-economic cost of not implementing such work is difficult to constrain or even contemplate.

The proposed reclamation will not be privately owned land but rather it will become crown land as stipulated by the Tuvalu Foreshore Act. No detailed land use plan has to date been sketched regarding the use (this will form part of the activities that will be undertaken by the project) however, there is the intention for the land is intended to be used for public good.

The existing beach and channel are used by boat users to access the lagoon. Boats are launched and retrieved from various locations along the beach and often moored in the channel when conditions are suitable. The reclamation will mean that this stretch of beach and channel will be lost to boat users and alternatives will have to be found. It has been suggested by boat users (during the consultation sessions) that boat ramps be installed at either end of the reclamation to facilitate boat launching and retrieval. There is an opportunity to develop a small boat harbour at the northern end of the reclamation as the design retains a 70m wide gap between TCAPII and QEII Park. Moorings will be able to be placed offshore from the reclamation, as occurs with TCAP1, although the water depths are greater at TCAPII.

8.3.3 Scale

Reclamation is frequently associated with “industrial uses” such as wharf and port facilities, aircraft runways, etc., and may involve significant scale. TCAPII’s proposed reclamation is not for industrial purposes and at approximately 8ha, by international standards, is small scale. TCAPII will be of a similar scale to TCAP.

8.4 Cumulative Impacts

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time. Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource.

“Cumulative impacts” must be viewed with a clear understanding of the present state of the environment and conditions of human exposure which exist at this location. Whilst there can be no doubt this reclamation proposal will further, permanently change this shore, this proposal will permanently remedy the litany of physical damage which has occurred at this site over the last 80 years and is continuing to have ongoing impacts to the physical, biological and socio-economic value of the site.

Cumulative impacts from the perspective of broader hydrodynamic processes including net water movement and exchange and surface wave conditions are not expected either. There will be a small increase in the loss of shallow reef habitat due to the combined reclamations, however this has been shown to be minor given the degraded nature of the locations. None the less, long-term concepts, such as L-TAP would result in much more significant cumulative impacts due to the considerable increase in scale and requirements for social change.

9 MITIGATION MEASURES

The previous chapter outlined the potential impacts that could occur because of the project. The following outlines the mitigation measures that would be implemented as part of the project to minimise and manage impacts.

These measures will be the basis for the Environmental and Social Management Plan (ESMP) for the project. The ESMP will form the basis for social and environmental management and monitoring throughout the project.

9.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT STRATEGIES

This section identifies the key environmental and social indicators identified for the project and outlines respective management objectives, potential impacts, and management strategies.

This section further addresses the need for monitoring and reporting of environmental performance with the aim of communicating the success and failures of control procedures, distinguish issues that require rectification and identify measures that will allow continuous improvement in the processes by which the projects are managed.

Environmental and social strategies have been devised to mitigate potential impacts during delivery of the project in the following areas:

- Ecology (FF)
- Groundwater (GW)
- Surface Water (SW)
- Air Quality (AQ)
- Noise and Vibration (NV)
- Erosion, Drainage and Sediment Control (EC)
- Waste Management (WM)
- Unexploded Ordinance (UXO)
- Social Management (SM)
- Archaeology and Cultural Heritage (CH)
- Emergency Response (ER).

9.1.1 Ecology

9.1.1.1 Performance Criteria

- no clearance of vegetation outside of the designated clearing boundaries;
- no death to native fauna as a result of clearing activities;
- no deleterious impacts on aquatic environments and terrestrial habitats;
- no introduction of new weed species as a result of construction activities; and
- no increase in existing weed proliferation within or outside of any project footprint as a result of construction activities.

9.1.1.2 Mitigation Measures

Table 5 Flora and Fauna Management Measures

Issue	Control Activity (and Source)	Action Timing	Responsibility	Monitoring and Reporting
FF1. Habitat loss and disturbance of fauna	FF1.1: Limit vegetation clearing and minimise habitat disturbance through adequate protection and management of retained vegetation.	During construction	Contractor	Maintain records
	FF1.2: Minimise noise levels and lighting intrusion throughout construction and operation in the vicinity of any sensitive locations.	During construction	Contractor	Daily and maintain records
	FF1.3: Ensure that all site personnel are made aware of sensitive fauna/habitat areas and the requirements for the protection of these areas.	During construction	Contractor	Daily and maintain records
	FF1.4: Minimise disturbance to on-site fauna and recover and rescue any injured or orphaned fauna during construction and operation.	During construction	Contractor	Maintain records, Report

FF2. Introduced flora and weed species	FF2.1: Implement an ESCP to reduce the spread of weeds through erosion and sediment entering any waterways and therefore spreading.	Pre and during construction	Contractor	Maintain records
	FF2.2: Revegetate disturbed areas using native and locally endemic species that have high habitat value.	During construction	Contractor	As required and maintain records
	FF2.3: Minimise disturbance to mature remnant vegetation, particularly canopy trees.	During construction	Contractor	Maintain records
	FF2.4: Seed is to be weed free.	Operation	Contractor	Maintain records
	FF2.5: Environmental weeds and noxious weeds within the project footprints shall be controlled.	During and post construction	Contractor	Weekly and maintain records

9.1.2 Groundwater

9.1.2.1 Performance Criteria

- no significant decrease in the quality and quantity of groundwater as a result of construction and operational activities in proximity to the projects; and
- effective implementation of site-specific Erosion, Drainage and Sediment Control Management Plans (EDSCPs) and other measures to protect groundwater.

