



# Site Diagnostic Analysis Hihifo, Tongatapu, Tonga

## Stakeholder Consultation Workshop Report





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# Abbreviations

<b>EIA</b>	Environmental Impact Assessment
<b>GEF</b>	Global Environment Facility
<b>GEM</b>	Geoscience, Energy and Maritime
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit
<b>IDA</b>	Island Diagnostic Analysis
<b>IW</b>	International Waters
<b>MEIDECC</b>	Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communication
<b>MLECCNR</b>	Ministry of Lands, Environment, Climate Change and Natural Resources
<b>MLNR</b>	Ministry of Lands and Natural Resources
<b>MLNR</b>	Ministry of Lands and Natural Resources
<b>PACC</b>	Pacific Adaptation to Climate Change
<b>PICs</b>	Pacific Island Countries
<b>PMU</b>	Project Management Unit
<b>PTOA</b>	Party of the Friendly Islands
<b>R2R</b>	Ridge to Reef
<b>RapCA</b>	Rapid Assessment of Priority Coastal Areas
<b>RPCU</b>	Regional Programme Coordination Unit
<b>SMA</b>	Special Management Areas.
<b>SPC</b>	Pacific Community
<b>UNDP</b>	United Nations Development Programme
<b>VEPA</b>	Vava'u Environmental Protection Association

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# Executive Summary

The Regional International Waters Ridge to Reef Project is funded by the Global Environment Facility and executed by Pacific Community based at Suva, Fiji. Nationally, the Tonga demonstration project through the Ministry of Lands and Natural Resources.

The IWR2R Tonga project has implemented activities in the Hihifo district in Tongatapu including a rapid assessment of priority coastal areas, interventions for conservation of >300 hectares of coastal habitats through Special Management Areas and community led development of the Hihifo youth council.

The Island Diagnostic Analysis is a secondary analysis for the prioritization of environmental and social issues and identification of further interventions needed to address immediate, underlying and root causes for the identified issues. To further this work a core IDA working group including Silia Leger, Angelic Pale, Lutolofi Taunisila from project management unit (PMU), Heidi Muller (Hihifo youth council and PMU), Nikolasi Heni (Ministry of Lands and Natural Resources), Amanda Le'ota (Ministry of Fisheries), Tua'melie Fusimalohi (Department of Environment, MEI DECC), Sesimani Lokotui (Civil Society Forum Tonga) and Karen Stone Vava'u Environmental Protection Association (VEPA). As a requirement of all IDAs, gender and social inclusion is part of the considerations, consultations of the workshop undertaken.

Stakeholder workshops were held in July with 29 participants (10 men and 19 women) representing Government Ministries, Community leaders from Hihifo district council, district officers and civil society members. These participants identified and prioritized environmental impacts and identified further the direct and indirect social impacts and causes.

The immediate threats facing the Hihifo district were prioritized as deterioration in the quality of water systems, solid and liquid waste management, and exploitation of marine resources with global impacts from climate change and changes to habitats and community (biodiversity) scoring closely as increasing impacts.

Social impacts identified include loss of life, income and increasing poverty from the ongoing impacts with further identified issues to caring for family members, children's education and increasing health and social issues.

Identified activities for Hihifo district included community led activities for training of environmental management through environment impact training and using indicators for monitoring, strengthening agriculture through ensuring organic farming and reducing the use of pesticides and reducing the impacts from septic and grey water systems. These community led activities are to be gender and socially inclusive.

Government-led activities are recommended as implementing a spatial land use plan for Hihifo with recommendations based upon best outcomes for environment, social and economic activities.

This report provides the diagnostic analysis for the Hihifo district, Tongatapu.

# 1. Introduction

The Pacific International Waters, Ridge to Reef project is funded by the Global Environment Facility and implemented by the Regional Project Coordination Unit at the Geoscience, Energy and Maritime Division, Pacific Community, Suva throughout 14 Pacific Island countries. The IWR2R Tonga project is through the Ministry of Lands and Natural Resources with a dedicated project management unit (PMU).

The focus of the IWR2R project is to provide climate resilient and integrated approaches to land, water, forests, and coastal management through the prioritization of strategic planning, capacity building and pilot programmes that support sustainable livelihoods and conserve the ecosystem services provided through the habitats and biodiversity. These community trainings were also participatory and gender inclusive.

Since the implementation of the IWR2R Tonga project, the PMU has completed the following components:

- Implementation of 3 compost and 3 sand filtering toilet blocks
- Training of community to grant writing and project management skills
- Training of community in wastewater management
- Rapid assessment of priority coastal areas (RapCA) which included ecological, social and water quality assessment of coastal and near shore habitats
- Support development of the Hihifo Youth Council
- Protection of >300 hectares of coastal habitats through the designation of the special management area (SMA) in Kanokupolu

The continuing components till September 2021 include

- Island Diagnostic Analysis (IDA)
- State of Coasts Report
- Strategic Action Plan

This report covers the Island Diagnostic Analysis conducted for the Hihifo district in Tongatapu and focuses on a consultative process to identify the social and environmental impacts and identifies priority sites and activities for management and policy interventions.

Hihifo is situated on the western Kolovai peninsula on the main island of Tongatapu, kingdom of Tonga with 6 coastal communities of Fo'ui, Ha'avakatolo, Kolovai, 'Ahau, Kanokupolu and Ha'atafu. The population for the Hihifo communities was 1,990 persons (1,011 males and 979 females) in 2016 (Tonga Statistics Department, 2016) with all the communities situated within close to very close proximity of the coastline.



Island Diagnostic Analysis Workshop- 21/07/2021. The Island Diagnostic Analysis (IDA) provides a framework for identifying and examining local and national environmental and social impacts within a Ridge to Reef process.

