Political Economy of Water Management and Community Perceptions in the Pacific Island Countries

Authored by Marc Wilson, Gordon Nanau, Milika Sobey & Semi Lotawa

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Photo courtesy of Dave Hebblethwaite, SPC

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Acronyms

ACWA	Addressing Climate Vulnerability in the Water Sector
ADB	Asian Development Bank
AWP	Australian Water Partnership
CBO	Community Based Organisation
CBSI	Central Bank of Solomon Islands
CCDA	Climate Change Development Authority
CDP	Committee for Development Policy
CLTS	Community Total Led Sanitation
CROP	Council of Regional Organisations in the Pacific
CV	Coefficient Variation
DFAT	Australian Department of Foreign Affairs and Trade
DLP	Developmental Leadership Program
ECE	Early Childhood Education
ECP	Economic Citizenship Programme
EDF	European Development Fund
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EKT	Ekalesia Kelisiano Tuvalu Church
ENSO	El Niño Southern Oscillation
EU	European Union
EVI	Environmental Vulnerability Index
FAO	Food and Agriculture Organization of the United Nations
FAST	Fa'atuatua i le Atua Samoa
FPTP	First-Past-the-Post
FSM	Federated States of Micronesia
GCC	Great Council of Chiefs
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GCU	Government Communication Unit
GDP	Gross Domestic Product
GEDSI	Gender Equity, Disability, and Social Inclusion
GEF	Global Environment Facility

GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLAAS	Global Analysis and Assessment of Sanitation and Drinking-Water
GNI	Gross National Income
GNP	Gross National Product
GWP	Global Water Partnership
H2S	Hydrogen Sulfide
HCC	Honiara City Council
HIES	Household Income and Expenditure Survey
HRWH	Household Rainwater Harvesting
IBRD	International Bank for Reconstruction and Development
ICHNS	Integrated Child Health and Nutrition Survey
IDA	International Development Association
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
LDC	Least Developed Countries
LLG	Local Level Government
MP	Member of Parliament
MPA	Member of Provincial Assembly
NGO	Non-Government Association
NOAA	National Oceanic and Atmospheric Administration
NZ	New Zealand
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PICS	Pacific Island Countries
PIFON	Pacific Island Farmers Organization Network
PLG	Polynesian Leaders Group
PMU	Project Management Unit
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PRIF	Pacific Regional Infrastructure Facility
RAP	Regional Action Plan
RMI	Republic of the Marshall Islands

RWH	Rain Water Harvesting
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
SIG	Solomon Islands Government
SOE	State Owned Enterprise
SOPAC	South Pacific Applied Geoscience Commission
SPC	Pacific Community
SPCZ	South Pacific Convergence Zone
SPREP	Secretariat of the Pacific Regional Environment Programme
TOR	Terms of Reference
TUV	Tuvalu
TVET	Technical and Vocational Education and Training
TWP	Thinking and Working Politically
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCAP	Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund,
USA	United States of America
USAID	United States Agency for International Development
USAPI	United States Affiliated Pacific Islands
USD	United States Dollar
USP	University of the South Pacific
UV	Ultraviolet Light
WASH	Water, Sanitation, and Hygiene
WATSAN	Water and Sanitation
WB	World Bank
WHO	World Health Organization
WMP	Water Management Plan
WRA	Water Resource Assessment
WRM	Water Resources Management
WSP	Water Safety Plan

Executive Summary

The purpose of this report is to contextualise the unique characteristics of the Pacific Island Countries (PICs) and identify some roadblocks to achieving universal access to clean water and sanitation. The PIC context is established by examining the PICs' unique economic, socioeconomic, geomorphology, climate, and cultural characteristics. Governance, institutions, and the political economy of water resource management (WRM) are discussed for each PIC to determine the role of and power of stakeholders in WRM, the sociocultural variation among PICs and how these may be better harnessed or modulated to achieve progress in WRM.

In a region overwhelmingly dominated by the Pacific Ocean, the availability of safe freshwater is a fundamental challenge for Pacific Islanders. The 14 PICs included in this report lie in an ocean area of around 25 million km^2 with a land area of fewer than 0.5 million km^2, of which Papua New Guinea (PNG) comprises 90%. The PICs' environment and rainfall are dominated by the ocean environment, climate change, and variability. As a result, they vary considerably in their size and geomorphology, biology, economies, and cultures, with over 6,000 islands and islets ranging from high volcanic islands to tiny low coral atolls. In addition, they have varied political and governance systems.

They are remote and isolated from major markets and each other, with relatively small GDPs, limited land area, and finite natural resources. Low and, at times, negative growth rates rely heavily on subsistence agriculture, fishing and personal remittances and imports, leading to very high import ratios. In addition, most are highly susceptible to natural disasters and the consequential negative impacts on their economies and infrastructure, further challenging their budgets. The public sector dominates their formal economies, and governance is characteristically weak, resulting in considerable fiscal pressure due to the fixed costs of running governments in an environment of fluctuating annual income. Most have high indebtedness and limited capacity to borrow. These factors limit the ability of PICs to undertake significant infrastructure works without Overseas Development Assistance (ODA). It also means that funding repairs and maintenance of facilities are challenging at best and impossible at worst, thus limiting their WRM capacity.

Basic drinking water access and sanitation are available to only 55% and 30% of Pacific Islanders, respectively, the latter the lowest globally. The national consequences of poor WRM will be reflected in a lack of access to water to sustain the growth, health, and wellbeing of Pacific Islanders, resilience to climate change, weather variability, and natural disasters. Progress in access to improved drinking water and sanitation has been slow, and some PICs have regressed. Sustainable Development GOAL 6 on water and sanitation aims to "ensure access to water and sanitation for all" by 2030. However, the Pacific Region will fall well below its SDG 6 Goals by 2030 unless urgent action and immediate significant funding are available to PICs.

The inexorable trifecta of water security, climate change and natural disasters needs to be further pursued through regional coordination and within national government policy. WRM is part of a broader need for national action planning, and the most apparent contemporary instrument for this is the National Adaptation Plans. Many of these are currently under review, and opportunities exist to formally align WRM in this process and to source significant adaptation funding to progress national water and sanitation management.

In PICs, development interventions, including in WRM, must acknowledge the importance of 'hybridity' on the ground across diverse and heterogeneous contexts. Hybridity in this context can be seen as a helpful framework for grappling with real-world phenomena that, in one way or another, entail the interpenetration of 'local', indigenous or place-specific socio-legal, political, or economic orders on the one hand, with global, transnational, or foreign orders on the other.

The context in which WRM interventions in PICs are designed and implemented needs to realise that the market and other introduced institutions have not entirely replaced or incorporated non-market social relations and other "traditional" institutions. They have instead merged with them, often in very creative ways that enable people and communities to have "the best of both worlds".

In many PICs, there are different levels of government (MPs, MPAs, members of the Falekaupule, City Councillors, etc.) either through election or by appointment. Moreover, traditional leadership networks persist and, along with religious structures, are significant actors in WRM. Land ownership significantly impacts WRM in PICs, where 11 out of 14 countries are comprised of over 80% customary lands. Consequently, WRM requires agreement with customary owners as compulsory acquisition is rarely a political option. Therefore, as WRM is a cross-cutting issue and service, several government departments, landowners, churches, and NGOs have a say and influence. Understanding these power dynamics at the national and local levels is fundamental to achieving agreement on WRM. Embedding WRM design at the societal level is critical, especially when dealing with rural communities. Unlike "Western" approaches to development, indigenous Pacific systems emphasise "relationality", spirituality, Pacific agency, and community and nature's inseparability. This difference in the way Pacific societies see development applies to WRM.

There are many examples of poorly defined areas of responsibility within government leading to poor coordination, communication, and a lack of accountability. These fundamental governance issues are compounded by poor policy, legislation, ownership, and capacity. As a result of a lack of human capacity in WRM, even existing facilities are not optimised. Among the over 8,500 people employed in the sector, a recent study estimated that 1,000 people needed to be trained on a yearly basis, and this number is likely to increase in the future to achieve SDG 6. These numbers indicate both human and financial resourcing constraints faced by PICs.

According to a perception survey carried out in the Nadi catchment area, organisations' characteristics can help or hinder politically informed programming. Often, peri-urban areas are located beyond the historical service area, and service provider budgets are limited, resulting in poor supply. Achieving universal access to safe water and sanitation in these communities, which are often small and geographically distant from the capitals and subject to significant climate risks, appears to be impossible for many PICs, given the limited funds they receive from government and ODA. There is also little government presence in rural and remote areas, and communities are mostly responsible for their water and sanitation. As they have a tradition of responsibility for water and sanitation, a community-based approach can be strengthened, and donors should support this approach. In rural communities, coalitions made up of customary landowning clans/groups and community members, who are often members of the same faith (communities are usually organised around denominational affiliations in PICs) can work together to ensure the successful implementation of WRM. In the Community Perception Study, it was noted that people with poor access to and low availability of water must be commended for their tenacity. They adapted and learned to tap alternative water sources during natural disasters, and they have learned to manage their water consumption to suit the supply.

Introduction

In a region overwhelmingly dominated by the Pacific Ocean, the availability of safe freshwater is a fundamental challenge for Pacific Islanders. The 14 Pacific Island Counties (PICs) included in this report, lie in an ocean area of around 25 million km^2 with a land area of fewer than 0.5 million km^2, of which Papua New Guinea comprises 90%. The PICs' environment and rainfall are dominated by the ocean environment, climate change and variability. They vary considerably in their size and geomorphology, biology, economies, and cultures, with over 6,000 islands and islets ranging from high volcanic islands to tiny low coral atolls. In addition, they have varied economies and systems of governance. The ethnic heterogeneity among the PICs is reflected in their classification into sub-regions: Melanesia (Papua New Guinea, Solomon Islands, Vanuatu, and Fiji); Micronesia (Palau, Federated States of Micronesia, Republic of Marshall Islands, Kiribati and Nauru); and Polynesia (Samoa, Tonga, Cook Islands, Tuvalu and Niue).

Some PICs consist of a few sparsely inhabited islands, others are more densely populated island groups, and some have no confirmed freshwater (dependent on rainwater and desalination). In addition, many small islands can only source limited water supplies from fragile shallow water lenses. Consequently, there is a need for various governance and water resource management (WRM) strategies and approaches focusing on different scales and levels of capacity and socio-cultural settings.

Many PICs are also exposed to some of the globe's most significant natural disasters, with four ranking in the top 10 of the World Risk Index[1] and 6 in the top 20. Natural disasters invariably place further challenges on fragile freshwater resources. Climate change-induced sea-level rise brings increased storms, and tidal inundation of atoll islands threatens the existence of atoll aquifers and the availability of fresh water to their inhabitants.

Dore (2021) has undertaken a stocktake of institutional settings and challenges in eight PICs (Fiji, Kiribati, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu) and has highlighted the opacity of governance processes. Multiple agencies' involvement, poor legislative responsibility alignment, and a lack of agency capacity were highlighted. The ability of PICs to manage their resources and ecosystems sustainably while sustaining their livelihoods is crucial to their social and economic wellbeing.

PICs have specific needs and requirements for their developing economies. These are related to small and often sparse populations and human resources, small GDPs, limited land area and natural resources. Melanesia comprises Papua New Guinea with 8.9 million people, Fiji with 894,500 people, the Solomon Islands with 721,455 people, and Vanuatu with 307,150 people, accounting for about 94% of the population of all 14 PICs. In contrast, five other PICs have populations of less than 20,000. Melanesian PICs make up 99% of the total PICs' landmass and have access to significant surface and groundwater resources. However, their smaller volcanic and atoll islands have the same water availability issues as the smaller PICs, i.e., small catchments, shallow aquifers, and lack of water storage. Therefore, sustainable WRM is critical to life in the PICs.

The World Bank defines WRM as *"the process of planning, developing, and managing water resources to ensure there is sufficient water of adequate quality for drinking water and sanitation services, food production, energy generation, inland water transport, and water-based recreational, as well as sustaining healthy water-dependent ecosystems. It includes the institutions, infrastructure, incentives, and information systems that support and guide water management"*. The World Bank further recognises that *"achieving water security in the context of growing water scarcity, greater unpredictability, degrading water quality and aquatic ecosystems, and more frequent droughts and floods, will require a more integrated and longer-term approach to water management"*.

Originating as a management approach for water supply, WRM has evolved considerably in practice over the past several decades. As water demand has increased and environmental needs recognised, so has the need for more complex and cross-cutting WRM. This has seen the development of an integrated approach to WRM (IWRM) to bring other stakeholders into the decision-making process and management (GWP 2000). There are examples of improved water governance due to this approach, particularly at a catchment level. IWRM has been adopted within

[1] https://reliefweb.int/sites/reliefweb.int/files/resources/WorldRiskReport-2020.pdf

the Sustainable Development Goals (SDG) as the measurable approach (SDG 6.5.1) to WRM. However, IWRM is still water-centric and fails to ensure management coherence across countries, regions, sectors, society and the environment. WRM needs to be aligned with societal goals (Muller 2015).

Decision-making within WRM ultimately rests with a diversity of interested actors rather than the water manager. The United Nations World Water Development Report 3 specifically examined the role of such externalities as drivers of change, and its key message was *"that most decisions about water are not made by water managers, but by decision-makers outside the 'water box'; that is, actors from the spheres of civil society, business and government leadership, whose decisions concerning policy formulation, resource allocation and other political and operational issues affect water directly (through allocation and demand) and indirectly (through various drivers of change)".* [2]

Apart from actors in government, civil society and business, there are also important actors in the cultural/traditional and religious/church domains. These actors may or may not have connections with those in the formalised/institutionalised domain, but they can potentially assist in better WRM. For example, villages in PICs are usually organised along traditional kin relationships and Christian denominational lines. Working through community structures to drive WRM initiatives may be effective at the community level as most communities respect their church leaders and authority. Likewise, customary landowning groups whose land on which water sources are located can be tapped to support WRM. Except for Tonga, most land and water sources in PICs are owned by customary landowners (e.g., 88% in Fiji, 95% in Tuvalu, >45% in Kiribati, 65% in FSM, 81% in Samoa, 99% in the Marshall Islands, 97% PNG, 87% Solomon Islands) (see Table 4 below). Governments often must negotiate with customary landowning groups/clans to access and manage water resources. Power dynamics at the national, provincial, island and community levels must be understood and recognised for WRM interventions to succeed.

Basic drinking water facilities and sanitation are available to only 55% and 30% of Pacific Islanders, respectively,[3] the latter being the lowest globally. Progress in access to improved drinking water and sanitation (WatSan) has been slow, and in some PICs, has regressed.[4] Despite the expenditure of considerable funds from PIC budgets and ODA, progress in WatSan has not kept pace with population growth in several PICs. SDG 6 aims to "ensure access to water and sanitation for all" by 2030. Specific targets under SDG 6 include achieving "universal and equitable access to safe and affordable drinking water for all", achieving "access to adequate and equitable sanitation and hygiene for all and end open defecation", and "implement integrated water resources management at all levels".

The slow and/or lack of progress in an environment where water resources are so fragile and under threat is often ascribed to the unwillingness and/or inability of decision-makers to commit the resources required. What are the reasons for this?

This report seeks to contextualise the unique characteristics of the PICs and attempts to determine the roadblocks to achieving universal access to clean water and sanitation. The PIC context is established by examining the PICs' unique economic, socio-economic, geomorphology, climate, and cultural characteristics. Governance, institutions and the political economy of WRM are discussed for each PIC to determine the role of and power of stakeholders in WRM, the socio-cultural variation amongst PICs and how these may be better harnessed or modulated to achieve progress in WatSan.

The five key questions that will guide our analysis are:

- What is the current socioeconomic status of the PICs?
- What is the current status of water resource management in the PICs?
- Are there significant water use and management differences in the Melanesian, Polynesian, and Micronesian political economies?
- What work has been conducted by development partners to strengthen water resource management and what challenges and opportunities were identified?
- How can the role of communities in water management be strengthened?

[2] https://unesdoc.unesco.org/ark:/48223/pf0000215644

[3] https://washdata.org/sites/default/files/documents/reports/2018-07/JMP-2017-annual-report.pdf

[4] https://www.theprif.org/sites/default/files/documents/jmp-2021-wash-households_1.pdf

The Pacific Islands Context

Pacific Economies

With country populations ranging from around 1,700 to 9 million and land areas from 21 km^2 to 463,000 km^2, the diversity of PICs makes analysing their economies challenging. Nevertheless, they share many common characteristics; all, save for Tonga, were colonised and all have narrow economic bases, particularly the Polynesian and Micronesian economies. They are remote and isolated from major markets and each other, with low and, at times negative growth rates relying heavily on subsistence agriculture, fishing, and personal remittances (Table 1) and imports leading to very high import ratios. In addition, most are highly susceptible to natural disasters and the consequential negative impacts on their economies and infrastructure, further challenging their budgets. The public sector dominates their formal economies, and governance is characteristically weak, resulting in considerable fiscal pressure due to the fixed costs of running governments in an environment of fluctuating annual income. However, the public service dominates PIC employment, and cutting employee numbers or wages to meet revenue is not a political reality.

Income varies significantly with high-income PICs (Cook Islands, Nauru, Niue, and Palau), upper middle income (Fiji. Marshall Islands, Samoa, Tonga and Tuvalu) and lower middle-income PICs (Micronesia, Kiribati, Papua New Guinea, Solomons and Vanuatu). Official Development Aid (ODA) comprises a significant portion of the PICs' GNI, in some cases exceeding 50% (Table 1). Many PICs have substantial debt and moderate to high-risk debt sustainability and limiting borrowing capacity (op.cit.), resulting in less discretionary funding in annual budgets. Only Kiribati, Solomon Islands, and Vanuatu have Least Developed Countries (LDC) status (op.cit.) and thus access to concessional financing. Except for the Cook Islands and Niue, all PICs are members of the International Development Association (IDA), which provides concessional loans and grants. Ten PICs had loans/grants totalling USD 474 million in 2020.