9.1.2.2 Mitigation Measures

Table 6 Groundwater Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
GW 1: Increase of gross pollutants,	GW1.1: Designated areas for storage of fuels, oils, chemicals or other hazardous liquids should have compacted	Construction and operation phase	DoE/Contractor	Keep records

hydrocarbons, metals, and other chemical pollutants into the groundwater.	impermeable bases and be surrounded by a bund to contain any spillage.			
	GW1.2: Undertake refuelling at designated places away from water systems.	All phases	All personnel	Report any spills
	GW1.3: Check all vehicles, equipment and material storage areas daily for possible fuel, oil and chemical leaks.	All phases	All personnel	Weekly
	GW1.4: Minimise the use of herbicides, pesticides and other chemicals and use only biodegradable herbicides that have minimal impact on water quality and fauna. Use only as per directions.	All phases	All personnel	Maintain records

9.1.3 Surface Water

9.1.3.1 Performance Criteria

- no significant decrease in water quality because of construction and operational activities
- no significant decrease in water quality because of dredging activities
- water quality shall conform to any approval conditions stipulated by DoE and/or other government departments, or in the absence of such conditions follow a 'no worsening' methodology
- effective implementation of site-specific EDSCPs.

9.1.3.2 Mitigation Measures

Table 7 Water Quality Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
SW1: Elevated suspended solids and other contaminants in surface water systems.	SW1.1: Develop and implement a site-specific Erosion, Drainage and Sediment Control Plan (EDSCP) to address drainage control, sediment and erosion controls and stockpiling of materials including soil during construction of all components of the projects.	Pre-Earthworks	Contractor	Initial set up and then as required with reporting to DoE and TCAP
	SW1.2: EDSCP measures to be inspected regularly to ensure all devices are functioning effectively.	Construction	Contractor	Weekly and maintain records
	SW1.3: Designated areas for storage of fuels, oils, chemicals, or other hazardous liquids should have compacted impermeable bases and be surrounded by a bund to contain any spillage. Refuelling to be undertaken in areas away from water systems.	Entire construction and operation phase	All personnel	Weekly with reporting to DoE and TCAP
	SW1.4: Schedule works in stages to ensure that disturbed areas are revegetated and stabilised progressively and as soon as practicable after completion of works.	Avoid undertaking bulk earthworks during wet season	Contractor	Maintain records
	SW1.5: Construction materials will not be stockpiled in proximity to aquatic environment that may allow for release into the environment. Construction equipment will be removed from in proximity to the aquatic environment at the end of each working day or if heavy rainfall is predicted	Entire construction and operation phase	Contractor	Maintain daily records

	SW1.6: Appropriate spill response plan in place.	Pre-construction / Construction	Contractor	Maintain record
	SW.1.7: Laydown areas established on pre-approved sites (as per C-ESMPs).	Pre-construction	Contractor	Maintain record

9.1.4 Air Quality

9.1.4.1 Performance Criteria

- release of dust/particle matter must not cause an environmental nuisance
- undertake measures to assist in minimising the air quality impacts associated with construction and operation activities
- corrective action to respond to complaints and/or grievances is to occur within 48 hours.

9.1.4.2 Mitigation Measures

Table 8 Air Quality Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
AQ.1 Increase in dust levels at sensitive receptors	AQ1.1: Implement effective dust management measures in all areas during construction.	Pre and during construction	Contractor	Daily and maintain records
	AQ1.2: Restrict speeds on roads and access tracks.	During construction	Contractor	Daily and maintain records
	AQ1.3: Manage dust/particulate matter generating activities to ensure that emissions do not cause an environmental nuisance at any sensitive locations.	During construction	Contractor	Daily and maintain records
	AQ1.4: Construction activities should minimise risks associated with climatic events (check forecasts).	During construction	Contractor	Daily and maintain records