## 2. Methodology of Diagnostic Analyses in Hihifo District

The following outlines the consultation process for developing the island diagnostic analysis through a series of workshops with the specified diagnostic analysis working team and broader stakeholder consultation.

Preparation and distribution of the workshop materials were organized from the guidelines for conducting an island diagnostic analysis prepared by the RPCU (Pacific R2R, n.d.) and in co-ordination with the core working team shown in Appendix 1.

The workshop activities were:

- Identify and agree on the scope, objectives and responsibilities pertaining to the focus area under investigation
- Identify and analyze the issues, problems, and impacts (and the environmental and associated socio-economic impacts) using problem-tree and causal-link analyses
- Prioritize the issues using risk assessment and problem-tree analysis
- Develop priority systems and plans for actions and interventions

# 3. Socio-Economic Description of Hihifo District

## 3.1 Physical Environment

Hihifo is a low-lying peninsula with a maximum land rise of 22 meters and most of the communities lying 0.5 to 6m above high tide water level, the island being formed through the raised limestone and soil deposits primarily from volcanic ash deposits with other soils formed by corals, lagoon, and mud sand (SPREP, 2014).

Primary land use is for root crops and fruit trees with native vegetation being removed from community settlements for plantations and home gardens.

## 3.2 Demographic Information

The six communities of the Hihifo have a total population of 1,990 persons with 50.8% male and 49.2% female. The population increased for three communities between the census of 2011 and 2016 Ha'atafu (21.2%), Fo'ui (14.9%), Kanokupolu (6.1%) and Kolovai (1.8%) whereas Ha'avakatolo had the largest decrease (-24.7%), and 'Ahau (-0.5%) showing smaller population decreases between 2011 and 2016 (Tonga Statistics Department, 2016).

**Demographics of the six communities of Hihifo, data is adapted from the Tonga National Census 2016.**

Community	Total Households	Total Population	Male	Female
Fo'ui	106	657	344	313
Ha'avakatolo	40	195	91	104
Kolovai	118	618	306	312
'Ahau	61	393	183	210
Kanokupolu	68	332	157	175
Ha'atafu	47	269	140	129
Total	440	2464	1221	1243

Fo'ui has the largest population of 657 persons and the smallest community is Ha'avakatolo with 195 persons in 2016.

## 3.3 Development & Employment Opportunities

Hihifo is a rural area located 17 kilometers from the main town district of Nuku'alofa where the central Government and majority of shops, bars and restaurants are located. Smaller shops (Fale koloa) are situated in each community providing foods and household goods and providing employment for both men and women. Farming of livestock and crops provides domestic and subsistence support to households through a system of land allocations or 'bush allotments' for each eldest male in the noble's family under the Lands Act 1988.

Hotels and restaurants are situated on the southern coast of the Hihifo area, and catering to both domestic and overseas guests through feast and cultural events. Most of these businesses were destroyed in the Tropical Cyclone Harold (in 2020) due to the large waves generated.

There is limited domestic manufacturing or medium to large scale industries in Tonga that can increase potential for employment and strengthen domestic economy, examples of emerging domestic activities are centered around agriculture products through Nishi Trading – a family-owned Tongan enterprise.

A large number of households rely on remittances from family members overseas or those working in New Zealand or Australia for the Government approved Regional Seasonal Employment scheme (National Reserve Bank of Tonga, 2021).

## 3.4 Natural Resource Use and Dependence

Natural resources such as food crops and marine resources (fish) are widely utilized and are heavily depended upon for subsistence, economic and social development activities. Women's fisheries activities appear to be primarily related to subsistence, food security and small-scale marketing for periodic income generation. Transportation costs and infrastructure barriers, such as unreliable sources of ice, constrain women from consistent engagement in small-scale informal business activities linked to shipping fish to larger markets

Land use is mainly for agricultural purposes for root crops (taro, yams, sweet potato), fruit trees (papaya, banana's, mango etc.) and household gardens for imported vegetables(Lettuce, tomatoes, pumpkins etc.). There are limited native forest areas within the Hihifo district and remaining forests areas are small and divided between community and agricultural plots. On average about 40% of subsistence workers are rural women with women comprising 35% of subsistence workers in rural Tongatapu.

Beach and lagoon sands are used through extractive mining for cultural activities of funerals and more extensively for building aggregate for making concrete blocks and carrying out road repairs. Sand resources in Hihifo have been over-utilized for development as well as impacted by the increase in tidal and storm surges from climate hazards. Commercial sand mining is licensed under the Lands Act 1988 however illegal mining occurs frequently for development.

Coastal marine habitats including mangroves, intertidal mudflats, seagrass beds and fringing coral reefs are widely used for subsistence and economic activities including fishing, gleaning (collecting of invertebrate species) and tourism (snorkeling and SCUBA diving).

## 3.5 Pollution and Introduction of wastes into the environment

Waste management including solid and liquid waste is an ongoing issue for Hihifo and more widely throughout Tonga. There is heavy reliance on imported goods from New Zealand, Australia, United States of America, and Asia. These imported goods include food, household and commercial goods including single-use plastics for food provisioning and bottled water, canned meats, and vegetables. This places high impacts on management of household waste supervised disposal at the landfill with littering and illegal dumping of waste on the coastal and bush areas.

As in most PICs, the cultural events of funerals, weddings, birthdays, church conventions, ceremonial/remembrance dates, demand extensive preparation of food for feasting. In Tonga, a lot of the imported goods that supplement or use in the preparation for these events are significant, which often contributed to large volume of municipal waste and pollution.