Assa and Meddeb (2021) have proposed a Multidimensional Vulnerability Index (MVI), building on the currently used Environmental Vulnerability Index, which forms one of the LDC categories. The MVI considers Small Island Developing States' (SIDS) vulnerability to an external economic shock. The Covid-19 pandemic has highlighted SIDS's vulnerability to shocks to earnings from tourism, foreign remittances and foreign direct investment. PICs' reliance on the importation of food and energy and their lack of export earnings means they have significant foreign trade deficits. MVIs for PICs are presented in Table 1. Adoption of the MVI would increase the number of PICs ranked in the top 30 vulnerable States to 8 rather than four based on the environmental vulnerability index (EVI). If incorporated as an LDC category, this would save around 1.5% of GDP annually (op.cit.).

The budget challenges described above diminish the capacity of PICs to undertake significant infrastructure works without ODA. It also means that funding repairs and maintenance of facilities are challenging and impossible at worst, which has relevance when considering PICs' WRM capacity.

Table 1: Pacific Island Countries financial summary

Pacific Island Country	Popn	GDP US$ Mil	GDP per Capita (US$)	Debt US$M	Debt (%GDP)	Deficit %GDP (2020)	Debt sustainability2	Net ODA received (% of GNI)3	Remittances Received (% of GDP)	LDC status	Access to IDA	MVI Index
Cooks	17,564	n.a.	15840	n.a.	n.a.	-2.8	Moderate risk	8 (2019)	n.a.	No	Non- member	Not ranked
Fiji	896,444	$4,494	$5,013	3,189	70.79%	-8.2	Moderate risk	2.76 (2019)	5.4	No	Blend	26 (high vulnerability)
FSM	115,021	$408	$3,586	76	18.83%	0	High risk	19.98 (2019)	5.7	No	IDA	8 (very high vulnerability)
Kiribati	119,446	$200	$1,671	36	18.10%	-0.7	High risk	14.85 (2019)	10.7	LDC	IDA	1 (very high vulnerability)
Nauru	10,834	$119	$11,055	67	59.34%	32.2	Unsustainable	31.20 (2019)	n.a.	No	IBRD	55 (medium vulnerability)
Niue	1,626	n.a.	n.a.	n.a.	n.a.	-4.9	No debt	77 (2019)	n.a.	No	non-member	Not ranked
Palau	17,000	$257	$14,732	n.a	n.a	-11.2	Sustainable	8.71 (2019)	0.8	No	IBRD	4 (very high vulnerability)
PNG	8,947,027	$23,592	$2,637	9,942	40.04%	-8.1	High risk	2.81 (2019)	0.0	No	Blend	92 (medium vulnerability)
RMI	59,194	$244	$4,122	46	19.01%	-4.9	High risk	22.54 (2019)	13.1	No	IDA	2 (very high vulnerability)
Samoa	198,410	$812	$4,093	378	46.50%	6.2	High risk	15.15 (2019)	18.0	No	IDA	49 (high vulnerability)
Solomons	686,878	$1,551	$2,258	131	8.31%	-2.5	Moderate risk	14.41 (2019)	1.6	LDC	IDA	33 (high vulnerability)
Tonga	11,792	$519	$4,903	6	11.53%	5.3	High risk	20.08 (2019)	37.2	No	IDA	5 (very high vulnerability)
Tuvalu	11,792	$49	$4,147	6	11.53%	9.1	High risk	55.84 (2019)	1.9	LDC	IDA	6 (very high vulnerability)
Vanuatu	302,000	$855	$2,830	420	45.28%	0.4	Moderate risk	13.27 (2019)	8.0	No	IDA	13 (high vulnerability)
Source	WB	WB	WB	WB	WB	ADB	WB	IMF	WB	WB	WB	UNDP

The World Bank publishes annually, with the input of regional banks, e.g., ADB, a list of fragile poor states eligible for concessional funding based on an assessment of a state's policies and institutions. They are classified as fragile if their governance score is below an established baseline. The 2022 list contains 17 countries classified as High Institutional and Social Fragility, including 6 PICs (Papua New Guinea, Kiribati, Marshall Islands, Micronesia, Solomon Islands and Tuvalu). The World Bank also produces Worldwide Governance Indicators based on six dimensions of governance (Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption). Two dimensions, Government Effectiveness and Regulatory Quality, are summarised (Table 2) for the PICs as directly relevant to WRM. As the Cook Islands and Niue are not members of the World Bank, there is no data for them. Only Fiji, Samoa and Tonga rate positively for Government Effectiveness and only Nauru and Palau rate positively for Regulatory Quality. Governance is a significant issue in the PICs and, accordingly, also for WRM.

Table 2: Two Dimensions of the World Bank's Governance Indicators for Pacific Island Countries

Indicator		Government Effectiveness	Regulatory Quality
Country		Governance (-2.5 to +2.5)	
Cook Islands	2020	na	na
Fiji	2020	0.30	-0.17
Kiribati	2020	-0.14	-0.57
Marshall Islands	2020	-1.41	-1.10
Micronesia, Fed. Sts.	2020	-0.08	-0.95
Nauru	2020	-0.08	0.11
Niue	2020	na	na
Palau	2020	-0.05	0.06
Papua New Guinea	2020	-0.85	-0.68
Samoa	2020	0.52	-0.20
Solomon Islands	2020	-0.91	-0.84
Tonga	2020	0.16	-0.39
Tuvalu	2020	-0.65	-0.49
Vanuatu	2020	-0.46	-0.43

Social Economy

The selected social indicators vary across PICs and subregions (Table 3). For example, several PICs show markedly lower life expectancy at birth rates than the global average of 72.6 years. Similar patterns are evident in education, with Papua New Guinea and the Solomon Islands achieving less than six mean years of schooling. The education level is relevant to WRM when pursuing greater community engagement in WRM through social learning.

Urbanisation continues to rise, with all PICs, except the Cook Islands, showing continued urban growth with people migrating from rural areas with consequent increased demand for services and presenting future challenges to the resilience of these systems. The socioeconomic sustainability indicator of skilled labour as a percentage of the workforce varies within PICs but is lowest in Melanesia, except for Fiji, and accords with the low mean years of schooling.

The number of women in positions of power is still lamentable, with nine PICs having less than 10% of women in parliament, well below the low global average of 25%. However, in the private sector and state-owned enterprises (SOEs), the situation is better, with 12 PICs having around 20% or more women chairs, deputy chairs or board members (op.cit.).

Table 3: Socioeconomic indicators for Pacific Island Countries

Indicator	Palau	FSM	RMI	Niue	Nauru	Cooks	Kiribati	Tuvalu	Samoa	Tonga	Fiji	Vanuatu	Solomons	PNG
SDG 3 Life Expectancy at birth1 (years)	73.9	67.9	74.1	74	67.62	76.89	68.4	66.2	73.3	70.9	67.4	70.5	73	64.5
SDG 4.3 Expected years of schooling[1] (years)	15.8	11.5	12.4	10	11.2	15	11.8	12.3	12.7	14.4	14.4	11.7	10.2	10.2
SDG 4.6 Mean years of schooling[1](years)	12.5	7.8	10	n.a.	n.a.	n.a.	8	na	10.8	11.2	10.9	7.1	5.7	4.7
Degree of Urbanisation1	81.00	22.8	77.4	46	100	75.7	54.8	63.2	18.1	23.1	56.8	25.4	24.2	13.2
Ave Rate of Change Urban Popn 2010-15 %	1.66	0.3	0,82	1.91	2.32	-0.91	3.53	2.6	-0.4	0,32	1.69	2.67	4.33	2.15
Socio-economic sustainability - Skilled labour force1 (% of labour force, 2020)	92.5	65	n.a.	n.a.	96.5	n.a.	48.3	50.1	66.6	72.3	62.5	10.1	18.7	26.7
Human Development Index2	0.826	0.62	0.704	n.a.	n.a.	n.a.	0.63	0.681	0.715	0.725	0.743	0.609	0.567	0.555
Women in Parliament[3]%	14	0	6.1	25	10.5	25	6.5	6.25	10	7.4	19.6	9.4	0	0.1
Women Chairs/Dep Chairs on Private Sector and SOE Boards[4]%	25	19	25	29	12	32	22	29	33	19	20	18	11	19
Women in Private Sector and SOE Senior Exec and Management[5]%	13	13	33	20	33	39	29	29	25	18	10	15	7	5
Rank														

[1] https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=PW Oct 2021

[2] http://hdr.undp.org/en/countries/profiles/PLW

[3] ???

[4] Leadership Matters: Benchmarking Women's Business Leadership in the Pacific, Pacific Private Sector Development Initiative Sept 2021

[5] Op.cit

Exposure to Extreme Natural Events

Threats from exposure to cyclones, storms, tidal and storm-induced inundation, volcanic activity, earthquakes, floods and droughts compounded by climate change pose increasingly significant challenges to Pacific Islanders' existence. While physical exposure to these events is often immediate, the social consequences are often prolonged. The World Risk Index (WRI)[5] is based on an assessment of the exposure and vulnerability of the world's countries. Vulnerability is assessed using three dimensions: susceptibility or the likelihood of harm from the event; coping or the capacity of communities to minimise the impact through direct action; and the availability of resources to make these adaptations, strategies and actions that seek to mitigate future events. Of the 181 countries assessed, six of the 14 PICs rank in the top 20 WRIs (Table 4) and three in the top five.

Table 4: World Risk Index Assessment and ranking for PICs 2020.

Country	World Risk Index	Risk Rank	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
Vanuatu	49.74	1	86.77	57.32	38.81	52.42	80.73
Tonga	29.72	2	61.21	48.56	28.76	37.08	79.85
Solomon Islands	24.25	5	40.04	60.56	45.75	54.73	81.21
Papua New Guinea	21.12	8	30.79	68.58	55.66	63.85	86.23
Fiji	16	15	34.63	46.21	21.98	40.4	76.24
Kiribati	14.94	18	26.05	57.36	39.27	50.04	82.77
Micronesia	7.59	73	14.95	50.77	31.79	48.39	72.13
Marshal Islands	Incomplete		Incomplete	Incomplete	Incomplete	Incomplete	Incomplete
Nauru	Incomplete		Incomplete	Incomplete	Incomplete	Incomplete	Incomplete
Palau	Incomplete		Incomplete	Incomplete	Incomplete	Incomplete	Incomplete
Tuvalu	Incomplete		Incomplete	Incomplete	Incomplete	Incomplete	Incomplete
Cooks	DNP		DNP	DNP	DNP	DNP	DNP
Niue	DNP		DNP	DNP	DNP	DNP	DNP

These threats pose significant water availability issues in both the immediate aftermath of disasters and the long-term effects of the destruction of infrastructure and pollution of water sources. In-country WRM must build resilience to these threats. Unsurprisingly, National Disaster Management Plans and Strategies now recognise this need and provide a segue into the broader issue of resourcing National WRM to improve resilience.

[5] https://weltrisikobericht.de/weltrisikobericht-2021-e/

Land Tenure

The provision of infrastructure and services invariably requires access to and surety of land occupancy. Usually, these are pre-conditions for funding such works. Most land is under customary ownership (Table 5). All PICs have legislated power to acquire land compulsorily; this is extremely rare and fraught with high political risk. The usual method of a negotiated lease with customary owners (op. cit.) is time-consuming as the customary owners are often not easily identifiable and obtaining a majority agreement and accepted negotiated lease arrangement is problematic. Often, water infrastructure projects are lost due to an inability to get a lease within an acceptable period for the donor. Another common issue with leasing land is that the customary landowners can demand a renegotiation of the rental arrangements once the infrastructure is in place and, in some instances, interfere with the water infrastructure and service.

Similar issues arise around managing catchments and aquifers where restrictions on land use are necessary to protect the water source from pollutants and or over-extraction.

Table 5: Distribution of Land by System of Tenure in Pacific Island Countries[6]

PIC	Publica	Freehold	Customary	Compulsory Acquisition	Is Comp Acquisition Applied	How is land secured
Cook Islands	Some	Little	95%	Legislated	Rarely	Lease
Fiji	4%	8%	88%	Legislated	Rarely	Lease
Federated States of Micronesia	35%	<1%	65%	Legislated	Rarely	Negotiated Purchase
Kiribati	50%	<5%	>45%	Legislated	Rarely	Lease
Marshall Islands	<1%	0%	>99%	Legislated	No	Lease
Nauru	<10%	0%	>90%	Legislated	na	Lease
Niue	1.5%	0%	98.5%	Legislated	na	na
Palau	Most	Some	Some	Legislated	Rarely	Lease
Papua New Guinea	2.5%	0.5%	97%	Legislated	Yes	Comp Acquisition
Samoa	15%	4%	81%	Legislated	Often	Comp Acquisition
Solomon Islands	8%	5%	87%	Legislated	Not Usually	Purchase or Lease
Tonga	100%	0%	0%	Legislated	No	Negotiated Purchase
Tuvalu	5%	<0.1%	95%	Legislated	Rarely	na
Vanuatu	2%	0%	98%	Legislated	No	Purchase or Lease

[a] Includes Crown land and land owned by provincial and local governments

[b] Includes land that is not strictly freehold but similar in characteristics, such as the 'perpetual estates' found in the Solomon Islands

[6] https://www.dfat.gov.au/sites/default/files/MLW_VolumeOne_Bookmarked.pdf

Population and Demography

All PICs show population growth, with the Cook Islands and Niue near neutral increase. The Melanesian countries Vanuatu, Papua New Guinea, and the Solomon Islands are at 2.4, 1.9 and 2.7 per cent per annum (Table 6), respectively. These and past high growth rates are reflected in the low median ages of the PICs' population (Palau being the exception). PIC populations are young and growing, requiring increased expenditure on services and greater demands on scarce and fragile resources such as freshwater and land. Sustaining these growing populations will require effective management of resources, including water and waste.

Table 6: Pacific Island Countries Demographic Profiles

Country	Land area (km2)	Popn (2020)	Pop Growth %	Pop Density P/Km2	Birth Rate/1000	Median Age	Region	Total Popn
Vanuatu	12,199	307,150	2.4	25	29	21.1		
PNG	462,840	8,947,000	1.9	20	26.4	22.4		
Sols	28,399	721,455	2.7	24	31.1	19.9		10,872,049
Fiji	18,274	896,444	0.7	49	20.4	27.9	Melanesia	
Samoa	2,831	198,410	0.7	70	24.1	21.8		
Tonga	747	104,494	1.1	147	24	22.4		
Cooks	237	17,459	0.09	73	12.8	38.7		
Niue	262	1,626	0.09	6	17.2	27		
Tuvalu	25.9	11,792	1.2	393	23	27.6	Polynesia	333,781
Kiribati	811	119,446	1.6	147	27.4	23	Micronesia	322,587
Nauru	20.98	10,834	0.6	541	21.5	21.5		
RMI	181.3	59,194	0.7	759	22.4	23.9		
FSM	702	115,021	1.1	173	17.9	26.8		
Palau	459	18,092	0.5	39.6	13.5	35.9		
Total	**527,988**	**11,493,840**						

Health

Expenditure on health among PICs varies from a low of 1.7% of GDP for Papua New Guinea to 15.2 % of GDP for Tuvalu (Table 7). Health expenditure accounts for a significant portion of annual PIC budgets, but this expenditure is not directly related to GDP, indicating PIC-specific attitudes toward public health and wellbeing. The quality of Pacific Islanders' health and health systems impact the productivity of PIC economies and their development potential. The general health indicators used here reflect significant variation in the quality of the health care system but are not directly related to the level of expenditure (op. cit). The health indicators are generally poor, with a few exceptions. The high incidence of waterborne illness in the Pacific, particularly in young children, is reflected in these indicators and places significant demands on the health system and its resources. This relates directly to the quality issues around water and sanitation in PICs.

Table 7: Selected WHO Global Health Indicators as proxies for Pacific Island Countries Health and Wellbeing Status

Country	GDP per Capita Current US$	Govt health expenditure (% of GDP)	Mortality rate, neonatal (per 1,000 live births)	Mortality rate, infant (per 1,000 live births)	Mortality rate, under-5 (per 1,000 live births)	Ave 13 International Health Regs core capacity scores
Cook Islands	15,840	6.1	4.1	6.5	7.6	43.15
Fiji	4,882	2.3	10.8	21.7	25.7	98
Kiribati	1,671	9.3	22.1	40.1	50.9	60
Marshall Islands	4,073	7.6	15.3	26.4	31.8	57
Micronesia, Fed. Sts.	3,585	3.3	15.9	24.5	29.4	85.8
Nauru	10,983	7.9	19.9	25.7	30.9	42
Niue	10,983	na	12.53	19.7	23.2	61
Palau	16,547	6.4	9.4	15.8	17.3	91.5
Papua New Guinea	2,637	1.7	21.9	35.9	44.8	64
Samoa	4,067	3.8	8.2	12.9	15	75
Solomon Islands	2,258	3.5	8.2	16.8	19.7	56.9
Tonga	4,903	3.2	7.4	14.3	16.6	74
Tuvalu	4,143	15.2	16	20.2	23.9	54.5
Vanuatu	2,782	2.1	11.4	21.9	25.9	34.7
Global Ave			29	36	38	59.3

WASH

The so-called "whole-of-water-cycle" strategy involves an integrated cross-sectoral socio-technical approach considering multiple water sources, waste and hazards (Ghimire et al. 2016). Already many Pacific communities utilise different quality and sources of water for consumptive and non-consumptive uses, e.g., washing and cleaning versus cooking and drinking.