	AQ1.5: Implement scheduling/staging of proposed works to ensure major vegetation disturbance and earthworks are minimised.	Entire construction	Contractor	Daily and maintain records
	AQ1.6: Locate material stockpile areas as far as practicable from sensitive receptors. Cover if appropriate.	During construction	Contractor	Daily and maintain records
	AQ1.7: Source sufficient water of a suitable quality for dust suppression activities complying with any water restrictions.	During construction	Contractor	Daily and maintain records
	AQ1.8: Schedule revegetation activities to ensure optimum survival of vegetation species.	During construction	Contractor	Maintain records
	AQ1.9: Rubbish receptacles should be covered and located as far as practicable from sensitive locations.	During construction	Contractor	Maintain records
AQ2. Increase in vehicle / machinery emissions	AQ2.1: Ensure vehicles/machines are switched off when not in use.	During construction	Contractor	Daily and maintain records
	AQ2.2: Ensure only vehicles required to undertake works are operated onsite.	During construction	Contractor	Daily and maintain records
	AQ2.3: Ensure all construction vehicles, plant and machinery are maintained and operated in accordance with design standards and specifications.	During construction	Contractor	Daily and maintain records
	AQ2.4: Develop and implement an induction program for all site personnel, which includes as a minimum an outline of the minimum requirements for environmental management relating to the site.	Pre and during construction	Contractor	Daily and maintain records

	AQ2.5: Locate construction vehicle/plant/equipment storage areas as far as practicable from sensitive locations.	During construction	Contractor	Daily and maintain records
	AQ2.6: Direct exhaust emissions of mobile plant away from the ground.	During construction	Contractor	Daily and maintain records

9.1.5 Noise and Vibration

9.1.5.1 Performance Criteria

- noise from construction and operational activities must not cause an environmental nuisance at any noise sensitive place
- always undertake measures to assist in minimising the noise associated with construction activities
- no damage to off-site property caused by vibration from construction and operation activities
- corrective action to respond to complaints and/or grievances is to occur within 48 hours.

9.1.5.2 Mitigation Measures

Table 9 Noise and Vibration Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
NV1: Increased noise levels	NV1.1: Select plant and equipment and specific design work practices to ensure that noise emissions are minimised during construction and operation including all pumping equipment.	All phases	Contractor	Maintain records
	NV1.2: Specific noise reduction devices such as silencers and mufflers shall be installed as appropriate to site plant and equipment.	Pre and during construction	Contractor	Maintain records

	NV1.3: Minimise the need for and limit the emissions as far as practicable if noise generating construction works are to be carried out outside of the hours: 7am-5.30pm.	Construction phase	All personnel	Daily and maintain records
	NV1.4: Consultation with nearby residents in advance of construction activities particularly if noise generating construction activities are to be carried out outside of 'daytime' hours: 7am-5.30pm.	Construction phase	All personnel	Daily and maintain records
	NV1.5: Provide temporary construction noise barriers in the form of solid hoardings where there may be an impact on specific residents.	Construction phase	Contractor	Daily and maintain records
	NV1.6: All incidents, complaints and non-compliances related to noise shall be reported in accordance with the site incident reporting procedures and summarised in the register.	Construction phase	Contractor/TCAP	Maintain records
	NV1.7: The contractor should conduct employee and operator training to improve awareness of the need to minimise excessive noise in work practices through implementation of measures.	Pre and during construction	Contractor	Maintain records

9.1.6 Erosion, Drainage and Sediment Control

9.1.6.1 Performance Criteria

- no build-up of sediment in the aquatic environments and/or surface and/or groundwater as a result of construction and operation activities
- no degradation of water quality on or off site of all projects
- all water exiting the project site and/or into groundwater systems is to have passed through best practice erosion, drainage and sediment controls
- effective implementation of site-specific EDSCP.

9.1.6.2 Mitigation Measures

Table 10 Erosion, Drainage and Sediment Control Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
EC1: Loss of soil material and sedimentation to the surface and/or groundwater systems from site due to earthwork activities	EC1.1: Develop and implement an EDSCP for any surface works, embankments and excavation work, water crossings and stormwater pathways.	Construction phase	Contractor	Maintain records
	EC1.2: Ensure that erosion and sediment control devices are installed, inspected, and maintained as required.	Construction phase	Contractor	Maintain records
	EC1.3: Schedule / work staging to minimise cleared areas and exposed soils at all times.	Pre and during construction	Contractor	Maintain records
	EC1.4: Incorporate the design and location of temporary and permanent EDSC measures for all exposed areas and drainage lines. These shall be implemented prior to pre-construction activities and shall remain onsite during work.	Pre and during construction	Contractor	Maintain records
	EC1.5: Schedule/stage proposed works to ensure that major vegetation disturbance and earthworks are carried out during periods of lower rainfall and wind speeds.	Pre and during construction	Contractor	Maintain records
	EC1.6: Ensure any stockpile sites are appropriately bunded or fenced to prevent sediment runoff.	Pre and during construction	Contractor	Maintain records
	EC1.7: Schedule/stage works to minimise the duration of stockpiling topsoil material. Vegetate stockpiles if storage required for long periods.	During construction	All personnel	Maintain records