Sewage household waste is managed using septic tanks or long drop systems. Septic tank maintenance and design remain an issue for these low-lying coastal communities which are often found intruding on fresh and coastal water supplies. Grey and wastewater are less managed and generally discarded straight in the household surroundings (Lal and Takau, 2006)

Due to limited management despite legislative requirements for livestock to be maintained in pens, roaming livestock (pigs, cows, and horses) and household animals (dogs and cats) are common throughout these communities and coastal areas. Animal waste washes into freshwater lenses and coastal waters further increasing nitrate and phosphates that can cause algal blooms and eutrophication of coastal waters, thereby reducing fish and invertebrate stocks

## 3.6 Catchments and Coastal protection

A two-kilometer long rock coastal wall was built in 1983 through funding between Australian Aid and the Hihifo community, which led to a partially enclosed wetland and increased the destruction of mangroves and salt intrusion to ground water and agriculture areas (Geocare and Petroleum Consultancy, 2014).

An environmental impact assessment (EIA) was conducted in 2014 through the former combined Ministry for lands, environment, climate change and natural resources (MLECCNR) for the establishment of five coastal interventions in the Hihifo area including the use of bamboo and natural mangrove protection, and infrastructure interventions through groynes at Fo'ui and Kanokupolu. These intervention methods were recommended through the feasibility study by Sustainable Seas in 2013/14 (McCue, 2014).

The Department of Climate Change (Ministry for Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communication) further implemented an infrastructure-based coastal protection along the shoreline at Kolovai in 2019.



## 4. Environmental Status of Hihifo district

### 4.1 Ecosystem Management

The Hihifo area has scattered native forest areas divided between community and agricultural areas and impacted upon by invasive species and environmental pollution.

The coastal habitats include mangroves, primarily *Rhizophora* species with inshore mangrove species and coastal flora being removed by development and land reclamation. Fauna such as birds were observed in low abundance in the mangrove areas. These include *Fregata ariel*, *Sterna sp.*, *Egretta sacra*, *Aplonis tabuensis*, *Pycnonotus cafer* and *Todiramphus chloris* where an abundance of 2 were seen for all except *Fregata ariel* and *Pycnonotus cafer* where only 1 of each species were seen (Stone et al. 2021)., Scattered nests of flying foxes are also observed at Kanokupolu.

Intertidal mudflats are heavily influenced by sediments brought by land-based activity impacts with a reduction in patches of seagrass and macro algae that are beneficial to ecosystem productivity.

Fringing coral reefs are of varying health with signs of impacts from environmental and human-based impacts including overfishing and unsustainable practices. Reef fish populations are dominated by smaller species such as damselfish (pomacentrids) and wrasse (labrids) and other species that are not targeted for consumption (Stone et al. 2021).

Freshwater lenses are found in the upper ridge of the Hihifo area (22 meters above sea level) and are infiltrated by pollutants from agriculture chemicals, sewage and poor septic management, wastewater and animal waste (Cara, 2021;(Lal and Takau, 2006)

### 4.2 Natural Vulnerabilities

#### 4.2.1 Review of studies regarding natural hazards; inundation, erosion, water quality impacts

The Pacific Adaptation to Climate Change (PACC) project included technical analysis of the impacts of natural hazards, water quality and needs, associated with strengthening the overall environment and social outputs. The information was provided in a series of technical reports<sup>1</sup>

The Joint National Action Plan II provided the framework for the adaptation and management of work relating to climate change and impacts, though focuses more broadly on infrastructure than ecosystem-based adaptation and ridge to reef processes (Government of Tonga, 2018a).

Disaster risk management plans and studies have been widely conducted by the National Emergency Management Office and Ministry for Infrastructure and focused on the implementing activities for disaster risk reduction including development of community-based disaster and emergency management plans (Government of Tonga, 2009; Government of Tonga, 2021).

#### 4.2.2 Disaster preparedness initiatives

The National Emergency Management Office runs disaster preparedness and manages impacts from natural and climate disasters alongside Government and civil society partners, training and widespread awareness has been conducted by multiple partners and supported through regional and international funding.

Newer developments include the building of improved cyclone-resilient schools and houses which are being introduced under partnerships between the Tongan Government and development partners such as Australian Department of Foreign Affairs and Trade, World Bank and Ministry for Foreign Affairs and Trade, New Zealand.

1 Access technical reports No. 1 – 18: <https://www.sprep.org/node/942>

### 4.2.3 Potential impacts of climate change

Low-lying land areas such as Hihifo are subject to increasing impacts from climate change, Tropical Cyclones are expected to increase in both frequency and strength with the increasing impacts felt by all communities across Tonga (IPCC, 2019). Tropical Cyclones have directly impacted Tongatapu with two Category four cyclones in the last 3 years Cyclone Gita (in 2018) and Cyclone Harold (in 2020).

Sea level rise is an ongoing issue for low lying communities such as Hihifo, prediction for sea level rise is to increase by 7.3mm annually as King tides are also impacting communities (MEIDECC, 2018).

Ocean acidification (increasing acidity) is a continuing threat to the reef-dependent communities as in Tonga and other Pacific Island countries. These countries would be impacted with the highest relative vulnerability to ocean acidification on reefs and their fisheries, tourism, and aquaculture (Johnson et al. 2015). Under the Commonwealth Blue Charter, New Zealand hosted the Commonwealth Ocean Acidification Action Group Workshop where scientific experts and observers were joined by government officials from 17 Commonwealth countries (including Tonga). This workshop opened the dialogue on possibilities of enhancing the ability of Commonwealth countries in addressing ocean acidification through capacity development, strategies for marine monitoring, governance, management, and ocean literacy (McGraw et al. 2021)

Changes in rainfall is widely anticipated to increase with longer drought periods affecting agriculture crops. Increased flooding during exceptional heavy rain periods, rainfall and changing air and ocean temperatures are also susceptible to the natural phenomenon of El Niño and La Niña (MEIDECC 2018).

### 4.2.4 Multiple users of waterways in Coastal Areas

Water supplies (including coastal and catchment areas) are broadly used across sectors including agriculture, fisheries, tourism, and community uses for livelihood and cultural activities. Fresh water supplies are also widely used between sectors, municipal waters in Nuku'alofa are managed through the Tonga Water Board with the Hihifo water managed locally through community committees and monitored by the Public Health Department. The bore wells are monitored by the Natural Resources Department, Ministry of Lands and Natural Resources.