SDG 6 on water and sanitation aims to "ensure access to water and sanitation for all" by 2030. Specific targets under SDG 6 include achieving "universal and equitable access to safe and affordable drinking water for all" and achieving "access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations." Water resources management in the Pacific cannot realistically exist in isolation from sanitation and hygiene. The current status of WASH in PICs is mixed, with some achieving close to universal coverage, while others are among the worst globally (Table 8).

Table 8: Pacific Island Countries WASH Status[7]

Country	Proportion of population using improved sanitation facilities	Proportion of population using improved drinking water sources	Proportion of population practising open defecation	Proportion of population with a handwashing facility with soap and water available at home
Cook Islands	99.1	100.0	-	-
Fiji	100.0	94.3	0.0	-
Kiribati	60.9	80.9	30.6	55.5
Marshall Islands	89.6	100.0	9.9	85.0
Micronesia (Federated States of)	88.3	88.3	-	-
Nauru	-	100.0	-	-
Niue	95.5	97.0	0.0	-
Palau	99.6	99.7	0.0	-
Papua New Guinea	23.3	46.6	15.9	29.7
Samoa	99.5	98.4	0.1	78.8
Solomon Islands	40.3	73.0	45.0	38.6
Tonga	98.3	99.6	0.0	69.5
Tuvalu	-	100.0	-	-
Vanuatu	68.2	92.3	0.3	-

[a]Improved sanitation facilities are defined as those that hygienically separate human waste from human contact. Improved sanitation includes flush or pour-flush to piped sewer system, septic tank pit latrines, ventilated-improved pit latrines, or pit latrines with slab or composting toilets.

[b]Improved drinking-water sources are defined as those that are likely to be protected from outside contamination, and from faecal matter in particular. Improved water sources include household connections, public standpipes, boreholes, protected dug wells, protected springs and rainwater collection.

[7] https://washdata.org/

Water Resources Management

The Pacific Regional Consultation Meeting on "Water in Small Island Countries" was held 20 ago. The consultations, which included national water managers, stakeholders, and Ministers of State, resulted in the Pacific Regional Action Plan (Pacific RAP), endorsed by all the PIC heads of state. The themes and components developed are presented below (Table 9). The Pacific RAP provided the framework for developing national-level policy and action plans. PICs were assisted in this process through the Global Environment Facility (GEF) Pacific IWRM (2009-2014) Project, which funded national-level projects and staff and provided regional technical support for developing national IWRM policy and planning, and demonstration projects to facilitate the adoption of these policies. The analysis in the previous sections of this report indicates that although the jargon may have changed, the issues have not changed significantly over the past 20 years.

Table 9: Themes and Components of Pacific Regional Action Plan for Sustainable Water Management.

Theme Name	Theme Components
Theme 1. Water Resources Management	1. Water resources assessment and monitoring 2. Rural water supply and sanitation 3. Integrated water resource and catchment management
Theme 2: Island Vulnerability	1. Disaster preparedness 2. Dialogue on Water and Climate
Theme 3: Awareness	1. Advocacy 2. Political will 3. Community participation 4. Environmental understanding 5. Gender
Theme 4: Technology	1. Appropriate technologies 2. Demand management and conservation 3. Human resources
Theme 5: Institutional Arrangements	1. Institutional strengthening 2. Policy, planning and legislation
Theme 6: Finance	1. Costs and tariffs 2. Alternative models 3. Roles of donor organisations and financing institutes

What is the current status of WRM in PICs?

UN-Water has compiled baseline country data to enable reporting on global progress towards SDG 6. As part of that baseline, the degree of IWRM implementation (indicator 6.5.1) has been assessed; this is presented below for PICs where data is available (Table 10). In addition, status has been evaluated for 2017 and 2020 to determine if progress has been achieved. Comparative yearly data is only available for eight PICs, while information was also available for Fiji in 2020. Six PICs (Marshall Islands, Micronesia, Samoa, Solomon Islands, Tonga, and Vanuatu) out of eight have progressed, and the remaining two (Papua New Guinea and Tuvalu) have regressed. The overall assessment revealed that Samoa had achieved high implementation, Fiji medium-high, and Papua New Guinea low, with the rest at a medium-low level of implementation.

Table 10: Assessment of Pacific Island Countries IWRM (SDG 6.5.1) Implementation Status and Progress 2017-2020[8]

Country	Enabling Environment		Institution and Participation		Management instruments		Financing		Final IWRM Score	
	2017	2020	2017	2020	2017	2020	2017	2020	2017	2020
Cook Islands	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fiji	nd	28	nd	61	nd	70	nd	63	nd	56
Kiribati	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Marshall Islands	33	37	32	42	45	50	13	16	33	36
Micronesia	42	50	51	52	33	46	28	42	38	49
Nauru	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Niue	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Papua New Guinea	27	17	23	20	20	30	30	7	25	19
Palau	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Samoa	73	78	69	78	70	74	68	70	70	75
Solomon Islands	25	30	28	30	30	35	20	24	26	30
Tonga	28	40	53	40	38	49	0	10	30	35
Tuvalu	25	48	73	69	45	38	45	24	47	45
Vanuatu	36	53	64	63	38	49	18	16	39	45

Assessment key for IWRM implementation status

Very Low	Low	Medium-low	Medium-high	High	Very High
0-10	11-29	31 - 50	51 - 70	71 - 90	91-100

The assessment demonstrates a lack of IWRM implementation in most of PICs. All PICs have developed WRM policies and plans (see individual country profiles) but have failed to convert these to actions and outcomes. Governance, institutional deficiency and poor regulatory capacity have already been highlighted (Table 2).

How does this impact WRM?

The OECD has completed a water governance survey of PICs, highlighting water governance shortcomings (Table 11). Very few processes supporting established water governance systems are in place. In addition, many countries failed to provide data because they lacked it or the resources to obtain it. The OECD results accord with the IWRM assessment and reveal a lack of commitment and capacity to establish effective WRM.

[8] http://iwrmdataportal.unepdhi.org/countrydatabase accessed Jan 2022.

Table 11: Pacific Island Countries OECD Water Governance Scores[9]

Indicator	Cooks	Fiji	Kiribati	RMI	FSM	Nauru	Palau	PNG	Samoa	Solomons	Niue	Tonga	Tuvalu	Vanuatu
1. Roles & responsibilities														
Water law and or environmental law	4	3	1	1	3	1	1	1	1	1	1	4	1	1
2. Appropriate scales														
Catchment-based organisations	4	3	1	1	3	1	1	1	1	1	1	1	4	1
3. Policy coherence														
Dedicated WASH policy	2	2	2	2	2	3	2	3	3	3	2	4	2	2
Dedicated policy for water-related disasters	2	1	2	2	2	3	2	2	2	3	2	3	2	2
Dedicated water quality and preservation policy	2	2	2	3	2	3	2	3	3	3	3	3	2	3
4. Capacity														
Guidelines or standards for capacity building across authorities at all levels	3	1	1	1	4	1	4	4	1	1	4	4	4	1
Peer-to-peer dialogue platforms across river basin organisations	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Networks of utilities and of basin organisations at the national level	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5. Data & information														
WSS information system harmonised, integrated, standardised	4	4	1	1	1	4	4	3	4	1	4	4	1	1
IWRM information system harmonised, integrated, standardised	4	4	1	3	4	4	3	3	1	1	4	4	4	4
Risk management water information system harmonised, integrated, standardised	4	4	4	4	4	4	4	3	4	1	4	1	4	1
6. Financing														
Abstraction charges Pollution charges	3	3	1	3	3	3	3	3	3	3	4	3	4	1
Evaluation tools to track budget transparency in the water sector	3	3	1	3	3	3	3	3	3	3	4	3	4	1
7. Regulation frameworks														
Regulatory bodies subject to by-laws or internal regulations clearly stating their mandate and powers	4	4	1	4	4	4	4	1	1	1	1	4	4	1
Mechanisms to solve water-related disputes	3	3	1	4	4	4	4	4	4	4	1	4	4	4

[9] OECD (2021), "Water governance in Asia-Pacific", OECD Regional Development Papers, No. 13, OECD Publishing, Paris, https://doi.org/10.1787/b57c5673-en.

Indicator	Cooks	Fiji	Kiribati	RMI	FSM	Nauru	Palau	PNG	Samoa	Solomons	Niue	Tonga	Tuvalu	Vanuatu
9. Integrity & transparency														
Institutional anti-corruption plans, codes of conduct or integrity charters	4	4	4	3	3	3	3	3	3	3	4	3	4	1
Evaluation tools to track budget transparency in the water sector	4	3	4	3	3	3	4	1	3	3	3	4	4	1
10. Stakeholder engagement														
Stakeholder mapping carried out	4	4	3	4	4	4	4	3	4	3	3	4	4	4
Formal and informal mechanisms to engage stakeholders	4	4	4	4	4	4	4	4	4	4	4	4	4	4
11. Tradeoffs														
Prioritisation among water uses in case of scarcity/ emergency	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Groundwater extractions monitored and allocated	3	3	3	3	3	3	3	3	3	3	3	3	3	3
12. Monitoring and evaluation														
Agreed-upon key performance indicators	3	3	3	3	3	3	3	3	3	1	3	3	3	3
Existing monitoring and reporting mechanisms	3	3	3	3	3	3	3	3	3	1	3	3	3	3

In place, functioning	In place, partly implemented	Not in place	No data available
1	2	3	4

The national consequences of poor WRM will be reflected in a lack of access to water to sustain the growth, health and wellbeing of Pacific Islanders; resilience to climate change; weather variability and natural disasters. This also impacts sanitation and hygiene. As shown above, population growth and increasing urbanisation place even more stress on water resources, and the need to ensure water security is fundamental to the future of PICs. ADB has developed a water security index based on five dimensions: (i) rural household water security (water and sanitation); (ii) economic water security (water to satisfy economic growth sustainably); (iii) urban water security (water and sanitation and flood management); (iv) environmental water security (catchment and aquatic health and environmental governance); and (v) water-related disaster security (resilience against droughts, floods, and storms). Each dimension is scored out of 20 and added to get a country's total water security score (Table 12).

Table 12: Pacific Island Countries ADB Water Security Scores[10]

Country	Rural Household	Economic	Urban	Environment	Water-Related Disaster	Total	PIC Rank	NWS Stage
Palau	19	9.7	15.3	12.1	16.9	73	1	Capable
Cook Islands	18	9	10.6	18.8	16	72.5	2	Capable
Samoa	14	10.3	12.6	13.8	12	62.8	3	Capable
Tonga	16	8.8	10.3	15.8	11.1	61.5	4	Capable
Niue	15	4	10.3	13.3	18.4	61	5	Capable
Fiji	12	13.6	9.1	12.5	12.3	59.5	6	Engaged
Nauru	na	7	7.1	17.6	15.7	58.6	7	Engaged
Tuvalu	14	6	10.6	17.6	4.8	53	8	Engaged
Vanuatu	8	9.8	7.9	13	11.2	49.9	9	Engaged
Solomon Islands	7	14	7.9	9.5	10.5	49.3	10	Engaged
Marshall Islands	9	7	9.1	15.1	8.6	48.9	11	Engaged
Kiribati	7	11.3	5.9	16.2	7.9	48.2	12	Engaged
PNG	4	8.8	5.6	12.5	12	42.8	13	Engaged
FSM	11	6	4.7	13	7.4	42	14	Engaged

Score Key

NWS Score	96 and above	78-96	60-78	42-60	0-42
NWS Stag	Model	Effective	Capable	Engaged	Nascent

Nine PICs scored within the Engaged range, which means:

- A significant majority of rural and urban households have access to basic water supply but less sanitation.
- Economic water security is low.
- Environmental governance is moderate, with severe pressures on aquatic ecosystems.
- Progress in achieving disaster risk security is low.

The inexorable trifecta of water security, climate change and natural disasters needs to be further pursued within national government policy. WRM is part of a broader need for national action planning, and the most apparent contemporary instrument for this is the National Adaptation Plans. Many of these are currently under review, and opportunities exist to formally align WRM in this process and to source significant adaptation funding to progress national water and sanitation management.

[10] https://www.adb.org/sites/default/files/publication/663931/awdo-2020.pdf

The Political Economy of Water Resources Management in PICs

This section pulls together the country assessments to discuss political economies related to water resources management in PICs. The individual country report/profile provides a more detailed analysis of contextual material. This section will first discuss the political context and power dynamics in PICs. Secondly, it will look at operational issues to see how political factors may or may not contribute to positive development outcomes and service delivery in the water resource sector. Third, it will discuss features of implementing organisations to determine whether they support or hinder politically informed programming. Fourth, it will analyse individuals' role in thinking and working politically in programme success, highlighting local political factors critical for communities and individuals to accept to lead interventions and reforms effectively. Moreover, it will provide a brief overview of the individual, collective and societal aspects of leadership and follower relationships.

1. Political context – What is our understanding of the balance of power (political settlements) between contending elite groups in PICs and formal and informal institutions that may also influence WRM?

It is important to note that PICs do not fall neatly under either the Westminster or presidential system of government. Generally speaking, except for the Marshall Islands, all PICs follow the system of government used by their former colonial rulers. Tonga is a monarchy; Samoa follows the Westminster model with a blend of traditional governance. Kiribati is a Westminster democracy with the president being the head of state and government. The point is that the political systems and institutions vary and deviate from metropolitan models of government that hinder their neat categorisation within either the Westminster or Washington mould without considerable justifications. Professor Yash Ghai (1988) therefore suggested other ways of categorising and understanding systems of government in PICs, including the following: (i) degrees of centralisation and decentralisation; (ii) relationship between the legislature and the executive; (iii) status of the head of state; and (iv) degrees of independence. PICs' different electoral systems and ways of defining political representation at the formal government level come with these variations. This is important at the formal level because understanding who represents who under what legitimising process may determine the outcome of WRM in given contexts.

The political context of each country may be different given the factors listed above. Most PICs have separate offices for the head of state and head of government. For example, Fiji, Solomon Islands, Vanuatu, Samoa, Tuvalu and Papua New Guinea have a separate head of government and head of state. On the other hand, Nauru, Kiribati, Palau and FSM combine the offices of the head of state and head of government. This political context must be understood and appreciated when designing WRM interventions and encouraging its acceptance in the Pacific.

The country reports also indicate the sorts of representation and levels of government (centralisation versus decentralisation) through which communication regarding WRM or the power to make decisions on WRM is vested. For example, PNG, Vanuatu and the Solomon Islands have provincial governments, while FSM and Palau are federal systems with autonomous states. Others like Tuvalu, Samoa, Kiribati and the Cook Islands have other forms of local governments, such as local councils, island councils, *falekaupule* or the village *fono* system in Samoa. This means that there are both vertical and horizontal channels of communication, some of which may not be effective when making decisions on WRM. Some of these second tiers of government are also responsible for WRM such as the states in FSM and, to an extent, Tuvalu.

Apart from the head of government and the executive government, it is essential to understand how representation is understood and practised in PICs. As may be seen in individual country reports, the electoral systems in each country determine the type of representation voters/citizens have through their members of parliament (MPs), lower tiers of government (e.g., provinces) and municipalities. Representation at the national level, in particular, is critical to understand as WRM interventions will have to engage with people's representatives. For example, Tonga is a monarchy, so all land and water sources are owned by the Crown/State; the situation is in Niue, where rights to groundwater are vested in the Crown. In Fiji, there are no constituencies (as it is a single constituency), so WRM interventions will have to be negotiated with the minister responsible and the various government departments and landowning groups on which the water source is located.

It is also essential to appreciate that in some PICs, one MP may represent several constituencies, while in others, a single constituency may have multiple representatives. In Samoa, there is only one MP per constituency. However, the MP is a person with the chiefly title (*matai*) that has a direct connection to their village. In that way, communication related to WRM can be direct from the village *Fono* to the MP, who is also directly connected to the village through their *matai* connection. This is a similar to Tonga, where nine nobles are MPs but elected by 29 nobles and not ordinary voters. They are influenced both by tradition and modernity when they represent their voters in parliament. Other countries, such as Vanuatu and Kiribati, have some constituencies that have multiple representatives. These variations may determine the success or failure of WRM interventions at the constituency or community level.

As mentioned above, because many PICs have different tiers of government, there are also politicians at different levels (MPs, MPAs, members of the *Falekaupule*, city councillors, etc.) who are either elected or appointed. In PNG, for instance, the provincial governments have governors who are also MPs representing their provinces. In Fiji, the city mayors are currently appointed by the ruling government, and they administer the affairs of the city, including issues of WRM and sanitation. In the Solomon Islands, city councillors are elected with a mayor as the head for each ward. At the same time, three MPs represent East, Central and West Honiara constituencies. The town's water needs are in the hands of the Solomon Islands Water Authority, an SOE that leases the *Kongulai* water source from customary landowners of Guadalcanal to supply the city (Hoverman et al., 2011). Sanitation is the prerogative of the Honiara City Council. There are also councillors in the Port Vila Municipal Council and six MPs representing the Port Vila constituency in Vanuatu. UNELCO provides electricity and water for the residents of Port Vila. Likewise, the Samoa Water Authority provides water services to residents of Apia. Such complex power dynamics between stakeholders, MPs, councillors, SOEs and government departments must be understood when designing WRM intervention in PICs. A detailed report and analysis of institutional settings and management challenges in eight PICs published in 2021 provides an excellent guide to understanding the complex roles of different stakeholders in PICs (see Dore, 2021).