	EC1.8: Locate stockpile areas away from drainage pathways, waterways, and sensitive locations. Consultation with Kaupule undertaken in finalizing location of stockpile and laydown sites.	Pre and during construction	Contractor	Maintain records
EC1: Loss of soil material and sedimentation to the surface and/or groundwater systems from site due to earthwork activities	EC1.9: Design stormwater management measures to reduce flow velocities and avoid concentrating runoff.	Pre and during construction	Contractor	Maintain records
	EC1.10: Include check dams in drainage lines where necessary to reduce flow velocities and provide some filtration of sediment. Regularly inspect and maintain check dams.	Pre and during construction	Contractor	Maintain records
	EC1.11: Mulching shall be used as a form of erosion and sediment control and where used on any slopes (dependent on-site selection), include extra sediment fencing during high rainfall.	During construction	All personnel	Maintain records
	EC1.12: Bunding shall be used either within watercourses or around sensitive/dangerous goods as necessary.	During construction	All personnel	Maintain records
	EC1.13: Vegetated buffer strips around sites will be retained.	During construction	Contractor	Maintain records
	EC1.14: Silt fences or similar structures to be installed to protect from increased sediment loads.	During construction	Contractors	Maintain records
	EC1.15: Excess sediment in all erosion and sediment control structures (e.g. sediment basins, check dams) shall be removed when necessary to allow for adequate holding capacity.	During construction	Contractors	Maintain records
EC2: Soil Contamination	EC2.1: If contamination is uncovered or suspected, undertake a Stage 1 preliminary site contamination investigation. The contractor should cease work if previously unidentified	Construction phase	All personnel	Daily and maintain records

	contamination is encountered and activate management procedures and obtain advice/permits/approval (as required).			
EC2: Soil Contamination	EC2.2: Adherence to best practice for the removal and disposal of contaminated soil/ material from site (if required), including contaminated soil within the project footprints.	Construction phase	Contractor	Daily and maintain records
	EC2.3: Drainage control measures to ensure runoff does not contact contaminated areas (including contaminated material within the project footprints) and is directed/diverted to stable areas for release.	Construction phase	Contractor	Daily and maintain records
	EC2.4: Avoid importing fill that may result in site contamination and lacks accompanying certification/documentation. Where fill is not available through on-site cut, it must be tested in accordance with geotechnical specifications.	Construction phase	Contractor	Daily and maintain records
	EC2.5: Vehicle washdown and concrete protection areas will be at the laydown site and will be bunded with all wastewater collected and treated prior to discharge.	Construction	Contractor	Maintain records
	EC2.6: UXO – refer to Section 9.1.8 for management requirements for UXO.	Pre-construction and construction	Contractor	Maintain records

9.1.7 Waste Management

9.1.7.1 Performance Criteria

- waste generation is minimised through the implementation of the waste hierarchy (avoidance, reduce, reuse, recycle)
- no litter will be observed within the project area or surrounds as a result of activities by site personnel
- no complaints received regarding waste generation and management
- any waste from on-site portable sanitary facilities will be sent off-site for disposal by a waste licensed contractor

- waste oils will be collected and disposed or recycled off-site.

9.1.7.2 Mitigation Measures

Table 11 Waste Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
WW1: Production of wastes and excessive use of resources	WW1.1: Preference shall be given to materials that can be used to construct the project that would reduce the direct and indirect waste generated.	Pre and during construction	Contractor	Maintain records
	WW1.2: Daily waste practices shall be carried out unless these are delegated to the activities of external waste management bodies.	During construction	Contractor	Daily and maintain records
	WW1.3: The use of construction materials shall be optimised and where possible a recycling policy adopted.	During construction	Contractor	Weekly and maintain records
	WW1.4: Separate waste streams shall always be maintained i.e. general domestic waste, construction, and contaminated waste. Specific areas on site shall be designated for the temporary management of the various waste streams.	During construction	Contractor	Weekly and maintain records
	WW1.5: Contractor will consult with GoT Department of Waste Management on export of hazardous substances.	During construction	Contractor	Weekly and maintain records
	WW1.6: Recyclable waste (including oil and some construction waste) shall be collected separately and disposed of correctly.	During construction	Contractor	Weekly and maintain records

	WW1.7: Waste sites shall be sufficiently covered to ensure that wildlife does not have access.	During construction	Contractor	Daily
	WW1.8: Disposal of waste shall be carried out in accordance with the Government of Tuvalu requirements.	During construction	Contractor	Weekly and maintain records
	WW1.9: Fuel and lubricant leakages from vehicles and plant shall be immediately rectified.	During construction	Contractor	Daily and maintain records
WW1: Production of wastes and excessive use of resources	WW1.10: Major maintenance and repairs shall be carried out off-site whenever practicable.	During construction	Contractor	Weekly and maintain records
	WW1.11: Where possible, fuel and chemical storage and handling shall be undertaken at central fuel and chemical storage facilities, such as petrol stations.	During Construction	Contractor	Daily and maintain records
	WW1.12: On-site storage of fuel and chemicals shall be kept to a minimum.	During Construction	Contractor	Daily, maintain records and report any incidents
	WW1.13: All Project staff will be trained on these requirements and attendance will be recorded.	All phases	All personnel	Maintain records