## 4.3 Environmental Issues

Hihifo has experienced ongoing and increasing environmental impacts between terrestrial and coastal ecosystems, natural resources, and inadequate environmental management. The Rapid Assessment of Priority Coastal Areas, undertook a biological and ecological assessment of the coastal and near-shore habitats and biodiversity in 2020 and identified issues with waste water, septic leakage, overfishing and unsustainable practices across the range of habitats (Stone et al. 2021). The water quality data collected found that 3 out of 8 sites for dissolved oxygen were below the lower limit for trigger values, 1 out of 8 sites exceeded the ammonia concentration trigger value (though 4 of the sites were very close to the trigger value) and 1 out of 8 exceeded the trigger value for phosphate. Animal trails were also found throughout the RapCA survey sites which contribute to the significant coliform counts (Lokotui, 2021).

Moreover, an island diagnostic analysis workshop was conducted in July 2021 in Tongatapu with Hihifo district council, town officers, Government, civil society, and public sector representatives to identify priority environmental issues, direct and indirect social impacts, and potential causes for the issues (Table 1).

**Table 1** Priority areas identified for the environmental impacts faced in the Hihifo district during the Island Diagnostic Analysis workshop. Scores indicate 1 = no importance, 2 = low importance, 3 = moderate important, 4 = high importance.

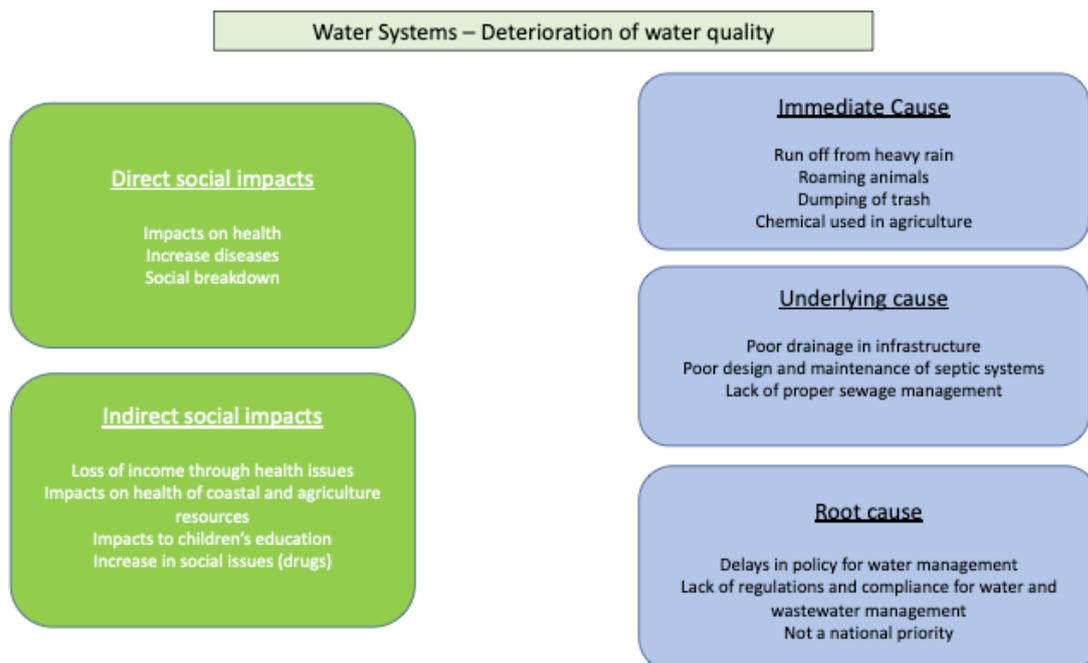
	Water systems	Pollution	Habitats and community	Exploitation of resources
Affected area (whole of Hihifo)	4	4	4	4
Future risk (10 years)	4	4	4	4
Relations with other environmental issues	4	4	4	4
Multiple benefits if managed	4	4	4	4
Addressing issues nationally	3	3	3	3
Urgency	4	4	4	4

The inter-connected issue with ecosystems and environmental impacts are shown in the scoring above using the risk analysis work provided by the regional programme co-ordination unit at Pacific Community (Table 1).

The basis for ecosystem-based management and ridge to reef processes identifies further issues through social patterns and diagnosis. These social and perceived causes are shown in the Figure 1 for water resources, Figure 2 solid and liquid waste, and Figure 3 exploitation of resources - primarily marine species.

## 4.4 Priority Issue 1: Water resources

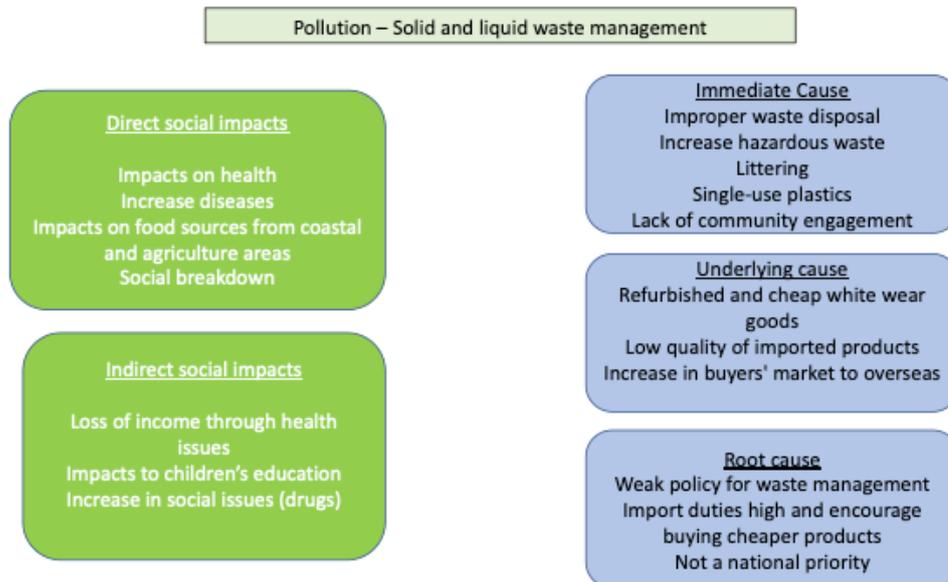
The fresh and coastal waters in Hihifo are impacted by human activities and climate change. The quality of the water supplies is degrading over time which will largely impact the health of the community through the increase of faecal coliforms (*E. coli*) and bacteria from leaking septic, grey water management and faeces from roaming animals (Lokotui, 2021; Stone et al. 2021) (Figure 1).