2. Political Factors - How do political factors contribute to positive development outcomes and service delivery in the water resources sector? How do characteristics of water resources in the specific Pacific Island countries and across the sub-regions more generally influence program implementation and impact?

The political factors highlighted above can also affect operations in WRM and whether or not the WRM intervention succeeds and contributes to positive development. It is crucial to bear in mind that with water being a cross-cutting issue and service, several government departments and other stakeholders have a say and influence over it. Because of that, various legislations and policies exist in individual PICs, some of which may require review or realignment. For example, in Fiji, eight government ministries have some involvement in the provision of water and sanitation services. The Water Authority of Fiji (WAF), which provides water for urban areas, is one of 37 government institutions. Likewise, in PNG, two SOEs are responsible for providing water services to the urban population, while NGOs and international organisations also provide services to most parts of the country. Each PIC also has many policies and legislations regarding water and how relevant government departments, NGOs and donors are expected to address WRM issues. For example, while the Cook Islands has appropriate policy instruments, these are not formalised through legislative instruments except for the *To Tatou Vai Authority Bill 2021*, as highlighted in the country report. There may be a need to look at appropriate WRM legislation and policies and realign them to better address water and sanitation delivery and WRM in all PICs.

Given the cross-cutting nature of water in PICs' development, the jurisdiction of each of these actors, departments, SOEs and other stakeholders must be clearly understood. As noted in specific country reports, skills, technical know-how and commitment on the ground are critical for the success of WRM, especially to sustain projects/infrastructure/WRM practices after the life of donor-funded projects and programmes. This is true for responsible government ministries, lower levels of government, SOEs and NGOs that provide water and sanitation services. The various levels of government, such as provinces in the Solomon Islands, local government councils in Tuvalu or the states in FSM, may have legal competence to deal with WRM. Still, skills and technical know-how are lacking at all levels. This must be addressed for successful WRM in PICs.

It is also important to note that water services in urban and some peri-urban areas are provided by either government departments or SOEs in most PICs. Most are provided by SOEs due to major neo-liberal reforms in the 1980s and 1990s. For instance, in Tonga, the Tonga Water Board (TWB) supplies water to Tongatapu, parts of the Vava'u and Ha'apai groups, and the island of 'Eua under the TWB Act of 2000. Likewise, the Samoa Water Authority (SWA) is expected to provide water supply, wastewater services and other services mandated under the SW Act 2003 for the people of Samoa (Poppelwell, 2021). In Fiji, it is the Water Authority of Fiji (WAF), and in the Solomon Islands, it is the Solomon Islands Water Authority, trading as Solomon Water. These SOEs often have to provide services while making a profit; at the same time, respective governments are conscious of the need to keep the cost of such services at subsidised rates. This is a dilemma that SOEs face in urban areas, and so their success rates at the operational level also vary.

Donors, multilateral agencies, and NGOs planning to assist WRM in PICs must be seen as supporting or working with ruling governments' ongoing plans and activities. It is vital that the government of the day is convinced of and supports any proposed donor intervention from the start. Hence, insights into political forces and workings in a given country are essential. In the process, bureaucratic processes that must be satisfied by donors/NGOs operating in the country must be adhered to as closely as possible. When procedures and requirements are closely followed, and communication around support for WRM is appropriately done, the chances of government support are high, and the likelihood of success also increases. Unfortunately, there are many examples in the Pacific of well-intentioned programmes and projects getting rejected or side-lined because of minor oversights that are perceived as attempts to bypass the legitimate processes of government. Although obvious, it is essential to keep in mind, especially in PICs where reciprocal respect and relationships are highly regarded.

While government ministries, levels of government, legislation, and policies are critical for the success of WRM, it is equally important to note the critical role informal institutions play in the cultural or informal domain. As can be seen in Table 4, land tenure in PICs is under either customary, freehold or public land. Except for Tonga (where all of the land is owned by the Crown) and Kiribati, Palau and FSM (where at least 35% of land is public land), most PICs have more than 50% of their land under customary tenure. This shows that although the state may have the overall power regarding land and natural resources, including water resources, it has to negotiate with customary landowners to access land and water sources to provide that service. In the Cook Islands, 95% of the land is under customary tenure, 88% in Fiji, 99% in the Marshall Islands, 90% in Nauru, 98.5% in Niue, 97% in PNG, 81% in Samoa, 87% in the Solomon Islands, 95% in Tuvalu, and 98% in Vanuatu (see Table 4). Since most of the land is under customary tenure, most water sources would also be under customary tenure.

Although the compulsory acquisition of customary land is catered for in PICs' laws, the state does not usually use that provision as it may create more problems than solutions. As such, Pacific governments usually lease or conduct negotiated purchases of the water source from customary landowners. These are then written into formal agreements with conditions including rates and frequency of lease payments to landowning groups. In a few places where the state owns most of the land in the country, such negotiations and agreements are not necessary. Understanding these power dynamics at the local level and the agreed commitments laid out in the agreements between the state, SOE and customary landowning groups, especially concerning water and land leases are critical for operational success. Moreover, at the community level, some leaders of customary landowning groups may also be members of church committees, village committees, school committees or hold other influential positions that allow them to rally support to implement and sustain WRM programmes. The processes and expectations in the informal/cultural domain are just as important as the processes of the state when it comes to development outcomes, impact, and sustainability.

3. Implementing Organisations - Features of the implementing organisation can support or hinder politically informed programming. What sorts of coalitions exist or can be built between different stakeholders to ensure the successful implementation of reforms in the WRM sector?

The perception survey carried out in the Nadi catchment area confirmed features of organisations that can support or hinder politically informed programming. Indeed, many specific country reports highlight similar issues outlined in the Nadi perceptions survey report. First, the Nadi report highlighted the Water Authority of Fiji (WAF) in delivering water supplies and piped water to communities. Since WAF focuses on urban areas and functions

as a business entity, profit is its primary focus. Therefore, places outside the town boundaries and those with limited potential for good returns are neglected. As indicated in the report, although many of those surveyed have piped water, they experience issues such as dirty water, low pressure, broken pipes, disconnected reticulation, and intermittent water supply, which result in water carting. They have lived with these issues for years and are hopeful that WAF will rectify them.

According to the Nadi perceptions survey, there are no clear coalitions in urban areas except for the service provider-client relationship between WAF and its customers. It can also be seen that other stakeholders in the region deal with WRM, such as district officers, district advisory councillors, *Turaga-ni-koro*, Ministry of Agriculture officials, and community members. Although there is potential for some coalition to be formed, there was none as there was no formal effort to facilitate such a coalition. Or there may be no need for such a coalition as it is a principal-agent relationship on the part of the state, the SOE and water users accessing piped water through WAF.

The Nadi perception survey also indicated that more than 30% of the population interviewed rely on boreholes, wells, water cartage and rationing by WAF. It further highlighted that water from boreholes is pumped into communal tanks for domestic use while creeks are used as secondary water sources for bathing and laundry. It can be deduced from the report that those communities living on the periphery of WAF's area of responsibility are not serviced. These communities would likely have formed coalitions, albeit informal ones, to address the need to pump water to community tanks and monitor the creeks and wells they use daily. Individual families and communities deal with the need to access water for daily use. Even though most PICs' populations reside in rural villages and isolated islands, the state is not always present in those places. The biggest challenge would be costs related to accessing water and maintenance/sustenance of water supplies after donor-funded programmes and projects lapse. For such communities, interventions in WRM must consider the cost of sustaining water resources and supplies. Therefore, revenue generation options should be integrated in WRM designs in PICs for maintenance and sustainability.

As indicated in this report, state institutions and SOEs that provide water supplies have very little influence in rural communities where water is regarded as a household responsibility. The only time one would see the impact of the state or its agents (e.g., provincial governments, donor-funded water supply projects, etc.) is when a water supply is constructed in the community. In the initial stages of the project, there would be a coalition between the government department implementing the project, owners of the source of water or land on which the community tank will be established, a manual labourer who will construct the water facility and community members at large. In rural communities, coalitions made up of customary landowning clans/groups and community members, who are often members of the same denomination (communities are usually organised around faith-based denominational affiliations in PICs) can work together to ensure the successful implementation of water supplies. Churches have tremendous influence and control in communities, and their structures can be instrumental in determining the success of WRM at the village level.

4. The Role of Individuals - in program success and local political factors is critical for communities and individuals to accept to lead interventions and reforms.

From the information provided above, it should be evident that WRM designs and interventions in PICs would differ from one country to the next and even from one region to the other. In addition, the design for WRM in urban areas would be mostly different from interventions in rural areas. WRM in urban areas is driven by SOEs, on behalf of the government, who make a profit as a business entity. In rural communities, business thinking is out of the equation, although facilities must somehow be maintained, repaired and sustained. Moreover, WRM design for countries that have surface water, streams and rivers would also differ from those that only have groundwater or ones that rely on rainwater harvesting.

Acknowledging these peculiarities and differences between PICs and even within different parts of each country would enable the design of WRM interventions appropriate to each context rather than relying on a 'one size fits all' intervention for all PICs. More importantly, the intervention must appreciate and be socially embedded in the cultural context of that country, island or community. This is critical as it will encourage individuals to actively participate in ensuring that the intervention is successfully implemented and sustained. Local political forces in all PICs stem from the sorts of legitimate institutions that they respect. These could be political forces related to state apparatus and institutions, forces

coming from cultural values and systems, or religious affiliations. Curry (2003: 419) succinctly puts it, "development practices should pay close attention to place-based conceptions of economy and society" and "losing sight of the social can and often does lead to the failure of development projects". The social context informs the political context, and the success of any development project, including WRM interventions, would have to be embedded in the context of the targeted country, island or community.

Individuals and communities will cooperate to ensure the success of WRM programmes if they are part of the WRM process from the start and if the proposed intervention is not perceived as disrupting their way of doing things and livelihoods. Schools, churches, community leaders (males and females) must be part of the process from the start. Communicating clearly and ensuring that the positive outcomes of the intervention are clearly understood, appreciated, and owned by individuals and families in the community should be a paramount consideration. Even if WRM issues are negatively affected by customary land tenure, as reported in the case of Nauru, proper information sharing, awareness, and communication can potentially lead to change. Individuals and communities must be encouraged to own the project from the start, and clear information on the link between WRM, sanitation and development/wellbeing must be actively disseminated. A communication strategy for the WRM intervention is essential in urban and rural communities. As seen from the Nadi perception survey, 58% of the respondents did not know if their drinking water had ever been tested, reaffirming the need to communicate effectively with beneficiaries about interventions.

Finally, there is a dire need for individuals in the community, both males and females, to have the capacity to implement the WRM project and sustain them after the donor-funded programme ceases. Water providers in urban areas under SOEs also lack technical skills, affecting the efficient provision of water service. As seen in the case in PNG in 2013, an additional 7,600 people were to be recruited, including 1,190 engineers and 4,140 technical staff, to provide that support in the country (see PNG country report). Although this is the picture for PNG, the biggest country among the PICs, the same is valid for most PICs providing water services to urban and rural areas. For instance, in Fiji, a significant constraint is the lack of technical capacity at WAF (see Fiji country report). Therefore, to ensure that individuals, especially in rural communities, effectively engage in WRM during and after the implementation of WRM interventions, capacity building (e.g., basic plumbing skills) through on-the-job training, workshops or long-term training scholarships for both males and females must be integrated. Such basic training is crucial for interventions in rural and maritime islands across the Pacific.

5. Individual, collective and societal aspects of leadership and followers in WRM

In this analysis, the questions are again related to the individual, collective and societal aspects of leadership and followers. For example, what might motivate or discourage leaders from driving developmental outcomes in the WRM sector, and how do they gain the power and legitimacy to act? Or how might leaders overcome collective action problems, recognise their shared interests, and form collectives or networks with the power and legitimacy to act in water resources management and governance of water and other natural resources? Further still, what are the relationships between leaders and followers and the broader set of societal norms, ideas, institutions, and associations that may block or drive change? The following section attempts to answer these questions.

Individual

Many of the above points also relate to what might drive individual leaders to push for developmental outcomes in the WRM sector. For example, the designed intervention must be socially embedded in the culture and value systems of the receiving community. This, together with clear communication and information sharing, would encourage individual leaders to drive positive developmental outcomes. Individual leaders and community members need to connect the dots for communication and information sharing. In other words, the message communicated must be easily understood, especially the connection between WRM, sanitation and development. For example, the apparent disconnect between people using rivers, lakes, wells and rainwater as sources of cooking/drinking water and the people using open defecation in PICs reveals a lack of understanding of the association. Even individual leaders at the national, sub-nation and community levels would need convincing so that they can assist in driving positive developmental outcomes. Comparative information on what others are doing in other parts of the country or region may also help encourage individuals to push for change in their respective countries, islands or communities.

A point that is not so obvious in the perception report or the country reports is the potential for aspiring political leaders (intending candidates) to be motivated to support such interventions. This may be interpreted as both good and bad. Still, a community vision for the future usually motivates individuals to drive change in WRM as they try to convince potential supporters of their intentions. For aspiring female candidates to any political office, one of the major stumbling blocks is the ability to show potential voters their ability to produce tangible development outputs. WRM intervention programmes in their localities would allow female leaders to showcase their leadership qualities with concrete results. In the long-term leadership, it would be in women leaders' interest to support and actively participate in such programmes that would bring positive change to their communities. Likewise, individuals who are already MPs or representatives at other levels of government would gladly support such interventions because it will boost their popularity among their supporters. On the other hand, failed candidates or politicians may be motivated to derail development projects such as WRM interventions if it has the potential to boost their rivals' chances.

Collective

It is also important to note that leadership legitimacy in rural communities may come from positions determined by culture (e.g., Aliki or Ariki in the Cook Islands) and leadership positions held in the church, school, or community. Indeed, being educated with some capacity to develop and fix water problems is a legitimising process. As indicated earlier, there is a high propensity to support WRM interventions by both individual leaders and community members, provided the vision shows how the outcomes of such interventions will benefit them individually and their communities. Again, proper communication to ensure leadership and buy-in is critical.

At the same time, there is a need for PICs to re-examine various laws, policies and government departments that deal with WRM. The specific country reports show that many different government departments, levels of government, SOEs, NGOs and international organisations deal with various aspects of water and sanitation. It is also unclear what mechanisms are in place to coordinate the different undertakings in urban, rural and maritime islands and communities. Water is a cross-cutting resource with various issues. Coordinating the different departments and organisations and realigning legislation regarding water is an essential undertaking. Tasks and responsibilities among national ministries, sub-national governments, states, local governments, community-level leadership and households must be clearly delineated to overcome challenges in this area. Again, communicating with leaders and convincing them of the WRM vision would go a long way in encouraging positive collective outcomes.

Societal

It is critical to embed WRM design at the societal level, especially when dealing with rural communities. Urban areas can follow the business model of doing things as SOEs providing such services (e.g., WAF, SIWA, UNICEL, SWA, etc.) must also profit. The only challenge for them would be the cost of that service, which governments usually control. However, relationships are essential in rural and maritime communities where most of the population in PICs live and where WRM issues are widely prevalent. Respect and relationships are at the centre of any development effort and must be featured in WRM designs. Most donor-funded interventions focus on individualism, the social division of labour, rationalisation, bureaucratisation and the emancipation of the state from society etc., with limited results.

In contrast to "Western" approaches to development, indigenous Pacific systems emphasise "relationality", spirituality, Pacific agency, and community and nature's inseparability. This difference in the way Pacific societies see development applies to WRM and is essential to designing interventions in the region. Vaka'uta, Vakauta and Lagi (2018) sums this up well:

> "Relationships are at the core of indigenous Pacific Island worldviews. Despite the rich cultural diversity across and between the sub-regions of Micronesia, Melanesia and Polynesia, this is the one constant. At the core of what it means to be human is a shared life philosophy of balance, harmony and deep connectedness. Our epistemologies, our knowledge systems and practices are premised on relational spaces. The 'good life' is grounded in core values such as love and compassion, trust, respect, service, duty, responsibility and an important component of custodianship of the land, sky and sea. These we believe can never be truly 'owned' but instead are inherited from the ancestors and borrowed from the next generation. Each generation is a temporary custodian tasked with maintaining and nurturing human relationships within our known cosmos in the indigenous psyche. "

In PICs, development interventions, including in WRM, must acknowledge the importance of 'hybridity' on the ground across diverse and heterogeneous contexts. Hybridity in this context can be seen as a helpful framework for grappling with real-world phenomena that, in one way or another, entails the interpenetration of 'local', indigenous or place-specific socio-legal, political, or economic orders on the one hand, with global, transnational, or foreign orders on the other (Boege et al., 2008). The context in which WRM interventions in PICs are designed and implemented would do well to realise that the market and other introduced institutions have not entirely replaced or incorporated non-market social relations and other "traditional" institutions. Instead, they have instead merged with them, often in very creative ways that enable people and communities to have "the best of both worlds", or agency (ibid). Proposed WRM interventions in PICs should appreciate this reality on the ground to ensure success and sustainability.

Summary

All PICs require assistance to meet the basic WRM needs of their people and to meet SDG 6 Goals by 2030. The ethnic heterogeneity among PICs is reflected in the classification of PICs into sub-regions: Melanesia (Papua New Guinea, Solomon Islands, Vanuatu and Fiji); Micronesia (Palau, Federated States of Micronesia, Republic of Marshall Islands, Kiribati and Nauru); and Polynesia (Samoa, Tonga, Cook Islands, Tuvalu and Niue).