9.1.8 Unexploded Ordinance

9.1.8.1 Performance Criteria

- No injuries are sustained as a result of UXO

9.1.8.2 Mitigation Measures

Table 12 Unexploded Ordinance Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
UXO1: Presence of unexploded ordinance	UXO1.1: Updated magnetometry survey to confirm presence/absence of UXO/ERW.	Prior to commencement of finalised dredge planning	Contractor	Survey report
	UXO1.2: Dredge to be fitted with a suitable screen to exclude ERW at the cutter head and a beach-screening cage to capture ERW at the discharge end of the dredge pipe.	Construction	Contractor	Daily records
	WT1.3: The Contractor's C-ESMP will detail the way in which they will safely handle and dispose of UXO/ERW if any UXO/ERW are encountered during construction.	Pre-construction	Contractor	Maintain records

9.1.9 Social Management

9.1.9.1 Performance Criteria

- the community has been consulted and project elements have been designed with their informed consultation and participation throughout the project
- all stakeholders are appropriately represented
- avoid adverse impacts to local community during construction and operations and where not possible, minimise, restore, or compensate for these impacts
- cultural heritage is not adversely impacted
- community health and safety is protected and overall well-being benefits derived from the project

- complaint and grievance mechanisms are put in place and proactively managed
- long-term social benefits are achieved.

9.1.9.2 Mitigation Measures

Table 13: Social Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
SM1: Land and Resource Use	SM 1.1: Conduct a stakeholder mapping and analysis of the landowners and non-landowning households in the adjacent community and other groups that the project may affect.	Pre-construction	TCAP	Maintain records
	SM 1.2: Facilitate the development of a community-based local planning and M&E process.	Pre-construction	DLG	Maintain records
	SM 1.3: Ensure compliance with the SEP, in particular the need to address the requirements of UNDP Standard 6 with respect to IPs and the potential need for FPIC associated with the use of land	All phases (FPIC pre-construction)	TCAP	Maintain records (as per SEP)
	SM 1.4: Ensure compliance with the Grievance Redress Mechanism process.	All phases	TCAP	Maintain records (as per GRM)
SM2: Public nuisance caused by construction/operation activities (eg noise, dust etc)	SM 2.1: Carry out community consultation prior to undertaking activities.	Pre-construction	TCAP	Maintain records
	SM 2.2: Implement appropriate management plans (refer to Noise, Air, ESCP, and Waste sections of the ESMP).	Construction	Contractor	Daily and maintain records
	SM 2.3: Ensure compliance with the Grievance Redress Mechanism process.	All phases	TCAP	Maintain records
SM3: Gender, Social Inclusion & GBV	SM3.1: Implement Gender Strategy and Action Plan.	All phases	All personnel	Maintain records
	SM3.2: Incorporation of gender-based violence into the Stakeholder Engagement Plan.	All phases	TCAP	Maintain records

	SM3.3: Code of conduct will be signed by all workers (including project management) to demonstrate commitment to prevention of gender-based Violence and the prevention of the spread of sexually transmitted diseases such as HIV/AIDs.	Construction	Contractor	Maintain records
SM4: Workers and Project Accommodation	SM4.1: Use of existing accommodation for project office and project personnel.	All phases	All personnel	Maintain records
	SM4.2: Minimise number of workers from off-island.	All phases	TCAP / Constructor	Maintain records
	SM4.3: All imported project staff will abide by Tuvalu immigration policy and provide all required documentation, including health checks.	All phases	All personnel	Maintain records
	SM4.4: Overseas workers will undergo cultural familiarisation induction upon arrival and sign a code of conduct applicable for the duration of their contract.	Construction	Contractor	Maintain records
	SM4.5: Contractor will supply all required food for workers to the community to enable community members to be appointed to cook and prepare food for a fee.	Construction	Contractor	Maintain records
	SM4.6: Contractor will provide first aid facilities and trained first aiders.	Construction	Contractor	Maintain records
SM5: Wave overtopping damages infrastructure on new land	SM5.1: A construction setback of 25m from lagoon edge is recommended to limit damage to structures during overtopping events	Post-construction	GoT	DA records
SM6: Works on new land damage revetment structure	SM6.1: A construction set back of 25m from lagoon edge is recommended to ensure piling or other excavation work does not have the potential to damage the underlying GMC units	Post-construtions	GoT	DA records

9.1.10 Archaeological and Cultural Heritage

9.1.10.1 Performance

- There will be no impact on any important Archaeological and/or Cultural Heritage sites
- Manage any specific sites of important Archaeological and/or Cultural significance (significant sites).