**Figure 1** Stakeholder responses from the Island Diagnostic Analysis workshop on the social impacts and causes deterioration of water quality.

## 4.5 Priority Issue 2: Pollution

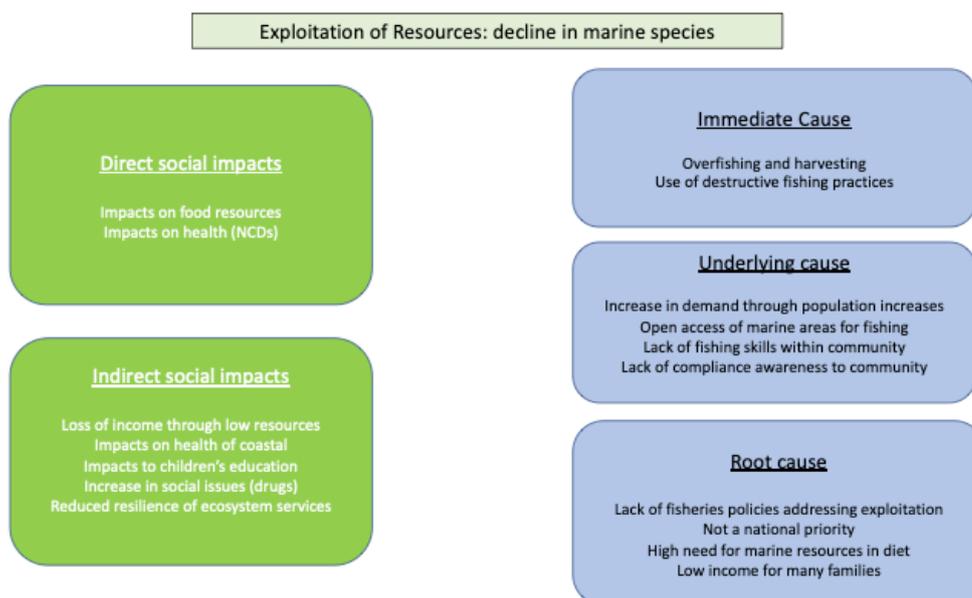
Solid and liquid waste is impacting widely across the Hihifo district and affecting the health of habitats and biodiversity as addressed in the Rapid Assessment of the Priority Coastal Areas (RapCA) in 2020 including coastal water quality and illegal dumping of waste in the mangrove habitats (Figure 2).



**Figure 2** Stakeholder responses from the Island Diagnostic Analysis workshop on the social impacts and causes for solid and liquid waste management practices

## 4.6 Priority Issue 3: Exploitation of resources (living and non-living)

Over-exploitation of natural resources places a heavy burden on ecosystems and the services they provide, including biodiversity. Through proper governance and commitment, both natural resources and ecosystem services can be co-managed, as identified in the IDA (Figure 3).



**Figure 3** Stakeholder responses from the Island Diagnostic Analysis workshop on the exploitation of resources and the decline of marine species.

## 5. Governance

### 5.1 Governance System

Tonga is a constitutional monarchy since 1875, was first ruled by King Tupou I and in 2010 became a parliamentary democracy following public riots in 2006 and the dissatisfaction of monarchial rule (Osborne, 2014). Although the legal framework is progressive and relatively liberal with regard to the promotion of gender equality, some laws discriminate against women, notably those related to land ownership and the distribution of property and wealth during divorce (Pacific Community, 2019)

Within the parliamentary democracy, the generally elected members of parliament (MPs) create the majority (17) with the nobility holding the remaining 9 seats. Elected representatives consist of members from the outer island districts ('Eua -1, Ha'apai -2, Vava'u - 3, Ongo Niua (Niuatoputapu and Niuafu'ou-1) plus 10 in Tongatapu.

The ruling monarch is supported by the Privy Council and retains power over the Military (Army and Navy), while the Judiciary is independent.

Political parties are not widely successful in Tonga, with only the Democratic Party of the Friendly Islands (PTOA) having wider diaspora membership through the former Prime Minister Samiuela 'Akilisi Pohiva (who passed away in 2019). The current Prime Minister is a member of the People's Party, though most of the Cabinet are classified as "Independent". Elections are conducted every four years for Members of Parliament.

The main Government is housed in Nuku'alofa, Tongatapu with smaller office branches in the outer island districts, Ha'apai and Vava'u have Governors in place that act as advisors to the Minister for Lands and oversee the government department meetings.

District and Town officers are elected by the public every three years and are mandated through the Prime Minister's office and District and Town Officers Act (Government of Tonga, 1988). District councils have been established including in Hihifo however are not currently recognized under legislation. Women have traditionally held high social status within Tongan society because of the 'fahu' system within families, where the eldest sister (or another chosen sister) holds a place of honour and respect and plays an important role in family decision-making (Pacific Community, 2019).