Moreover, there is also heterogeneity in sources of water among PICs. Some countries like Tuvalu, Kiribati and Nauru have no rivers or streams. Others like Samoa and Tonga have accessible groundwater, while the more prominent Melanesian countries have rivers, lakes and streams on bigger islands but none in the small atoll islands.

The social stratifications that differentiate Melanesia, Polynesia and Micronesia as either egalitarian, highly stratified or in between (hybrid) exist, as can be seen in the specific country reports. These also influence how respective countries develop their laws and how they respond to interventions from donor agencies. However, we found little real difference between the sub-regions of Melanesia, Polynesia and Micronesia. The only differences related to (i) the type and nature of islands; (ii) the existence or absence of rivers, lakes, groundwater, etc.; and (iii) the social structures and organisation in respective countries. However, even with these differences, there are also variations between countries and islands. The design of WRM in any Pacific country must take into account the specific features and nature of that country and the variations within. Therefore, there can be no one-size fit approach to WRM in PICs.

Learnings Concerning WRM in PICs

Pacific Island families have traditionally been responsible for their water supplies and sanitation (White et al. 2020a). In a region that is the least urbanised on earth, the engagement of the extended family unit is the key to achieving improved water availability and sanitation in rural and remote islands. The centralisation of government to capitals and the traditional responsibilities of the family may cause a disconnect, preventing politicians from feeling responsible for achieving universal access to water and sanitation. Indeed, progress in improving access to safe water and sanitation, particularly in rural and remote communities, has been slow over the past decades. Progress toward SDG Goals for 2030 has not improved as it has in other regions of the glob and appears to have stagnated (JMP 2021). Simply stated, the Pacific Region will fall well below its SDG 6 Goals by 2030 unless urgent action and immediate significant funding are made available to PICs.

Where should the effort be directed and what will achieve a better outcome than the past two decades of effort in WatSan? Piped urban supplies offer the best option to deliver safe billable water. Urban water supplies and sanitation in many PICs have improved significantly with ADB and other donor funding, enabling significant upgrading and renewal. The current issue is how these are to be maintained and expanded to meet urbanisation and population growth. Most governments have established SOEs to run these services as efficient and effective stand-alone businesses. However, achieving adequate revenue from these systems is critical to their survival, but the charging rates are set at a political level independent of the costs of operating the business. The political economy of water charges demonstrates that politicians are unwilling to pass the actual cost of supply services to users for fear of an electoral cost. Thus, governments are forced to

subsidise these services from budgets that are already under immense pressure from other government needs (Table 1). The result invariably is that services are underfunded, maintenance becomes non-existent, the network deteriorates, water supply diminishes or fails, quality deteriorates, and users lose confidence in the service and are unwilling to pay for it. As a result, users seek other more reliable and safe supplies with a further decline in revenue; so the cycle continues. Until the revenue side of urban water and sanitation services are addressed in PICs, there is little prospect that urban water reticulation systems can be operated and maintained sustainably.

Rural and remote communities are mostly still responsible for their water and sanitation. However, achieving universal access to safe water and sanitation in these communities, which are often small and geographically distant from the capitals and subject to significant climate risks, appears to be impossible for many PICs, given the limited national and ODA funds currently available. The GEF Pacific IWRM Projects' success in PICs was achieved through two impactful approaches. The first was the development of the Community to Cabinet approach, which has now found its way into other parts of the world. This approach deliberately sought to empower people at a community level to improve their WatSan through small community-scale projects and through establishing communication and resourcing pipelines with the government. Community successes increased political awareness of what was possible, and a success loop was established, which fostered replication. The "Doing is seeing the need" approach, meanwhile, helped develop communities' knowledge and capacity to implement WRM projects. This resulted in communities realising their needs and successfully meeting these with some external assistance. These principles had as their basic premise the empowerment of communities, local leaders, churches, and local and national political actors. They were highly catalytic and impactful at a local and national level resulting in replication and scaling up and giving rise to integrated government WRM policy. Future local and remote island WatSan projects should incorporate the lessons learned from this project.

Often, the PIC communities most vulnerable to climate change are the same rural and remote communities with the least access to basic water and sanitation. Significantly, the funding needs to mitigate these vulnerabilities may not be that great. Given the traditional responsibility of the extended family in WatSan, adaptation generated through this level could efficiently, effectively, and sustainably address these vulnerabilities. Funds directed at locally led solutions offer better outcomes as they empower traditional roles and power balances and acknowledge each community's unique socio-ecological situation. Few PICs have the resources to operate at the rural and remote community level, so building community capacity is the only sustainable option.

The GEF Pacific IWRM Project and its follow-on GEF Pacific Ridge to Reef Programme developed and funded postgraduate certificate courses for PIC staff. The courses were delivered primarily on a remote learning basis so that the participants could continue serving their countries while studying. Over 30 postgraduate certificates were obtained through these two interventions. Ensuring that genuine and formal capacity is developed and retained in PICs is critical. Training courses without formal and recognized qualifications do not achieve a long-term impact. On the other hand, participants who achieve formal qualifications gain financial recognition through increased positional scale and the PIC retains skilled staff. Meanwhile, while staff who attending a two-to-five-day training course, receive an attractive per diem, there is little long-term benefit to the PIC.

Opportunities for Donors in Pacific Island Countries Water Resources Management

1. For WRM to be effective, three elements must be in place: effective and transparent governance, adequate financing, and effective and efficient implementation. Both vertical and horizontal policy coherence is needed in WRM due to its cross-cutting nature. A standard WRM policy needs to have vertical coherence across national and local government agencies. Similarly, horizontal policy coherence is required across government agencies—all have a role to play in WRM. Agencies need to coordinate their efforts through an immersed WRM policy. Indeed, their respective policies should be joined through the incorporation of WRM. This approach contrasts with a specific WRM sectoral approach used in the past and has mostly failed. IWRM goes partway in accom-

modating other actors in WRM but still has a sectoral approach as its basis. An opportunity exists for an intervention to promote and trial a whole government approach to WRM.

2. WatSan infrastructure in PICs deteriorates rapidly due to the lack of recurrent funding for maintenance. There is little political incentive to level a charge for WatSan that reflects the cost of its ongoing supply due to the "common good" nature of water, i.e., usually phrased as "provided by God, so why is there a charge for it?" Politicians see service charges as a "hip pocket issue" and, therefore, electorally unpopular. Most PIC public WatSan facilities suffer significant annual losses and need to be subsidised by the government. Deteriorating infrastructure increases water losses in the system and places increased demand on scarce water resources. Well-managed and resourced WatSan utilities would increase financial and technical efficiencies, decrease water losses, improve revenue and increase capacity to source additional finance. Moreover, it would develop consumer and political confidence and a willingness to pay for and support the services.

There also needs to be a recognition within society that the government alone cannot take on the full responsibility for providing WatSan services to all, particularly given the remoteness of the outer islands. However, while municipalities and communities need to take some responsibility, they also need assurance that will receive capacity building and management and financial assistance. Urban water security could be improved with a stronger focus on household water collection. Any scheme to promote an increase in household rainwater harvesting (RWH) could be nudged through water charges for the freshwater supplied by the utilities.

There are opportunities to engage in urban, rural, and remote islands in this space by raising public and political awareness of these issues and a public and transparent process of valuing water and sanitation services.

3. WRM is not the only sector where progress is lagging in PICs. Financial and human capital are two seemingly insurmountable hurdles to improvement in most PICs. Even the existing systems cannot be operationally optimised due to a lack of human capacity in WatSan. An estimated 8,500 people are employed in the sector, with training needs estimated at 1,000 people per annum with a likely increased demand in the future to achieve SDG 6. The opportunity exists to fund this training and ensure that financial resources directed to the sector are efficiently and effectively used in the future. The establishment of a regional training approach is estimated to cost USD 5 million with a further USD 1 million per annum to fund 1,000 participants for eight years, for a total of USD 13 million.

4. For water quality to be maintained and improved, land use planning needs to address cross-cutting environmental issues impacting surface water and groundwater. Formal or informal mechanisms need to be developed, trialled, assessed, and implemented across customary and privately owned land. Such a mechanism must be created with stakeholders, and an opportunity exists for a gender-inclusive approach. Women traditionally have had a primary role in the growth and health of children and animals. This includes the collection of water and waste disposal. However, Pacific communities have significant heterogeneity, so any party seeking to ensure an inclusive approach to their interventions needs to be aware of the social structures within the target communities. For example, Christian religions in the Pacific have actively promoted women's groups and women's fellowships, providing an opportunity to engage women in WRM.

5. Specific WRM interventions on customary land must be done according to an area's protocols, factoring in informal structures and prominent positions of customary landowners and other community groups. Programme design should incorporate customary land tenure rather than viewing it as a stumbling block. In addition, participation and input from the community and leaders should be accommodated for successful implementation and sustainability.

6. Often, the most vulnerable PIC communities to Climate Change are the same rural and remote communities with the worst access to basic water and sanitation. Significantly the funding needs to mitigate these vulnerabilities may not be that great. Given the traditional responsibility of the extended family in WatSan, adaptation generated through this level could efficiently, effectively, and sustainably address these vulnerabilities. Funds directed at locally led solutions offer better outcomes by empowering traditional roles and power balances and acknowledging each community's unique socio-ecological situation. Few PICs have the resources to operate at the rural and remote community level, so building community capacity is the only sustainable option.

7. Rural and remote atoll communities need to improve the treatment and disposal of sewage. These improvements are required

for WRM and communities' health and wellbeing. However, it is evident that setting appropriate regulations does not always achieve these objectives. There needs to be a recognition of the political economy in states and their rural and remote communities and solutions developed from within these.

An opportunity exists to develop a best practice atoll aquifer management tool that empowers communities to:

- develop an understanding of the dynamics of their freshwater lenses
- develop management approaches under various extraction and recharges scenarios
- provide appropriate technology monitoring devices
- provide capacity building in the application of the tools
- provide appropriate technology and training in water quality monitoring
- strengthen community awareness-raising on hygiene and sanitation practices to counter the high incidence of typhoid and diarrhoea
- improve the design, quality and maintenance of septic tanks by monitoring and enforcing new building codes and strengthening maintenance of septic tanks at the household level.

8. Achieving universal access to safe water and sanitation requires in-country capacity to monitor water quality. Some PICs lack the human resources or technical ability to routinely monitor water quality at source and supply. An opportunity exists to establish such facilities and technical capacity within appropriate PIC agencies. The routine release of water quality testing in conjunction with a public WASH awareness programme would contribute to a sustainable and accountable water quality monitoring system, which should be aligned with a National Strategic WASH Plan.

9. Many Pacific communities rely on rainfall as their primary source of potable water. Significant resources have been invested in installing RWH at a household and community level, which plays a vital role in many PICs in rural and remote island locations. However, greater public awareness needs to be built around the maintenance of RWH systems. The PVC guttering and downpipes often fail after exposure in the tropics. The PVC becomes brittle, RWH efficiency decreases and, in some instances, no longer functions. The PVC guttering and pipes are also difficult and costly to purchase and transport to remote areas. An opportunity exists to develop and trial alternative, more robust materials with greater durability. For example, rolled metal gutters would be cheaper to transport and provide increased robustness and longevity.

10. The clear and increasingly accepted link between water security, climate change and disaster management offer a broader funding base for many PICs. Unsurprisingly, PIC leaders have been strident climate change activists. For example, the 2018 Boe Declaration on Regional Security recognised that 'climate change remains the single greatest threat to the livelihood, security and wellbeing of the peoples of the Pacific'. They have invested significant political capital in pushing their nation's needs for adaptation funding to address their vulnerabilities to climate change. They have successfully lobbied for preferential financing from the various international climate change funds. This political capital provides real opportunities to bridge the void between action to achieve universal access to WatSan and the political will to resource this adequately. New and significant funds can be sourced through better communication and awareness of the inexorable link between WatSan and climate change adaptation funding. Many PICs are currently reviewing and updating their National Adaptation Plans, and an opportunity exists to provide technical support to assist in integrating WRM into these plans.

Methodology

This political economy analysis explores deeper contextual issues to strengthen partnerships and support and sustain reforms in the water resource sector. In doing so, we may be better positioned to support development and reforms in WRM, premised on an understanding that governments and donors must ensure all actors are empowered to make informed decisions when partnering with other stakeholders. The approach and analytical framework in this study are detailed in Appendix 1.

Photo courtesy of Dave Hebblethwaite, SPC

Country Context

Photo courtesy of Jonacani Lalakobau, The Fiji Times

Papua New Guinea

Introduction

Papua New Guinea (PNG) is a country covering 462,840 km^2 with 9.1 million people (current estimate) who speak over 800 languages. The landscape has rugged mountain ranges, active volcanoes, large river systems, dense rainforests, savannah grassland, extensive wetlands and pristine coral reefs. The country has a wealth of natural resources in oil, gas, gold, and copper on land and large tuna stocks in the sea. However, the vast biodiversity in flora and fauna is matched by the cultural diversity of its people, who belong to a patriarchal society.

Political Context

PNG has a parliamentary-executive form of government with a National Parliament that has 111 members elected on a 5-year election cycle. The current Parliament has 20 political parties, with 10 of those parties represented in a coalition government led by the Pangu Party. The political landscape of PNG is complex, volatile and political patronage plays a significant role in the country's governance. The priorities for the PNG Government can be broadly grouped into five key areas: economic growth, infrastructure, law and order, education and health. The two key development frameworks are the 20-Year Development Strategic Plan 2010-2030 and the 40-year Vision 2050 (Ata, 2018).

The central government has a policy of decentralisation of administration and services. Thus, provincial governments have been tasked with oversight of services like the supply of water and sanitation services. The administration at the sub-national level in PNG is particularly complex with the 22 provinces, 89 districts and 327 local-level governments (LLG).

Economy

PNG is the Pacific's largest, most geographically and biodiverse country with a rich endowment of natural resources. Its economy is dominated by agriculture, forestry and fisheries (where most informal labour is engaged) and minerals and energy extraction. The mining and energy sectors account for most of the export revenue and PNG's GDP. GDP in 2019 was USD 23,592 million and GDP per capita was USD 2,637, which is amongst the lowest in the Pacific. It had a budget deficit of 8.1% of GDP (2020), and its debt was 40.4% of GDP in 2019 and is considered high risk (Table 1).

Socioeconomics

PNG's socioeconomic indicators are the lowest in the Pacific (Table 3). Its Human Development Index (HDI) is 0.55, which ranks it 155 of 189 countries globally. Moreover, there are currently no women in national parliament. PNG also ranks among the lowest in PICs of women on company and SOE boards and the lowest in private sector executive roles.

Population

PNG's population was estimated at 8,947,000 in 2020, with an annual growth rate of 1.9%. Its median age is 22, with a birth rate/1000 of 26.4 (Table 6).

Health

SDG 3 good health and wellbeing data for PICs is poor; selected WHO global health indicators were examined to compare the health and wellbeing of PNG's inhabitants (Table 7). PNG's reported indicators are among the worst for PICs, and it has the lowest expenditure on health as a percentage of GDP.

Water, Sanitation and Hygiene

PNG's National Statistical Office's Demographic and Health Survey (2016-2018) showed significant differences between provinces' access to basic drinking water services and sanitation facilities. The PNG Demographic and Health Survey Report (2019), meanwhile, showed that in 14 of 22 provinces, less than half of the sampled population had access to basic drinking water service, with the Southern Highlands recording the lowest figure of 14%. By contrast, 97% of the population in the National Capital District, where Port Moresby is located, has access to basic drinking water services (Table 13).

Table 13: Drinking water according to region, province, and wealth in PNG

Background characteristic	Improved source of drinking water1	Unimproved source of drinking water2	Other/ missing	Total	Percentage with basic drinking water service3	Percentage with limited drinking water service4	Number of persons
Region							
Southern	55.9	43.3	0.8	100.0	53.9	1.2	15,043
Highlands	39.0	60.8	0.2	100.0	35.1	3.3	32,442
Momase	43.3	56.5	0.2	100.0	41.9	1.2	21,258
Islands	63.6	36.0	0.4	100.0	60.8	1.6	11,626
Province							
Western	50.5	49.2	0.3	100.0	46.7	2.9	1,914
Gulf	41.8	58.2	0.0	100.0	40.0	0.8	1,453
Central	49.1	49.7	1.2	100.0	45.4	1.4	3,063
National Capital District	98.8	0.1	1.1	100.0	97.7	0.5	2,247
Mine Bay	59.5	39.8	0.8	100.0	58.5	0.9	4,124
Northern	29.3	69.8	0.9	100.0	28.3	0.9	2,221
Southern Highlands	19.4	80.5	0.2	100.0	14.8	4.5	5,894
Enga	29.6	69.9	0.5	100.0	27.7	1.8	2,994
Western Highlands	52.4	46.9	0.7	100.0	46.7	4.0	3,808
Chimbu	39.5	60.5	0.0	100.0	37.3	1.3	5,324
Eastern Highlands	54.5	45.4	0.1	100.0	52.3	1.7	6,641
Morobe	49.9	50.0	0.0	100.0	49.2	0.7	7,851
Madang	39.8	60.0	0.2	100.0	38.7	1.0	577
East Sepik	35.0	64.6	0.4	100.0	32.9	2.0	4,785
West Sepik	45.7	54.3	0.0	100.0	43.5	1.7	3,044
Manus	82.3	17.7	0.0	100.0	78.7	1.5	742
New Ireland	64.7	35.1	0.2	100.0	61.7	2.3	2,268
East New Britain	62.2	36.6	1.2	100.0	61.0	0.6	2,875
West New Britain	54.5	45.3	0.2	100.0	50.5	3.0	2,802
Autonomous Region of Bouganville	68.0	31.8	0.2	100.0	65.1	0.8	2,939
Hela	30.9	69.1	0.1	100.0	28.8	2.1	4,699
Jiwaka	47.0	52.7	0.1	100.0	35.9	10.4	3,063
Wealth quintile							
Lowest	12.7	87.2	0.0	100.0	11.0	1.6	16,073
Second	29.6	70.3	0.1	100.0	25.6	3.5	16,070
Middle	40.5	59.2	0.3	100.0	37.1	2.7	16,078
Fourth	59.3	40.1	0.7	100.0	56.7	1.8	16,072
Highest	92.2	7.3	0.6	100.0	90.4	0.9	16,075
Total	**46.9**	**52.8**	**0.3**	**100.0**	**44.2**	**2.1**	**80,369**

[1] Improved source includes piped into dwelling or lot, piped to a neighbour, public standpipe, tubewell or borehole, protected dug well, protected spring, rainwater, tanker/ truck/cart with tank and bottled water.