9.1.10.2 Mitigation Measures

Table 14: Archaeological and Cultural Heritage

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
CH1: Damage or disturbance to significant important Archaeological and/or Cultural Heritage during the earth disturbances and land clearing activities	CH1.1: Should any Archaeological and/or Cultural Heritage artifacts be identified (Chance Finds) implement the following Chance Find Procedures: • Stop the construction activities around the chance find. • Delineate the discovered site or area. • Secure the site to prevent any damage or loss of removable objects. • Notify the supervisory Engineer who in turn will notify the responsible local authorities. • Responsible local authorities will oversee protecting and preserving the site before deciding on subsequent appropriate procedures. • Construction work could resume only after permission is given from the responsible local authorities and the HPO concerning safeguard of the heritage.	Pre and during construction	Contractor	Maintain records and immediately notify TCAP and DoE of any find
	CH1.2: Implement Stakeholder Engagement Plan.	All phases	All personnel	Maintain records

9.1.11 Emergency Response

9.1.11.1 Performance Criteria

- no incident of fire outbreak
- no failure of water retaining structures
- no major chemical or fuel spills
- no preventable industrial or work-related accidents
- provide an immediate and effective response to incidents that represent a risk to public health, safety or the environment
- minimise environmental harm due to unforeseen incidents.

9.1.11.2 Mitigation Measures

Table 15 Emergency Management Measures

Issue	Control activity (and source)	Action timing	Responsibility	Monitoring & reporting
EM1. Fire and Emergency management and prevention strategies implemented	EM1.1: Flammable and combustible liquids bunding/storage areas to be designed in accordance with appropriate international standards.	Pre and during construction	Contractor	Daily and maintain records
	EM1.2: Fire extinguishers are to be available on site.	During construction	Contractor	maintain records
	EM1.3: No open fires are permitted within the project area.	During construction	All personnel	Daily and maintain records
	EM1.4: Communication equipment and emergency protocols to be established prior to commencement of construction activities.	Pre-construction	Contractor	Maintain records
	EM1.5: Train all staff in emergency preparedness and response (cover health and safety at the work site).	During construction	Contractor	Maintain records

	EM1.6: Check and replenish First Aid Kits.	Construction	Contractor	Monthly and maintain records
	EM1.7: Use of Personal Protection Equipment.	Construction	All personnel	Daily and maintain records
EM2. Spill Response	EM2.1: Spill response plan will be developed to ensure that all fuels and lubricants used during the construction phase in machinery, equipment, generators and on marine vessels are contained, collected, treated and disposed of.	Construction	Contractor	Maintain records
	EM2.2: Identify areas within the project site and nearby vicinity that are sensitive to spills and releases of hazardous materials and locations of any water intakes.	Pre-construction	DoE	Maintain records
	EM2.3: Include regular training schedules and simulated spill incident and response exercise for response personnel in spill alert and reporting procedures, the deployment of spill control equipment, and the emergency care/treatment of people or wildlife impacted by the spill.	Construction	Contractor	Maintain records

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS

The TCAP II works will provide the community of Funafuti additional safe raised land and improved coastal protection for community members.

Consideration has been given to the impacts arising due to the construction and operation of the project have. Based on experience on similar projects eg TCAPI, it is believed that, overall, it is possible to identify and adequately address those impacts through mitigation measures in a comprehensive manner. The issue of managing the impacts of dredging, changes in the land use of the area and maintaining the integrity of the vegetation line have been fully incorporated into the design of the project. There may still be potential impacts to the boat owners along the project foreshore area which will require further consultation and supplementary projects eg design and construction of boat ramps, to fully address.

In the view of this report, it is anticipated that there will not be significant adverse impacts on the physical, ecological or social environment as adequate mitigation and monitoring measures can be implemented. A Stakeholder engagement plan, grievance redress mechanism, and an environmental and social management Plan (ESMP) will be prepared and implemented as part of the project. These plans will draw on the documents and experiences of the recently successfully completed TCAP, which is a very similar project, with similar issues to TCAPII.

10.2 RECOMMENDATIONS

10.2.1 Contractor ESMP

The Contractor for the TCAP works will be required to produce a Construction Management Plan (CMP), that will include a suite of safeguard sub-plans, including Environmental and Social Management Plan. The CMP will be the Contractors governing document for the implementation of this ESIA during works. The CMP will contain the contractor's methodology and planning for adhering to their safeguard requirements. Additionally, the CMP will detail how the Contractor plans to resource their team with personnel and financial resources as per the Contract.