Land ownership plays a vital role and challenge in the ongoing governance with land primarily owned by the King through Royal estates and the Nobles whom each have hereditary ownership across the island groups. The eldest male of each household is "gifted" a town and bush allotment, often tied within locations of other family plots meaning extensive land ownership is generally shared between large families. Land parcel ownership within the Hihifo district is shown in Table 2.

**Table 2** Estate titles for land in the six communities of Hihifo (source: Socio-economic assessment of the Hihifo district (SPREP 2014))

Community	Estate Owner
Fo'ui	Noble Vaha'l
Ha'avakatolo	Noble 'Ahome'e
Kolovai	Noble Ata
'Ahau	Government
Kanokupolu	Royal (King)
Ha'atafu	Government

Women cannot legally own land and even through land is being passed on after death, the land will pass to the next oldest male and not to the widow or female family members. Foreign ownership of land is also not permitted and is generally only through long term Government lease (30-99 years) or private tenure [not legally supported in Tonga by the Government].

## 5.2 Policy

**The Tonga Strategic Development Framework II [2015-2025]** (Ministry of Finance and Planning, 2015) provides the overarching mandate for social, cultural, environmental, and economic objective for the Government of Tonga including:

- More inclusive, sustainable, and balanced urban and rural development across island groups
- More inclusive, sustainable, and empowering human development with gender equality
- More inclusive, sustainable, and responsive good governance with law and order
- More inclusive, sustainable, and successful provision and maintenance of infrastructure
- More inclusive sustainable and effective land administration, environment management and resilience to climate and risk

**The State of Environment** provides the framework for current status of coastal, terrestrial and marine habitats and the biodiversity within and indicates priority broad scale management activities in Government sectors (Government of Tonga, 2018b).

**Integrated Water Resource and Coastal management (IWCM/IWRM)** reports and frameworks have included the national integrated water resource management diagnostic analysis in 2007 funded by Global Environment Facility and highlighted management and resource needs to strengthen the development of water resources management in Tonga (SOPAC, 2007)

**Special Management Areas (SMAs)** are a community-based fisheries program under the Ministry of Fisheries and legislated through the Fisheries Coastal Community Regulations and Fisheries Act. The SMAs are a near-shore fishery resource management program which includes an outer boundary and at least one fish habitat reserve. The aim of the SMA program is to tackle complex challenges facing coastal communities including the depletion of fisheries resources, restoring marine habitats, and responding to climate change and achieving inclusive growth and sustainably managing natural resources (Smallhorn-West et al. 2020).

Building codes are regulated by the Ministry of Infrastructure (Government of Tonga 2016a) however secondly the Health Act, Ministry of Health may specify for the design and placement of septic tanks including proximity to public or domestic water (Government of Tonga 2016c). Town water supplies for urban areas are managed and designated under the Tonga Water Board and inspections conducted under the Ministry of Lands and Natural Resources (Katoa, 2020).

The Environmental Impact Assessment Legislation and Regulations are implemented through the Ministry for Environment (MEIDECC) for providing best practices and guidelines for determining the potential size and scale of development and infrastructure programs and to oversee and approve Environment Impact Assessment reports through projects and consultants (Government of Tonga 2016b).

Currently in draft is a 10-year strategic plan for hydrological resource management through the Ministry of Lands and Natural Resources, which aims to address institutional and human capacity for effective and inclusive water resource and related ecosystem management; operate and strengthen infrastructure for sustainable water resources; facilitate the potential for wastewater treatment and reuse and to improve the efficiency on the use of water resources.

## 5.3 Communities and other stakeholders

Table 3 below outlines the formal and informal ways that communities and wider stakeholders support and communicate over social, environmental, and economic activities.

**Table 3** Formal and informal communication and support sectors.

Category	Stakeholder	Role
Community	Town officer	Elected official for representing community needs and providing input to the district and government ministries
	Church	Spiritual support and assistance to the congregation, emergency shelter during cyclones
	Kava Clubs	Social men's gathering, provide support for social and community needs, fundraising activities for families
	Women's groups	Community groups providing economic activities (weaving) and social gathering and support
	Youth groups	Support and program-based activities for youth between 15-34 years of age
District	District Officer	Oversees needs of communities within the district, liaises with District Council and Government
	Church	Spiritual and cultural counsel Evacuation centers during Cyclones and natural disasters
	Schools	Education and social support for children, parents, and youth
	District Council	Manages the needs of the communities and presents political engagement through Member of Parliament
	Business	Social and economic engagement, provides some employment benefit
	Civil Society and NGO's	Communication, awareness, and project-based programs covering economic, social and environment programs
	Government	Governance, communication, awareness, social and financial support

## 5.4 Public Participation

The 'Fono' is the traditional provincial community and district meeting which is undertaken as part of the elected roles of the District and Town officers. The Fono is held quarterly and includes community representatives from women, men, and youth.

Town officers may hold regular meetings within their community depending on the ongoing needs, projects, and upcoming activities.

Government, civil societies, and non-governmental organizations through funded projects also hold meetings which communities participate in to both gain knowledge and provide feedback. Civil society and NGOs also provide more open communication platforms for women, youth, and disabled groups to participate.

## 6. History of interventions

Hihifo has been privy to an ongoing range of interventions for the aimed improvement of social, economic, and environmental management. The following outlines the interventions, who was involved and when they were implemented.

Climate adaptation and resilience projects have been widely implemented by a range of donors and partners; Table 4 below provides an overview.