[2] Unimproved source includes unprotected dug well, unprotected spring, surface water and other.

[3] Defined as drinking water from an improved source, provided either water is on the premises, or round-trip collection is 30 minutes or less. Includes safely managed drinking water.

[4] Drinking water from an improved source, provided collection time is more than 30 minutes.

Source: PNG Demographic & Health Survey Report, 2019

In terms of sanitation facilities, the National Capital District is the only province where more than 50% of the population has access to basic sanitation services. West Sepik and Hela have the lowest, at around 10% (Table 14).

Governance and literacy levels can influence WASH. Table 2 shows that PNG's rates are lower than other Pacific Island countries, except for the Solomon Islands, in the World Bank ratings for Government Effectiveness and Regulatory Quality. This has a bearing on water resource management in PNG because of the disconnect between central coordination agencies in Port Moresby and provincial governments. Low education levels in PNG also impact community engagement in addressing WASH issues.

Table 14: Household sanitation facilities in PNG

Type and location of toilet/latrine facility	Households			Population		
	Urban	Rural	Total	Urban	Rural	Total
Improved sanitation facility	60.0	25.7	28.9	62.3	26.0	30.1
Flush/pour flush to piped sewer system	29.6	2.2	4.8	32.6	2.4	5.9
Flush/pour flush to septic tank	13.7	3.3	4.3	13.0	3.5	4.6
Flush/pour flush to pit latrin	1.1	0.9	0.9	1.1	0.8	0.9
Ventilated Improved pit (VIP) latrine	2.4	2.9	2.8	2.6	2.9	2.8
Pit latrine with slab	12.9	14.6	14.4	12.6	14.8	14.6
Composting toilet	0.4	1.7	1.6	0.4	1.5	1.4
Unimproved facility						
Unimproved sanitation facility	32.6	56.7	54.4	30.5	55.8	52.9
Flush/pour flush not to sewer/septic tank/pit latrine	0.4	0.0	0.1	0.4	0.0	0.1
Pit latrine without slab/open pit	29.3	54.8	52.3	27.3	53.8	50.8
Bucket	0.7	0.0	0.1	0.6	0.0	0.1
Hanging toilet/hanging latrine	1.9	1.6	1.7	1.7	1.7	1.7
Other	0.2	0.1	0.1	0.1	0.1	0.1
Missing	0.2	0.2	0.2	0.3	0.2	0.2
Open defecation (no facility/bush/field)	7.4	17.6	16.7	7.2	18.2	16.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of households/population	1,521	14,500	16,021	9,162	71,207	80,369
Location of toilet facility						
In own dwelling	46.4	10.2	14	49.4	11.2	16.1
In own yard/plot	45.1	74.2	71.1	42.9	73.5	69.6
Elsewhere	7.9	15	14.3	7.2	14.7	13.7
Missing	0.7	0.6	0.6	0.5	0.6	0.6
Total	100	100	100	100	100	100
Percentage with basic sanitation service[1]	48.3	19.3	22.1	52.2	20.4	24.0
Percentage with limited sanitation service[2]	11.0	6.0	6.5	9.5	5.3	5.8
Number of households/population	1,521	14,500	16,021	9,162	71,207	80,369

1 Defined as use of improved facilities that are not shared with other households. Includes safely managed sanitation service, which is not shown seperately.

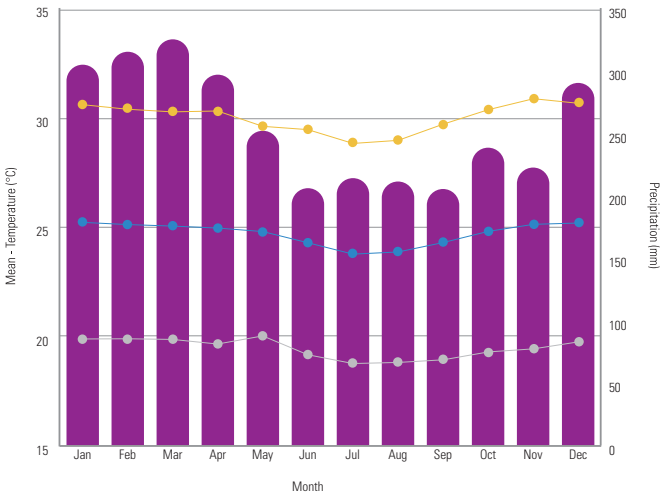
2 Defined as use of improved facilities shared by two or more households

Source: PNG Demographic & Health Survey Report, 2019

Physical Dimension

PNG's climate is marked by high temperatures and humidity throughout the year with two monsoon seasons, the northwest monsoon from December to March and the southwest monsoon from May to October. It has one of the wettest climates in the world, with an average rainfall of 200-400 mm/month. Figure 1 shows average temperatures and rainfall over a 30-year period.

Figure 1. Papua New Guinea Temperature and Precipitation 1991-2020



Source: Papua New Guinea - Climatology | Climate Change Knowledge Portal (worldbank.org)

Climate Change

Based on 18 global climate models, the projected trends for the 21st century are as follows:

- Increase in surface air temperatures and sea surface temperatures (very high confidence)
- Increase in annual and seasonal mean rainfall (high confidence)
- Increase in intensity and frequency of days of extreme rainfall (high confidence)
- Increase in intensity and frequency of days of extreme heat (very high confidence)
- Decrease in incidence of drought (moderate confidence)
- Increase in ocean acidification (high confidence)

(Ref: Climate Change in the Pacific: Scientific Assessment and New Research Volume 2: Country Reports, Chapter 11 PNG)

Water Availability

PNG ranked 2nd out of the top ten countries with populations having the lowest access to water, with only 37% of PNG's population having access. The other nine countries are all on the African continent (The State of the World's Water 2018).

Eda Ranu was responsible for supplying piped water to residents of Port Moresby, while Water PNG was responsible for supplying provincial and district towns. The two SOEs were merged in 2020 under the name Water PNG. Service provision to urban areas was estimated at 89% in 2015, up slightly from 87% in 1990. Over 87% of PNG's total population live in peri-urban and rural areas, of which only 33% have access to safe water. While this shows improvement from 1990 when only 24% had access, the rural population remained poorly served.

Structures and Institutions

The rural population of PNG is estimated at roughly 85%; however, the reach of formal state structures is minimal beyond the urban and peri-urban areas. This is due primarily to poor transport and communication infrastructure, although the latter has improved significantly with the introduction of mobile phone service providers in 2007. The archipelagic nature of the country and *wantokism* has further exacerbated the extent of state reach. Given the poor transport infrastructure, the cost of service delivery in rural areas is inherently high; thus, the government has become reliant on non-state actors, particularly churches, to deliver services in the critical sectors of health and education. Development organisations and NGOs are implementation partners in conducting pilot projects in the rollout of the national WASH policy. They are working in 12 districts and include Plan International, World Vision PNG, Live & Learn Environmental Education, WaterAid PNG and Oxfam PNG.

The public sector consists of 21 national departments, 48 statutory authorities and government companies and six constitutional offices. The subnational administrative arrangements are operational in 22 provinces, 89 districts and 327 localities. In addition, six central coordination agencies are headed by ministers and therefore subject to political influence: the Departments of Prime Minister and National Executive Council, Treasury, Personnel Management, Justice and Attorney-General, National Planning and Monitoring and Provincial and Local Level Government Affairs (Ata, 2018).

The PNG Government has for a number of decades been promoting the decentralization of power and funding from central government to the provinces and districts. Decentralisation is among four key national issues cited as having a major impact on the social and economic development of the country, the other three being the high population growth rate, urbanisation and Bougainville (Dept National Planning & Monitoring, 2020). Decentralisation is constantly evolving and in 2014, the District Development Authority Act was passed, giving the 89 districts increased autonomy and establishing the District Development Authority (DDA) chaired by the Open MP (parliamentary representative) from that particular electorate. The DDA has significant funding and administration that is basically under the control of the Open MP. The way funds are spent are influenced by ethnicity, local customs and the *wantok* groups, which can vary greatly in PNG. These informal institutions also have a bearing on governance, conflict resolution and development activities, which would include the installation of water supply systems.

The formal state structure comprises government departments, associated institutions, and SOEs like the two water utilities, Eda Ranu and Water PNG. They were established as separate entities in the 1980s and were merged in December 2020 despite reservations about the need for the merger. It seems that merging the two entities would benefit Water PNG as it would allow for cross-subsiding profits and the viability of Water PNG's operations.

Although Water PNG was mandated to "promote access to water and sanitation services in the rural areas", its urban priorities have led to rural populations becoming neglected. Subsequently, the delivery of rural services became remit of the National Department of Health (NDoH). Unfortunately, the lack of government funding and a national strategy has rendered NDoH largely ineffective. As a result, national and international NGOs, community and faith-based organisations have been primarily responsible for providing water and sanitation services in the peri-urban and rural areas.

The government agencies that are listed as key implementing agencies and partners in the PNG National Environment Management Strategy 2021-2025 to "improve access to safe and quality water" are the Department of National Planning and Monitoring (DNPM), Conservation and Environment Protection Authority (CEPA), NDoH, PNG Forest Authority (PNGFA), Mineral Resource Authority (MRA) and Climate Change Development Authority (CCDA).

The administration at the sub-national level in PNG is particularly complex with 22 provinces, 89 districts and 327 LLGs.

Guiding documents have been developed in recent years to help achieve SDG targets. These include:

- Draft National Monitoring and Evaluation Framework, developed by the WASJ PMU, to standardise WASH indicators and definitions for rural and urban communities, schools, healthcare facilities and track progress and financing.
- National WASH in Schools Policy and Standards outline minimum standards, specifications and ambitions to achieve 100% access to WASH in schools by 2030. (VNR, 2020).

Key WRM Actors in PNG

The key actors and their roles in WRM are summarised in Table 15:

Table 15. Key Actors involved in WRM in Papua New Guinea

Key Actors	Role Relative to WRM
Dept of National Planning & Monitoring	Central coordination agency responsible for strategic planning and the development budget, formulation, and allocation to development programs and projects. Chair of the multi-agency task force that developed the first national WaSH Policy 2015-2030.
Dept of Treasury	Central coordination agency responsible for recurrent budgeting
National Dept of Health	Promotion of WaSH in rural areas.
Water PNG	Provision of piped water and sewerage services to provincial and district towns outside Port Moresby
Eda Ranu	Provision of piped water and sewerage services to Port Moresby
Dept of Implementation and Rural Development	Responsible for implementation of new infrastructure in provinces. Disburse Service Improvement Program (SIP) funds for infrastructure projects in rural areas.
Conservation and Environment Protection Authority	It is mandated to conserve and manage PNG's natural resources, including freshwater resources.
Dept of Provincial and Local Government Affairs	The central coordination agency is responsible for mobilising, coordinating and providing necessary support for provincial governments and LLGs to function and advance.
Mining companies and other resource developers	Provide public infrastructure like water supplies in provinces and districts where they operate. This is part of the government's Tax Credit Scheme (TCS), where developers can claim the value of such infrastructure as an offset against taxes in any one year. It is capped at 0.75% of assessable income (Temu, 2002). Such infrastructure allows communities to benefit from services that government programs cannot provide.
World Bank, ADB, EU	Provision of technical advice and funding of infrastructure

Overview of WRM (Status, Constraints and Drivers)

Status

Water is abundant in PNG, and with a mean annual rainfall of between 2000-6000 mm, the country is one of the wettest on earth. Despite this, PNG could not meet the MDG water and sanitation target for 2015 and is likely to miss the SDG target for 2030 of 70% access to safe water and sanitation (Tables 16 and 17). PNG has the lowest water and sanitation access indicators among 15 developing Pacific Island countries (VNR, 2020). In response, the WASH Policy (2015-2030) is being rolled out in pilot projects across 12 of the 89 districts. Lessons learnt for the pilot districts will be used to scale to other districts. Because of the significant funding required for infrastructure, operations and maintenance of water supplies, government agencies, development partners, the private sector, and NGOs are working together to improve WASH services at the district level. An interim management information system (MIS), made possible by UNICEF, the EU and WaterAid, has been put in place to track targets and to support decision-making. Monitoring and evaluation will then become the responsibility of subnational stakeholders.

The two entities responsible for providing water and sanitation services to Port Moresby, 88 district towns and 20 provincial towns, are SOEs that are expected to operate commercially. Water PNG has the mandate to supply water to urban areas outside Port Moresby but currently serves roughly 300,000 residents, less than 3% of the country's total population (www.waterpng.com.pg). Utility companies' commercial approach inevitably means that towns and peri-urban areas deemed unprofitable will remain unserved. Water PNG cited landowner conflicts, staff harassment, and security concerns for the limited scope of services.

Table 16. Status of SDG Goal 6.1 Water Supply in Papua New Guinea (2020)

Indicator	Baseline		Actual	
	Value	Year & source	Value	Year & source
Rural Water Supply				
Proportion of rural population using safely managed drinking water	No Data	2015	0%	2019 (UNICEF KAP survey 2019)
Proportion of rural population using basic drinking water	33.4%	2015 (JMP)	39.3%	2018 (DHS)
Proportion of rural population using limited drinking water	1%	2017 (JMP)	2.3%	2018 (DHS)
Proportion of rural population using unimproved water for drinking	6%	2017 (JMP)	57.5%	2018 (DHS)
Proportion of rural population using surface water for drinking	58%	2017 (JMP)	16.1%	2018 (DHS)
Proportion of rural population with access to an improved drinking water source	34.8%	2015 (JMP)	41.5%	2018 (DHS)
Proportion of urban population using safely managed drinking water	No Data	2015	No data	2020
Proportion of urban population using basic drinking water	86%	2017(JMP)	82.2%	2018 (DHS)
Proportion of urban population using limited drinking water	4%	2017(JMP)	0.8%	2018 (DHS)
Proportion of urban population using unimproved water for drinking	3%	2017(JMP)	16.0%	2018 (DHS)
Proportion of urban population using surface water for drinking	7%	2017(JMP)	4.3%	2018 (DHS)
Proportion of urban population with access to an improved drinking water source	89.4%	2017(JMP)	83.5%	2018 (DHS)

Table 17. Status of SDG Goal 6.2 Sanitation and Health in Papua New Guinea (2020)

Indicator	Baseline		Actual	
	Value	Year & source	Value	Year & source
Rural Sanitation and Hygiene				
Proportion of rural population using safely managed sanitation	No data	No data	24.8%	2019 (Micro data UNICEF KAP survey)
Proportion of rural population using basic sanitation	8%	2017 (JMP)	20.4%	2018 (DHS)
Proportion of rural population using limited sanitation	1%	2017 (JMP)	5.3%	2018 (DHS)
Proportion of rural population using unimproved sanitation	74%	2017 (JMP)	55.8%	2018 (DHS)
Proportion of rural population practicing open defecation	17%	2017 (JMP)	18.2%	2018 (DHS)
Proportion of rural population with access to an improved toilet	9.1%	2017 (JMP)	26%	2018 (DHS)
Proportion of rural population with access to basic hygiene	No data	No data	28.6	2018 (DHS)
Proportion of rural population using limited hygiene	No data	No data	34.5%	2018 (DHS)
Proportion of rural population with access to no service hygiene	No data	No data	36.9%	2018 (DHS)
Urban Sanitation and Hygiene				
Proportion of urban population using safely managed sanitation	No data	No Data	No Data	No data
Proportion of urban population using basic sanitation	48%	2017(JMP)	52.2%	2018 (DHS)
Proportion of urban population using limited sanitation	8%	2017(JMP)	9.5%	2018 (DHS)
Proportion of urban population using unimproved sanitation	44%	2017(JMP)	30.5%	2018 (DHS)
Proportion of urban population practicing open defecation	1%	2017(JMP)	7.2%	2018 (DHS)
Proportion of urban population with access to an improved toilet	55.5%	2017(JMP)	62.3%	2018 (DHS)
Proportion of urban population with access to basic hygiene	No data	No data	64.9%	2018 (DHS)
Proportion of urban population to limited hygiene	No data	No data	27.2%	2018 (DHS)
Proportion of urban population with access to no service hygiene	No data	No data	7.9%	2018 (DHS)

Source: VNR, 2020

Constraints

Despite the legislation and policies in place, water and sanitation is still not a government priority. Several issues contribute to the lack of progress in achieving SDG 6.

The Government's WaSH Policy 2015-2030 articulates five key issues. Firstly, the lack of importance assigned to this sector by the government and reflected in the lack of funding and directives. There are no plans, policies, or strategies for how 2030 and 2050 targets for water and sanitation are to be achieved. Although the government has a policy of decentralisation of administration, funding and services, there is little direction on how these can be utilised to improve WaSH services at the provincial level. Therefore, the responsibility to progress this sector has fallen on community-based organisations, NGOs, and foreign agencies like the EU, ADB, and WB.