Spill Response Plan: The Contractor will have a spill response plan in place to account for all potential instances. A Spill response plan will be developed to ensure that all fuels and lubricants used during the construction phase in machinery, equipment, generators and also on marine vessels are contained, collected, treated and disposed of. The spill response plan will: (i) identify areas within the project sites and nearby vicinity that are sensitive to spills and releases of hazardous materials and locations of any water intakes; (ii) outline responsibilities for managing spills, releases, and other pollution incidents, including reporting and alerting mechanisms to ensure any spillage is reported promptly to the Kaupule; (iii) Include provision of specialized oil spill response equipment, and; (iv) include regular training schedules and simulated spill incident and response exercise for response personnel in spill alert and reporting procedures, the deployment of spill control equipment, and the emergency care/treatment of people or wildlife impacted by the spill.

Erosion, Drainage and Sediment Control Plan (EDSCP): This plan will address drainage control, sediment and erosion controls and stockpiling of materials including soil during construction of all works. The plan will include measures to be inspected regularly to ensure all devices are functioning

effectively. Specifically, the plan will be designed to ensure that: (i) there is no buildup of sediment in the coastal marine environment and/or groundwater as a result of the construction activities; (ii) there is no unacceptable degradation of water quality on or off project sites; (iii) all water exiting the project area and/or into the groundwater systems is to have passed through best practice erosion, drainage and sediment controls; (iv) there are no changes to existing erosion or sediment deposition regimes form taking of sediment from the coastal zone; (v) ensure effective implementation of site specific EDSCP.

Dredge Management Plan (DMP): The plan will address the management controls that the Contractor will put in place for all dredging and filling works. The objective of the plan is to ensure the dredging and disposal activities associated with the project meet the conditions of development consents and this ESIA. The plan should encompass vessel control and management; processes for selecting dredge site under advisement from TCAP experts; water quality controls; environmental and social controls for dredging and filling; and, UXO/ERW survey and disposal processes.

Sampling and Analysis Plan (SAP): The overall objectives of the SAP are: provide a description of the proposed dredging and spoil disposal activities for the project; provide methodology for collecting regular samples of sediment to keep a spatial distribution record of grain size and composition to build up improved knowledge of the resource; identify areas with high silt content which could create increased turbidity so these areas can be avoided; provide a summary of the catchment and land-use activities with the potential to impact on the quality of the dredge material; identify the list of likely contaminants present, based on review of surrounding uses and historic sediment quality data; identify the number of samples required to provide adequate representation of the average and upper 95% confidence interval for the contaminants tested; identify rigorous sample handling, storage and transport processes, to ensure sample integrity; establish data quality objectives, related to quality assurance and quality control standards; provide a description of the statistical analysis procedures, for determining the contamination status of the sediments; identify the appropriate sediment quality guidelines, (e.g. National Assessment Guidelines for Dredging, Commonwealth of Australia, 2009)

10.3 ESIA IMPLEMENTATION

10.3.1 Integration of ESIA into Project Procurement

This ESIA should be included in the bid document package.

The safeguard requirements of this ESIA will be referenced in appropriate parts of the technical specifications, the contractor's contract and any TORs for supervision or issued under the TCAP. The TCAP Project Manager will be required to review all bid documents prior to approval.

10.3.2 Roles and Responsibilities

The TCAP GCF Project Proposal Document ESMP outlines the implementation responsibilities for the environmental and social management, which also applies to this ESIA

10.3.3 General Management Structure and Responsibilities

The UNDP and DoE are accountable for the provision of specialist advice on environmental issues to the contractor and for environmental monitoring and reporting. The PMU on behalf of DoE will assess the environmental performance of the contractor in charge of construction throughout the project and ensure compliance with the CMP.

The DoE will be responsible for monitoring the implementation of the C-ESMP by relevant supervisory staff during construction. During operations, the contractor will be accountable for implementation of the C-ESMP. Contractors working on the projects have accountability for preventing or minimising environmental and social impacts.

10.3.4 Administration

The PMU will be responsible for the revision or updates of this document during the course of work. It is the responsibility of the person to whom the document is issued to ensure it is updated.

The site supervisor will be responsible for daily environmental inspections of the construction site. The DoE will cross check these inspections by undertaking monthly audits.

The contractor will maintain and keep all administrative and environmental records which would include a log of complaints together with records of any measures taken to mitigate the cause of the complaints.

The contractor will be responsible for the day-to-day compliance of the ESIA.

DoE will be the implementing agency and will be responsible for the implementation and compliance with the ESIA via the contractor. The ESIA will be part of any tender documentation.