**Table 4** Overview of the climate adaptation and resilience programs implemented in the Hihifo district.

Year	Funder	Project Name/ Communities	Partners	Objective	Links to R2R
2017	GIZ	Mangrove Planting: Fo'ui, Ha'avakatolo, Kolovai and 'Ahau	MEIDECC, European Union, Pacific Islands Forum Secretariat	Establish "green buffer zone" through the planting of mangroves and establish nurseries for benefitting biodiversity (MEIDECC 2017) Implementation of seawalls for reducing waves.	Ecosystem-based adaptation has strong ties to the Ridge to Reef process.  The infrastructure of the seawalls has been linked to other coastal erosion issues.
2014	UNDP, GEF	Pacific Adaptation to Climate Change: Fo'ui, Ha'avakatolo, Kolovai, 'Ahau, Kanokupolu and Ha'atafu	MEIDECC, SPREP, Hihifo	Increasing resilience of water resource management for the Hihifo district	Water resources are a critical component of the R2R
2020		Planting of coastal trees and clean-up for climate change awareness	Climate Change (MEIDECC), Tonga Development Bank, Department of Environment (MEIDECC) and Fo'ituluta Women's group <sup>2</sup>	Reduce coastal erosion through planting of tree species, remove waste that impacts ecosystems	Ecosystem-based adaptation

<sup>2</sup> Coastal tree planting and clean up <https://www.pacific-r2r.org/index.php/news/coastal-clean-and-coastal-tree-planting-tonga>

**Compost and sand filtering toilets** were installed under the R2R Integrated Water and Coastal Management Tonga project in 2020, with the aim to pilot toilet systems that reduce water resource needs and install plastic septic tanks reducing the potential for leakage from poorly maintained septic systems. This program is funded by the Global Environment Facility and implemented regionally by Pacific Community and nationally through the Ministry of Lands and Natural Resources.

**Upgrading of water systems** was conducted in 2019 funded by the Grass-roots human security projects, Government of Japan. (<http://www.tonga-broadcasting.net/?p=16720>)

**Special Management Areas (SMAs)** are a community-based near-shore fishery management program developed and implemented through the Ministry of Fisheries and supported by a range of donors and civil society/non-governmental organizations. The objective of the SMA program is to “enhance and conserve the near-shore marine resources to previous abundance and strengthen the resilience of habitats and community to ongoing climate hazards”. Each SMA has an outer boundary and at least one fish habitat reserve (no-take area) and may include mangroves, intertidal mudflats, seagrass beds and fringing coral reefs.

There are currently two designated SMAs within the Hihifo district at Ha’atafu and Kanokupolu (development of SMAs is ongoing). There are also integrated coastal management plans associated with these SMAs. The Ministry of Fisheries led the work, with support of R2R resources, in preparing the above ICM plans.

Community led interventions that were gender and socially inclusive have also occurred through programmes conducted by civil society organizations and in support of national programs including clean up campaigns and tree planting for climate change awareness week.

## 7. Key Findings

### 7.1 Summary of main findings

The main findings from the Island Diagnostic Analysis for the Hihifo district are the anthropogenic pressures facing the natural resources, environment and biodiversity and the urgent need for implementation of projects including awareness and knowledge exchanges which include gender and social considerations that address the water quality and solid waste management issues that are broadly impacting both ecological and social structures.

There is a large need for developing ridge to reef process interventions to reduce and eliminate threats to water quality and strengthen community-led management of habitat and community (biodiversity). Both need to be linked in interventions and infrastructure development need to be mindful of the very fractured nature of the Hihifo environment.

Broadening engagement and ensuring increased interactions and awareness programs with women and youth, and other vulnerable groups in communities will also be critical to the future implementation and success of programs. These programs should include training on policy and management actions such as the basis of environmental impact assessments.

Policy interventions are needed through land use planning and increasing the ability for food security and direct economic opportunities. There are also urgent policy actions needed to minimize and avoid municipal waste and pollution levels contaminating underground water lenses and surface coastal marine waters. The Dry Litter technologies through compost toilets, piggeries and sand filter systems are only the start, but future R2R investments and planning needed to replicate and upscale combination of innovative technologies and land-use planning.

## 7.2 Opportunities

Some of the factors that exist in Hihifo that can be harnessed for successful implementation of the GEF-IW Ridge to Reef project include:

- Implementing a spatial mapping for land use to identify risks from and to food security and resources use activities such as agriculture
- Develop an organic agriculture plan to reduce harmful pesticides and herbicides and encourage a domestic market of healthy produce. These activities to target women, youth, and other vulnerable groups.
- Identify potential community-based aquaculture programs for improving marine resources and food security. Women, youths, and other vulnerable groups could be involved in these initiatives.
- Reduce wastewater intrusion to fresh and coastal waters, secure funding for septic tanks for households within 20m of freshwater lenses and coastal areas

Develop a grey water mitigation program to reduce grey water intrusion to fresh and coastal waters through installing soak away pits with rocks, shells from clams after harvesting and natural sand filtration around sensitive coastal and fresh water areas (Wurochekke et al. 2016)

- Further interventions need to be developed with the community and through the Hihifo district council following full review and gap analysis from previous programs
- Training of the Hihifo Council and Hihifo Youth Council on the basics of environmental impact assessments and the need for development to be carefully implemented for the benefit to the environment and reducing the social impacts identified in the document.

## 7.3 Risks

Some of the risk factors that exist for the successful implementation of the GEF-IW Ridge to Reef project at Hihifo include:

Lack of resources and training for the Hihifo council and community leaders to implement awareness and information workshops on the outcomes of the island diagnostic analysis.

Hihifo has already had a lot of work conducted on improving the water supply and water quality, however, there seems to be ongoing issues to the duration and sustainability of these projects, until further investigation and consultation with communities, these ongoing issues are not being addressed. Any subsequent water resource programs will be subject to the same issues, so continuity of projects needs to be ensured.