Secondly, no single entity has been assigned the responsibility for overseeing the policy formulation and implementation for this sector. This has resulted in a lack of planning, coordination, funding, and projects remain reactive to funding availability rather than being part of a coordinated program.

The third issue is the insufficient funding for infrastructure including recurring budget commitments to maintain existing infrastructure.

The fourth is the insufficient manpower employed in the sector, and lastly, the lack of monitoring and evaluation in the sector. There is no central database of WaSH programs, implementing partners, coverage and capacity in the rural sector. Such information would assist in framing a better planned and coordinated approach to meeting national WaSH targets.

The national WaSH policy was developed by a taskforce comprising government and nongovernment agencies in the water, sanitation and hygiene sector, to address these issues and thus provide some impetus to PNG achieving SDG 6 by 2030.

The horizontal coordination of the six central coordination agencies is also a constraint, especially between agencies that impact the water sector's expansion, rehabilitation, and advancement. For example, the poor collaboration between the Department of Prime Minister and National Executive Council and the Department of National Planning and Monitoring is primarily due to different strategic and process orientations. The latter is more development-oriented and is in charge of the development budget, while the former is interested in how the development budget fits with the recurrent budget and the broader policy development and implementation of the government. The result is a lack of clarity, incohesive messaging, and poor administrative coordination. The same can be said of the Department of Treasury and the Department of National Planning and Monitoring, which are responsible for the recurrent and development budgets, respectively. Their different short- and long-term priorities and assessment practices have resulted in mixed messaging and poor coordination between sectors. As a result, the six central coordination agencies work in silos, impacting sector development like the water sector.

The vertical coordination of central coordination agencies, sector departments and subnational administrations are even more complex. Central and subnational coordination is a significant focus of the Provincial and Local Level Service Monitoring Authority. The Authority links the sector departments like Heath and Infrastructure with the provincial governments for policy and administrative coordination. However, a lack of communication between the various agencies, fragmentation caused by the decentralisation policy of the PNG Government, competing interests and unclear roles have been detrimental to effective coordination at the provincial level.

Although access to safe water and sanitation is widely considered a basic human right and necessary for human development and poverty alleviation in PNG, access to both services was on the decline in PNG early in the 21st century, and little improvement has been made. This is primarily due to a lack of consistent government focus on water and sanitation priorities. Given the Open MP's clout at the district level, influencing progressive parliamentary representatives prioritise this basic human right can have a significant impact on the development trajectory of PNG. The WASH Policy of 2015-2030 has recommended the establishment of a National Water, Sanitation and Hygiene Authority to be the apex body to provide leadership and coordination in this sector and to implement the national policy. But there is no apex authority and until the WASH policy of 2015, there had been no guideline explicitly defining roles and responsibilities. Instead, the responsibility for this sector is fragmented among different government agencies.

Water PNG is mandated to promote water and sanitation services on a self-help basis in rural areas but is constrained by the need to provide returns as a commercial entity. Under the Organic Law of 1995, subnational administrations are permitted to develop their water and sanitation infrastructure that had been within the ambit of the Department of Health and Department of Works. However, minimal progress made by the subnational governments inevitably led many in the rural areas to source water from natural resources such as rivers, creeks and shallow wells and to use rudimentary sanitation facilities. While NGOs, churches and resource companies have stepped in and built village water supplies, these have been restricted in geographical spread and funding.

There is also a critical shortage in human capacity to deliver improved water and sanitation services. This has contributed to the poor operation and maintenance of systems. There is an acute shortage of engineers, technicians and managers at the national level, in the utilities and subnational governments. In 2013, PNG required an additional 7,600 people to be recruited, including 1,190 engineers and 4,140 technical staff. The Pacific Region Infrastructure Facility commissioned a scoping study in 2021 for a regional approach to water sector training. It highlighted that for SDG 6 to be met by the Melanesian countries, there was a dire need to offer training for staff regularly rather than on an ad hoc basis as is currently offered. The study recommended that a rolling training program be offered on two levels:

1. A set of low-cost, introductory vocational courses for junior and operational staff and

2. A set of advanced vocational training courses for planners, management staff and specialist staff

A regional training framework would be required and would comprise the following parts:

- A Pacific Advisory Centre for Water Training to be set up either at USP or SPC to develop and deliver the courses
- The staff of national water sector agencies to be the clients and beneficiaries of the training
- National and regional TVET organisations to provide training.

Funding is another critical issue that needs to be addressed. For PNG to meet its SDG target, it is estimated that USD 31million/year is required for water supplies and USD 70million/year for sanitation services. (Service Delivery Assessment, 2013).

Other factors that need to be addressed are unique to the PNG context. These include political volatility, the lack of roads, lack of electricity, customary land ownership, and tribal conflicts that hamper the delivery of services, particularly in the country's rural areas.

Drivers

Several factors contribute to the low access to safe water supplies that plagues PNG. A high population growth rate of 2.1% (SPC, 2022) and urban drift have increased urban populations, and the water demand has exceeded the supply. This is especially true for informal settlements in Port Moresby and district towns like Lae, Mt Hagen, Medang and Wewak. Infrastructure has not kept up with population growth, and there is an increased incidence of waterborne diseases. Poor access to safe piped water and sanitation facilities has also led to diarrhea and other WASH-related illnesses being the leading cause of death in PNG, especially among children.

Elevated temperatures have increased the risk of waterborne diseases and insect-transmitted diseases, increasing morbidity rates. In addition, changes in temperature and rainfall patterns due to climate change affect water quantity and quality of rivers and groundwater and increase flood risk and droughts.

Urban water supplies are still plagued by land ownership issues, water quality and reserve sufficiency. Data collection and monitoring are poor; management capacity is weak and financial support for infrastructure and sustainability of water supply systems needs strengthening. Inadequate institutional frameworks and a lack of clarity on roles also contribute to poor services.

Recommendations

- Support funding for water sector staff to be trained in planning, management and specialist technical skills to address the lack of water engineers and other technical specialists. Scholarships for vocational studies at institutions like APTC could be offered.
- Work with the Provincial and Local Level Service Monitoring Authority to strengthen vertical coordination between agencies involved in the water sector for greater clarity of roles and improved communication of national policies to provincial governments and LLGs.

- Work with the national government to establish the National Water, Sanitation and Hygiene Authority as the apex body for the water sector and lead in the implementation of the WASH Policy.
- Assist Water PNG to expand WASH services to informal urban settlements through the installation of water tanks
- Strengthen WASH regulations by improving surveillance, standards and compliance and public awareness-raising
- Improve sector coordination by strengthening WASH Task-force reporting

Photo courtesy of Dave Hebblethwaite, SPC

Solomon Islands

Introduction

Solomon Islands in a large archipelago of almost 1,000 islands with a population of 721,455 people, of which 25.6% live in urban areas and 74.4% in rural areas. A dozen of the islands can be considered large in Pacific terms with a coastline of 5,313 km and land area of 27,549 km^2. It has a territory covering 910 km^2 of ocean and a 321 km exclusive economic zone (EEZ) of 1.3 million km^2. The Solomon Islands was declared a British Protectorate in 1893. It was granted independence in July 1978 after 85 years of colonial administration. The first European to visit this group of islands was a Spaniard named Alvaro de Mendana in 1567 (Bennett 1987).

Political context

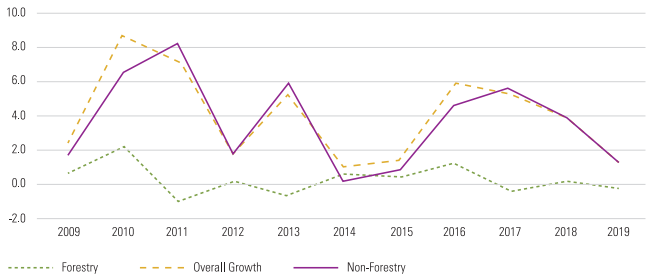
The Solomon Islands adopted a unitary system of government following the Westminster model at independence in 1978. Its national parliament accommodates 52 members representing 52 constituencies. The Prime Minister is the Head of Government, and he and his ministers form the Cabinet usually with the support of backbenchers. To date, there have been no female PMs. The Governor-General, representing the British Monarchy, is the Head of State. Beneath the national parliaments are provincial governments and the Honiara City Council. The provinces were established by the 1997 Provincial Government Act, while the Honiara City Act, 1999, established Honiara City. Provincial governments formally connect to the national government via the Ministry of Provincial Governments and Institutional Strengthening (MPGIS).

In contrast, the Honiara City Council is connected through the Ministry of Home Affairs (MHA). The Solomon Islands has been rated negatively over the years in terms of governance. As shown in Table 2, Solomon Islands was rated -0.91 for Government Effectiveness and -0.84 for Regulatory Quality in 2020 based on the World Bank's Governance Indicators scale of -2.5 to +2.5. These indicators reflect some of the challenges that the country will have to deal with to effectively implement WRM interventions.

Economy

The Solomon Islands is the second largest country in the Pacific, after neighbouring Papua New Guinea, with a land area of 28,896 km^2 and 4,023 kms of coastline. It is an archipelago of 944 islands comprising high mountainous islands and low-lying coral atolls with a maritime economic exclusive zone (EEZ) of 1.34 million km^2 (SIG, 2020a: 3). The country's economy relies on its natural resources with agriculture, logging, fisheries and mining, contributing to its national revenue. Forestry and logging have been the primary sources of income since independence, contributing 70% of exports, but in recent years, logging revenue has been declining as the forests have been depleted (CDP, 2021: 4). Figure 2 below shows the recent decline in revenue from the logging industry compared to the non-forestry sector and the overall growth/decline of the Solomon Islands economy.

Figure 2: Growth of forestry and non-forestry sources over a decade



(Source, CBSI 2019)

Agriculture products, primarily in the form of palm oil (3%), minerals (5%), copra and coconut oil (1.8%), cocoa and other smaller agriculture products, also contribute significantly to the non-forestry sources of the economy. Fisheries and seafood products comprise 12% of exports for the country (CDP, 2021: 4). Solomon Islands is also a member of the Parties to the Nauru Agreement (PNA). In addition, the country's EEZ is tuna rich and potentially mineral-rich.

Solomon Islands is on the path to graduate from Least Developed Countries (LDC) status in the near future.

It has a GDP of USD 1,551 million and a GDP per capita of USD 2,258. It has a debt of USD131 million, equivalent to 8.31% of GDP. The country's deficit as a percentage of GDP was at -2.5%, and its debt sustainability is categorised as 'moderate risk'. In 2019, the level of net ODA received as a percentage of GNI was 14.41%, while remittances received was only 1.6% of GDP. The World Bank ranked Solomon Islands 33 under the MVI index with 'high vulnerability'.

Population

The Solomon Islands has a significant subsistence economy. People in the rural and outer islands rely predominantly on subsistence farming, fishing, and other similar activities to support their daily livelihood. Since rural and maritime communities often face transportation and logistics challenges, there are only a few development projects related to water supplies and sanitation in these communities. The Solomon Islands is a country of villages, with Honiara being the fastest growing urban centre in the country. The annual population growth rate for Honiara in 2019 was 5.8%, one of the highest in the Pacific with a population of 130,176 people. In addition, the 2019 national census showed that 74.4% of the population lived in rural areas and only 25.6% in urban areas (SIG, 2020b). Given the proportion of rural to urban population in the country, it is imperative that although Honaira faces specific WASH issues, more must be done in rural communities where most people live. Table 18 below provides a summary of the population of the Solomon Islands based on the preliminary results of the 2019 national and household census.

As shown in Table 3 of the report, life expectancy at birth in the Solomon Islands is currently 73 years, expected years of schooling is 10.2 years, and the mean years of schooling is 5.7 years. In addition, the percentage of the skilled labour force in 2020 was 18.7%, and the HDI was 0.567. There are currently three women in parliament (6%), an improvement from some years back as well as 11 women in private organisations and SOEs chairs and 7 in senior executive and management positions.

As noted in the introduction, data on health and other issues from the 2019 national population and household census are not yet available. Still, two reports provide valuable guidance: the 2009 National Population and Household Report (SIG 2009) and the Solomon Islands Demographic and Health Survey, 2015 (SIG, 2017a). These provide some indication of the health and WASH issues described below.

Table 18: Provisional urban-rural area population for the Solomon Islands by province (2019)

PROVINCE	All Areas		Urban		Rural	
	Number	%	Number	%	Number	%
Solomon Islands	721,455	100	184,832	25.6	536,623	74.4
Choiseul	30,619	100	909	3.0	29,710	97.0
Western	94,209	100	13,628	14.5	80,581	85.5
Isabel	30,399	100	829	2.7	29,570	97.3
Central	30,326	100	1,431	4.7	28,895	95.3
Rennell-Bellona	4,091	100	-	0.0	4,091	100.0
Guadalcanal	154,150	100	28,395	18.4	125,755	81.6
Malaita	173,347	100	6,695	3.9	166,652	96.1
Makira-Ulawa	52,006	100	1,542	3.0	50,464	97.0
Temotu	22,132	100	1,227	5.5	20,905	94.5
Honiara town council	130,176	100	130,176	100.0	-	0.0

(Source, SIG: 2020b)

Health & WASH

Infectious diseases and non-communicable diseases (NCDs) are prominent throughout the Solomon Islands. The 2015 survey highlighted that, "Communicable diseases and NCDs remain the main diseases in the Solomon Islands, with malaria and tuberculosis being the major public health concerns and sexually transmitted infections, acute respiratory tract infections, diarrhea and viral hepatitis. Dengue fever and measles are other major health concerns among communicable diseases" (SIG, 2017a: 8). Health and wellbeing are important building blocks for Solomon Islands progress. As shown in Table 6, the GDP per capita in the Solomon Islands is USD 2,258. The government's expenditure on health is around 3.5% of GDP. The mortality rate, neonatal (per 1,000 live births) is 8.2; mortality rate, infant (per 1,000 live births) 16.8; and mortality rate, under-5 (per 1,000 live births) 19.7.

Of interest is the accessibility to and use of safe water resources to ensure a healthy population. From the 2009 census, the national water authority, who are primarily responsible for urban centres and charging people for water use, recorded that only 9% of the population had metered water connections. Since most of the population live in rural village communities, the most common source of drinking water is the community standpipe, followed rivers and streams and then household tanks (SIG, 2009). It is important to note that there are disparities between and within provinces on the types of water sources accessed for drinking water. Table 19 below provides some indications of drinking water sources used in Solomon Islands' provinces.

Apart from access to drinking water, critical data on sanitation, particularly the types of toilet facilities used by citizens, is also available. The 2015 demographic and health survey by the Solomon Islands Statistics Office in collaboration with the Ministry of Health and Medical Services (MHMS), surveyed a nationally representative sample of more than 5,000 households. (SIG, 2017a: 9).

Table 20 shows the types of sanitation facilities households in the Solomon Islands use, based on the representative sample. The survey showed that 57.9% of households and 57.2% of the population had no toilet facilities and used the field/bush/sea/ocean/beach. Even 6% of urban households did not have toilet facilities at the time of the survey. Notably, only 22.6% of households and 24.1% of those surveyed, primarily those in urban centres, had improved/not shared facilities. The numbers depict a significant sanitation issue in the Solomon Islands, similar to the problems highlighted in Kiribati even though the former has more land and water resources. The biggest challenge for the Solomon Islands is to develop water supply infrastructure that would pave the way for the introduction and use of appropriate sanitation facilities.