10.3.5 Contractors

It is the Contractors responsibility to:

- Ensure the Contractors project team includes experienced safeguard specialists with sufficient in-country time allocation and financial resources specified in the Contract
- Prepare and have cleared by the Supervision Engineer the C-ESMP in accordance with this ESIA prior to commencement of works
- Carry out the project implementation in accordance with the C-ESMP
- Not to undertake any works or changes to works unless first approved in an updated C-ESMP
- Conduct daily and weekly safeguard inspections of the works to ensure compliance and reporting the results of these inspections to the Supervision Engineer
- Undertake community consultations on the draft C-ESMP in coordination with the PMU
- Post all notifications specified in this ESIA at the site entrance
- Report all environmental and OHS incidents to the Supervision Engineer for any action
- Provide monthly reports of all safeguard monitoring, incidents, complaints and actions to the Supervision Engineer
- Maintain a database of all complaints, incidents or grievances received. Any issues which cannot be dealt with immediately should be reported to the Supervision Engineer.

10.4 Institutional Capacity

The TCAP Project Management Unit has been tasked with the delivery and management of TCAPII. The PMU has been resourced with support staff based in Funafuti and Fiji specifically tasked to manage project implementation across management, finance, procurement, communication and technical. As such, the PMU carries much of the institutional capacity to implement the Project and to monitor the works for technical compliance. The PMU includes a safeguard specialist to ensure that they are able to monitor for compliance with the requirements of the ESIA, UNDP Social and Environmental Standards and national legislation.

Other parties who have monitoring or implementation responsibilities during project implementation eg Contractor, will be required as part of the contract to be resourced with a suitably experienced and qualified safeguard specialist.

It is the responsibility of the Contractor to ensure that they allocate budget lines to have the necessary specialist capacity, tools and equipment for the mitigation and monitoring measures as stipulated in the ESIA. Budget line items will be provided in the bid documents and Bill of Quantities (BoQ) to allow for the provision of adequate safeguards implementation, monitoring and training. This section will be updated prior to the release of the bid documents and once the BoQ has been prepared.

10.4.1 Contingency and Emergency Response

The TCAP National Project Manager (NPM) is the contact person for emergency situations that may arise during the implementation of the TCAPII works on Funafuti. The NPM will be available 24 hours a day, seven days a week, and has delegated authority to stop or direct works. In the event of an environmental emergency, the procedures outlined below are recommended for TCAPII to consider for implementation.

10.4.2 Contingency Plan

As part of their CMP, the Contractors are required to prepare a Contingency Plan encompassing the COVID-19 global pandemic, cyclone and storm events. The purpose of the plan is to ensure all staff are fully aware of their responsibilities in respect to human safety and environmental risk reduction. Procedures should clearly delineate the roles and responsibilities of staff; define the functions to be performed by them, the process to be followed in the performance of these functions including tools and equipment to be kept in readiness, and an emergency medical plan. All the Contractor's staff should undergo training/induction to the plan.

While it is preferable to undertake construction works outside of the wet season, it is probable that storm and heavy rain events will occur while works are underway.

The Contractors are responsible for monitoring weather forecasts, inspecting all erosion and sediment control measures and undertaking any remedial works required prior to the forecast rain or storm event.

In general, the Contractor will:

- Inspect daily weather patterns to anticipate periods of risk and be prepared to undertake remedial works on erosion and sediment control measures to suit the climatic conditions.
- Monitor the effectiveness of such measures after storms and incorporate improvements where possible in accordance with best management practice.
- Ensure appropriate resources are available to deal with the installation of additional controls as and when needed.
- Inform the Supervising Engineer if there are any concerns associated with the measures in place.

10.4.3 Emergency Response Plan

In the event of actions occurring, which may result in serious health (including pandemic), safety and environmental (catastrophic) damage, emergency response or contingency actions will be implemented as soon as possible to limit the extent of environmental damage.

There are residences located near the construction activities at the northern and southern ends of the reclamation.

The contractor will need to incorporate construction emergency responses into the projects complying with the requirements under the Occupational, Health and Safety Policy of the contractor or the work-related Government of Tuvalu legislation.

The DoE and UNDP staff must be notified immediately in the event of any emergency, including fire or health related matter including those that have resulted in serious environmental harm. The Contractor will be required to develop an Emergency Response Plan as part of their CMP and they are required to ensure that the following health and safety measures are included:

- Flammable and combustible liquids bunding/storage areas to be designed in accordance with appropriate international standards.
- Fire extinguishers are to be available within all site vehicles.
- No open fires are permitted within the project area
- No cigarette butts are to be disposed of onto the ground throughout the project areas, all smokers must carry a portable disposal bin to reduce the risk of a spot fire starting and general litter.
- Any stockpiles of mulch, sawdust or any other flammable materials are not to exceed two meters in height and width and must be turned regularly.
- Train all staff in emergency preparedness and response (cover health and safety at the work site)
- Check and replenish first aid kids and dedicated first aiders are within the project personnel on site
- Personal Protection Equipment is provided, and staff are trained on their correct use.

Appendix 1: Design Plans