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## 9 Appendix

### Appendix one: Island Diagnostic Analysis Team Members

Name	Ministry/ Agency	Gender (M/F/O)
Amanda Le'ota	Ministry of Fisheries	Female
Nikolasi Heni	Natural Resources Division	Male
Silia Leger	R2R, Natural Resources Division	Female
Lutolofi Taunisila	Natural Resources Division	Male
Heidi Muller	R2R, Youth Council TBU 5	Female
Angelic Pale	R2R, Natural Resources Division	Female
Kilisitina Moala	R2R, Natural Resources Division	Female
Tu'amelie Fusimalohi	Department of Environment	Male
Karen Stone	Vava'u Environment Protected Area	Female
Sesimani Lokotui	Small Grants Program, Civil Society	Female

### Appendix two: Workshop Attendees for the Island Diagnostic Workshop, Nuku'alofa, July 2021

#	Name	Ministry/ Agency	Gender (M/F/O)
1	Siola'a Malimali	Ministry of Fisheries	Male
2	Amanda Le'ota	Ministry of Fisheries	Female
3	Peta Koloamatangi	Department of Environment/MEIDECC	Female
4	Lola Tonga	Waste Authority Limited	Female
5	Eleni Latu'ila	Ministry of Internal Affairs/WAGED	Female
6	Mele Kioa	Ministry of Agriculture, Food, Forestry	Female
7	Emaloni Tongi	Live and Learn Tonga	Male
8	Sione Tokai	Ministry of Finance & National Planning	Male
9	Amelia Sili	Ministry of Lands & Natural Resources	Female
10	Susitina Ta'ai	Ministry of Lands & Natural Resources	Female
11	Karen Stone	Vava'u Environment Protection Association	Female
12	Melesila Weilert	Ha'atafu Community	Female
13	Sivilaise Manumanu	Ahau Community	Female
14	Sione Manumanu	Hihifo District Officer	Male

15	Siosaia Ma'asi	Hihifo Constituency Council	Male
16	Losaline Ma'asi	Tongatapu 5 Parliament Representative	Female
17	Samuela Finau	Youth Council - Hihifo	Male
18	Tupou Pinomi	Hihifo Constituency Council	Female
19	Marika Moala	Tonga Red Cross	Female
20	Elisapeti Veikoso	Marine Spatial Plan	Female
21	Maka Matekitonga	PUMA	Male
22	Tu'amelie Fusimalohi	Department of Environment/MEIDECC	Male
23	Sesimani Lokotui	Small Grants Programme, Civil Society	Female
24	Renny Vaiomo'unga	Ministry of Lands & Natural Resources	Male
25	Silia Leger	IWR2R/Ministry of Lands & Natural Resources	Female
26	Kilistina Moala	IWR2R/Ministry of Lands & Natural Resources	Female
27	Angelic Pale	IWR2R/Ministry of Lands & Natural Resources	Female
28	Lutolofi Taunisila	Ministry of Lands & Natural Resources	Male
29	Heidi Muller	R2R, Youth Council TBU 5	Female

## Appendix Three: Working group documents from the Island Diagnostic Workshop, Nuku'alofa July 2021

Size of the affected area (as percentage of the total national land area)	<ol style="list-style-type: none"> <li>1. &lt; 10sq.km</li> <li>2. 10 to 100sq.km</li> <li>3. 100 to 1000sq.km</li> <li>4. 1000 to 10,000sq.km</li> <li>5. &gt;10,000sq.km</li> </ol>		
Affected population (as percentage of national population)	<ol style="list-style-type: none"> <li>1. &lt; 1000</li> <li>2. 1000 to 10,000</li> <li>3. 10,000 to 100,000</li> <li>4. 100,000 to 500,000</li> <li>5. &gt;500,000</li> </ol>		
Extent to which the natural catchment, aquifer or receiving coastal and marine waters support the livelihood of <b>local communities</b> (e.g., subsistence or commercial farming, forestry, mining, tourism, fisheries)	<ol style="list-style-type: none"> <li>1. very low importance (&lt;10%)</li> <li>2. low importance (10-30%)</li> <li>3. average importance (30-50%)</li> <li>4. important (50-80%)</li> <li>5. very important (&gt;80%)</li> </ol>		

Extent to which the natural catchment, aquifer or receiving coastal and marine waters support the <b>national development</b> (e.g., commercial farming, forestry, mining, tourism, fisheries)	<ol style="list-style-type: none"> <li>1. very low importance (&lt;10%)</li> <li>2. low importance (10-30%)</li> <li>3. average importance (30-50%)</li> <li>4. important (50-80%)</li> <li>5. very important (&gt;80%)</li> </ol>		
Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans e.g., NEAPs)	<ol style="list-style-type: none"> <li>1. no, not a priority</li> <li>2. yes, low priority</li> <li>3. yes, medium priority</li> <li>4. yes, high priority</li> <li>5. yes, very high priority</li> </ol>		
Extent to which the site is of regional and/or global significance and priority (see WWF ecoregions, IUCN categories, UNESCO world heritage sites, etc.)	<ol style="list-style-type: none"> <li>1. no, not a priority</li> <li>2. yes, low priority</li> <li>3. yes, medium priority</li> <li>4. yes, high priority</li> <li>5. yes, very high priority</li> </ol>		
Degree of Degradation at the site (e.g., type of degradation)	<ol style="list-style-type: none"> <li>1. very low</li> <li>2. low</li> <li>3. average</li> <li>4. high</li> <li>5. extremely high</li> </ol>		
Extent of degradation on catchment and/or aquifer and any receiving coastal and marine resources and systems	<ol style="list-style-type: none"> <li>1. very low</li> <li>2. low</li> <li>3. average</li> <li>4. high</li> <li>5. extremely high</li> </ol>		
Cultural or traditional value of the site	<ol style="list-style-type: none"> <li>1. very low</li> <li>2. low</li> <li>3. average</li> <li>4. high</li> <li>5. extremely high</li> </ol>		
Extent of community management at the site	<ol style="list-style-type: none"> <li>1. very low</li> <li>2. low</li> <li>3. average</li> <li>4. high</li> <li>5. extremely high</li> </ol>		