Table 19: Sources of drinking water used in Solomon Islands provinces

Province	Metered SIWA	Communal Standpipe	HH tank	Communal Tank	Well-protected	Well-unprotected	River/ Stream	Bottled Water	Other	Population
Choiseul	0%	30%	24%	18%	0%	0%	25%	0%	2%	26,372
Western	0%	30%	33%	18%	0%	0%	14%	1%	3%	76,649
Isabel	0%	64%	10%	11%	1%	0%	11%	0%	2%	26,158
Central	1%	39%	19%	18%	1%	0%	18%	2%	2%	26,051
Rennell-Bellona	0%	0%	80%	13%	1%	1%	0%	3%	2%	3,041
Guadalcanal	6%	27%	5%	7%	7%	6%	38%	0%	4%	93,613
Malaita	2%	45%	5%	8%	2%	0%	33%	1%	4%	137,596
Makira-Ulawa	0%	50%	3%	8%	1%	0%	34%	0%	3%	40,419
Temotu	0%	38%	10%	24%	2%	6%	8%	0%	11%	21,362
Honiara	75%	4%	10%	1%	0%	3%	5%	1%	1%	64,609
Total	9%	35%	12%	11%	2%	2%	25%	1%	4%	515,870

(Source: SIG, 2009)

Table 20: Solomon Islands household sanitation facilities

Percent distribution of households and de jure population by type of toilet/latrine facilities, according to residence, Solomon Island 2015

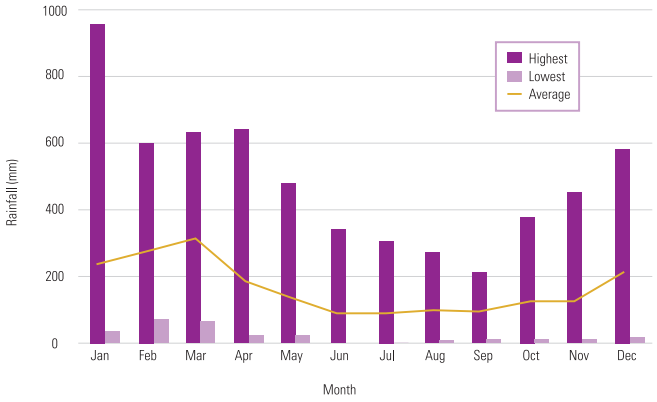
Type of toilet/latrine facility	Households			Population		
	Urban	Rural	Total	Urban	Rural	Total
Improved, not shared facility						
Flush/pour flush to piped sewer system	17	1	3.7	18.5	1	4.4
Flush/pour flush to septic system	34.9	3.5	8.8	37.8	3.3	10
Flush/pour flush to pit latrine	6.5	2.9	3.5	6.4	2.6	3.4
Ventilated improved pit (VIP) latrine	2.4	1.9	2	2.2	1.9	1.9
Pit latrine with slab	6.8	4	4.4	6.9	3.6	4.3
Composting toilet	0.2	0.1	0.1	0.3	0.1	0.1
Total	67.8	13.4	22.6	72.1	12.6	24.1
Shared facility[1]						
Flush/pour flush to piped sewer system	3	0.4	0.8	2.4	0.3	0.7
Flush/pour flush to septic system	7.6	1.2	2.2	6	0.8	1.8
Flush/pour flush to pit latrine	5.4	0.9	1.7	5.5	0.9	1.8
Ventilated improved pit (VIP) latrine	1.8	0.9	1.1	1.4	0.8	0.9
Pit latrine with slab	3.5	0.9	1.3	3	0.9	1.3
Composting toilet	0.1	0.1	0.1	0.1	0.1	0.1
Total	21.3	4.3	7.1	18.4	3.7	6.6
Non-improved facility						
Fluch/pour flush not to sewer/septic tank/pit latrine	0.9	0.2	0.3	0.7	0.2	0.3
Pit latrine without slab/open pit	3.1	9.7	8.6	2.6	9.7	8.3
Hanging toilet/hanging latrine	0.2	2.5	2.1	0.3	2.5	2.1
No facility/bush/field/sea/ocean/beach	6	68.4	57.9	5.4	69.6	57.2
Other	0.5	1.4	1.3	0.5	1.6	1.4
Missing	0.1	0.1	0.1	0.1	0	0.1
Total	10.9	82.3	70.3	9.6	83.7	69.3
Total	100	100	100	100	100	100
Number	850	4,192	5,042	5,207	21,652	26,859

[1] Facilities that would be considered improved if they were not shared by two or more households
(Source: SIG, 2017)

Physical Dimension – Climate, Climate Change, Water Availability

Like many other PICs, the Solomon Islands has two distinct seasons, and the average temperature is 27 degrees Celsius. The wet season is usually from November to April, and the drier season is from May to October (SIG, 2021). The average monthly rainfall in Honiara from 1955 to 2000 is shown in Figure 3.

Figure 3: Average monthly rainfall for Honiara (1955-2000), representative of the Solomon Islands



(Source: SOPAC, 2007)

The Solomon Islands are directly affected by the effects of climate change. In recent years, the low-lying atoll and islands have felt the brunt of rising sea levels. For instance, the islands of Walande and Fanalei in the southern part of Malaita Province are sinking, and people are relocating to the mainland or other parts of the country (Ploeg et al., 2020). There are other similar accounts in other parts of the country, such as in Ontong Java, Malaita Outer Islands (see SPREP, 2011) and Reef Islands in Temotu province.

On the high mountainous islands, the adverse effects of climate change are also being felt. Tropical cyclones that bring destruction and devastating floods that rob people of their homes, food gardens, and lives are all too frequent in the country. One of the most catastrophic cyclones to ever hit the Solomon Islands was Cyclone Namu in 1986 (Revell, 1986). In recent years, the frequency of tropical cyclones accompanied by flash floods has been common. In 2014, flash floods claimed 22 lives, destroyed 675 homes and affected the livelihoods of about 60,000 people around Honiara and Guadalcanal (GEF, 2020:5; Mohanty, 2015: 14). Other similar incidents resulted in the loss of lives and livelihoods in the Solomon Islands in 2008, 2009 and 2010 (Mohanty, 2015). Climate change in the form of sea-level rise and extreme weather events continuously affects the Solomon Islands. As one government document succinctly puts it, the country was:

> "subject to a high frequency of natural disasters such as storm surges and island overtopping, earthquakes and tsunamis in 2007 and 2013, and volcanic eruptions, all of which disrupt water supplies and sanitation services. Climate change is expected to increase the frequency of extreme events, and groundwater sources in low islands, atolls and coastal areas are exceptionally vulnerable to sea-level rise (SIG, 2017b: 11)".

The differences in the types and sizes of islands also means that water availability across the country differs. The low-lying islands and atolls, where water is scarce, rely more on rainwater harvesting and groundwater wells often affected by saltwater intrusion. On higher mountainous islands, the primary water sources are rivers, streams and boreholes, as highlighted in Table 19 above. While rivers, streams, and lakes can be found in bigger raised islands, connecting them to villages in the mountains or having proper boreholes in areas like the Guadalcanal plains remains a challenge.

In terms of IWRM (SDG 6.5.1) implementation status and progress for 2017-2020, Solomon Islands performed at medium-low and low levels on a scale of 0 to 100 (0 being the lowest and 100 being the highest level). As shown in Table 9, in terms of enabling environment for IWRM, Solomon Islands scored 25 in 2017 and 30 in 2020; institution and participation, 28 (2017) and 30 (2020); management instruments, 30 (2017) and 35 (2020); financing, 20 (2017) and 24 (2020); and the final IWRM score was 26 (2017) and 30 (2020). This means that there is a lack of IWRM implementation across the country. Looking at water governance scores provided in Table 10, Solomon Islands did well in the following areas: roles and responsibilities; water law and/or environmental law; catchment-based organisations; guidelines or standards for capacity building across authorities at all levels; data and information; and monitoring and evaluation. It is also essential to look at the country's water security scores provided by the ADB in Table 11. The five dimensions and their respective scores for the Solomon Islands are as follows: (i) rural household water security (water and

sanitation) was 7 (out of 20); (ii) economic water security (water to sustainably satisfy economic growth) was 14; (iii) urban water security (water and sanitation and flood management), 7.9; (iv) environmental water security (catchment and aquatic health and environmental governance), 9.5; and (v) water-related disaster security (resilience against droughts, floods, and storms), 10.5. The total score for the Solomon Islands from these five dimensions is 49.3, earning it 10th position in PIC rankings.

Structures and Institutions

Formal structures of the modern state and indigenous/informal structures and institutions in the Solomon Islands influence any development undertaking. The Solomon Islands adopted a unitary system of government from Britain with a national parliament comprising 50 single-member constituencies. This means that each constituency is only represented by one member of parliament (MP), unlike some constituencies in Kiribati, Vanuatu or PNG where there are multiple seats in one constituency. These 50 MPs are elected through the First-Past-the-Post (FPTP) electoral system, ensuring that the person with the highest votes represents the people in their constituency.

Once elected, all MPs hold another election in Parliament to elect the prime minister, who then appoints ministers as members of the executive government. Other MPs become government backbenchers or part of the official opposition. There is also a constitutional position for the leader of the independent MPs. The MPs also elect a speaker nominated from outside parliament and a deputy speaker from among themselves to preside over parliament business. Moreover, the 50 MPs also elect the governor-general, the head of state, representing the British Monarch. The governor-general is a ceremonial head of the state. The ministers are responsible for their respective ministries' day-to-day running.

The constitution also provided for the establishment of provincial governments in the country. The nine provincial governments are administered under the national Ministry of Provincial Governments and Institutional Strengthening (MPGIS), which is the coordinating body. The provincial governments have devolved a list of functions/areas under which they can make by-laws. Such areas include cultural and environmental matters, land and land use, local matters, rivers and waters (SIG, 1997). A new national federal constitution that will establish a new government structure under a federal arrangement has been drafted after more than a decade of consultations and is now with the government for deliberations. Speaking during the Western Province's Second Appointed Day celebrations in December 2021, Prime Minister Manasseh Sogavare declared that "the DCGA [Government] is fully committed to introducing the Federal System of Government recommended by the Eminent Persons Group" (GCU, 16 December 2021).

The provincial governments usually oversee the provincial towns as their administrative hub, except for Honiara and Guadalcanal. The Honiara City Council (HCC) comes under the Ministry of Home Affairs. It has its election and a government similar to provinces. However, Honiara is the only urban centre with a municipal council. Guadalcanal province's headquarters is in Honiara, with no control over Honiara. The case of Honiara is complicated by the fact that apart from the HCC that have elected representatives from different wards, there are also three constituencies – East, Central and West Honiara constituencies – each with its own financial resources and minimal connection with the Municipal Council. Water service in the city is under the control of the Solomon Islands Water Authority (SIWA), an SOE, while sanitation is under the control of the HCC.

Christian churches are vital institutions in the Solomon Islands political economy. Although not directly involved in government processes, churches do have a lot of influence over their followers. The principal church denominations in the country are the Anglican Church of Melanesia, Roman Catholicism, Wesley United Church, the South Seas Evangelical Church (SSEC), and the Seventh Day Adventist Church (SDA). These 'mainline' churches have a formal association (the Solomon Islands Christian Association or SICA) through which they communicate and engage with the government as a group. Smaller and newer churches have their own association called the Solomon Islands Full Gospel Association (SIFGA). They represent their member churches when liaising with the government on issues of importance and concern. Interventions in WRM should consider churches' influence over their members in their respective communities.

Finally, while institutions and structures in communities and villages are not part of the formal government mechanisms, they determine the day-to-day relationships and interactions at the village level. In each of the islands, some tribes are formed by clans. These clans are formed by extended families with a common

ancestry that could either be matrilineal or patrilineal. The clans are the landowning units in Solomon Islands communities, similar to *mataqali* in Fiji. In northern Guadalcanal, clans are called *mamata* and tribes, *kema* (see Nanau, 2021). In the west, they are called the *butubutu* (Liligeto, 2006). The *mamata* or *butubutu*, which have their own leaders especially on predominantly Melanesian islands, control land and land rights over a specific portion of land in their community. In the smaller Polynesian outliers such as Anuta and Tikopia, the chiefs (*Ariki*) or their assistant chiefs have influence on matters related to land and land use.

The state does not own land categorised as customary land in the country. Around 87% of land in the country is under customary tenure (Fitzpatrick, 2013: 14). Negotiations must be conducted with landowning clans to access land or water sources as and when required. This must be considered when designing WRM interventions in rural communities. Engaging appropriate people in the community who know "who's who" is critical when addressing WRM at the community level. Even water sources that supply urban areas, such as the Kongulai water source in Honiara and the Ziata source that supplies Noro town in the Western province, are on customary land. Through the Solomon Islands Water Authority, the state has to deal with leaders of clans that host these water sources when disputes arise. Sometimes, customary landowners disrupt water supplies when the state ignores their views. Of course, some processes can be used to convert customary land into titled/registered land for significant development or water projects. An example is the Tina Hydro project on Guadalcanal, where the state, donors and landowners collaborated to implement the project.

Key Actors

Table 21: Key Actors involved in WRM in Solomon Islands

Key Actors	Role Relative to WRM
State structures and processes (SS)	State structures and processes will have to be followed to get WRM programmes accepted
Prime Minister and Cabinet Office (PMC)	The Prime Minister and his cabinet ministers can endorse or reject WRM interventions in the country.
Provincial Governments (MPAs)	Provincial governments are agents of the central government and are tasked with providing water and sanitation service in their provinces.
Honiara City Council (HCC)	Responsible for providing services, including water and sanitation services together with providers in Honiara.
Solomon Islands Water Authority (SIWA)	Responsible for providing water services to Honiara residents and other urban centres.
Chiefs/elders/respected community leaders (CFS)	Provide leadership, order and stability in their communities. They could potentially assist with WRM interventions.
Customary Land Owners (LO)	These are local indigenous clans and tribes that own land where most water sources and rivers are located. They can be support or hinder WRM efforts.
Political rivals	These individuals may sometimes challenge WRM efforts in rural communities, especially if they own land where water sources are located.
State owned enterprises (SOE)	They provide water, sanitation and other services to urban residents.
Churches - Solomon Islands Christian Association (SICA)	Their member churches have huge followings in rural communities, including LOs. They can influence their member churches for WRM efforts.
Churches - Solomon Islands Full Gospel Association (SIFGA)	Although not as large as SICA, they have followings in rural communities. They are a potential force in WRM.

Overview of WRM – Status, Constraints and Drivers

Various studies and plans provide some detail on the status and constraints of WRM in the Solomon Islands. For example, an SPC supported study was undertaken in 2007 in the Solomon Islands and produced a diagnostic report on national Integrated Water Resource Management. The detailed report provides a table outlining "measures to overcome impacts and concerns for a coherent IWRM approach" (SOPAC, 2007: 70) and covers specific themes, existing tools, limitations, measures to overcome impacts, and the IWRM approach. The themes outlined are water resources management, water quality, island vulnerability, awareness, technology, institutional arrangements and finance (ibid: 70 & 71). The report also provided the status of water resources, constraints and suggestions to drive WRM. In addition, the Strategic Plan on *Rural Water Supply, Sanitation and Hygiene (RWASH) 2015-2020* was developed (SIG, 2015) and the country has made some progress in this area.

Following the 2007 report and the RWASH strategic plan, the National Water and Sanitation (WATSAN) Plan, 2017-2033 (SIG, 2017) was developed. The document outlined the water and sanitation sector's challenges that the plan addresses as well as policy goals and objectives, strategies, activities and resources to implement the WATSAN policy. The document also highlights resource implications and an implementation plan. This shows that studies and analyses have already been done. As a result, a long-term policy document with an accompanying plan was developed, highlighting the country's status, constraints, and drivers of water and sanitation.

While a plan with activities, indicated costs and a timeframe has been developed, implementation has been slow, if not lacking. The challenge would be to revisit this plan to see what can be implemented. International organisations such as UNICEF have recently been active in this area, especially with water and sanitation projects in schools. It will require political will see that the plan is funded and implemented by 2033.

Considering key actors (Table 21) and an overview of their power dynamics relative to WRM, how do we enable WRM and the political economy? This is an important question, and the responses directly connect to the recommendations made in the next section. First, as in other PICs, it is essential to take stock of past efforts and current plans and projects already in place or ongoing. Based on that information, an area of interest could be identified and a programme designed to address that need in WRM. Detailed studies on selected areas in the country could be undertaken if there is insufficient information and knowledge in the area of interest. These would determine what needs to be meet and how donors' support could be more effective and beneficial to the target community.

As highlighted above, numerous studies and plans have been undertaken developed in the field of WRM. For instance, the diagnostic study on national integrated WRM carried out in 2007, and the WATSAN Plan 2017 – 2033 are national documents that can provide the basis for intervention in specific areas of interest by AWP or areas in need of assistance. However, it is easier to intervene in WRM by designing a programme within the area of interest of the host/recipient government/country. These could work with specific documents and plans, such as those mentioned here or within the country's mid-term or long-term development strategy. In the case of the Solomon Islands, a long-term development strategy, the *National Development Strategy 2016 -2033* (SIG, 2016), is in place. The Medium-Term Strategy (MTS) 5 states the need to ensure improved safe water, sanitation and hygiene practices. It specifically aims to "improve hygiene awareness and promote behaviour change in communities" and "access to clean water and sanitation facilities in schools, clinics and public institutions" (SIG, 2016:37). Carving a niche in line with aspects of the country's national development strategy would ensure government endorsement and support for proposed WRM interventions.

Early in the stages of programme design, it is essential to understand and appreciate local-level politics and engage with appropriate ministries and technical experts as collaborators in the Solomon Islands. There may be a lack of people with the technical knowledge to deal with WRM issues. Therefore, as part of the initial thinking behind the design of any intervention, it is important to know the level of expertise available in the country or where capacity building can facilitate the effective implementation of WRM programmes. It goes back to the idea that local talents should be respected and maximised, and if they are not available, capacity development should be factored in the programme. The focus should be on building the capacity of local people in rural communities to maintain support and ensure continuity after the end of the programme. Organised women's groups connected to

churches in local communities are an important feature of the society to engage with for continuity.

Closely related to this were findings by Lenga (2006) who studied a community water supply project in Tamale village in West Guadalcanal. The materials for the dam, cement, nets, fittings, water pipes and tap-stands for village taps were donor-funded, and the community also contributed cash and labour towards the project. The need for a water supply incentivised the community, who drew on their social capital and institutional arrangements and adapted arrangements put in place by the funding agency. Lenga highlighted the following structural dimensions and results: "Villagers belong to (i) one religious group, (ii) one cultural group, (iii) some members of the village are part of the nearby school committee, and church committee, and (iv) decisions in the village are reached by consensus in open public village discussions" (Lenga, 2006: 121). The community also cooperated because they anticipated that the outcome would benefit them individually and as a community. They even formed a committee to take on the challenge of maintaining the water supply after the project's completion. The importance of local contexts, knowledge, and experience as the basis for genuine participation cannot be overemphasised.

Finally, there is a general view by donors and the state that customary land tenure is a stumbling block to development projects, including water supplies and sanitation. This view must change as landowning clans in rural communities own land and water resources in their respective localities. The political economy of rural communities is such that development undertakings in local communities will have to engage with customary landowners. While it may be complicated to deal with some communities and landowning clans/groups, this should not justify the position that developing customary land will always be problematic. Indeed, even registered land faces the same challenges in the Solomon Islands and other Melanesian countries. As Kabutaulaka succinctly puts it, "governments are pushing for land registration because it is necessary to access land for economic development. But the process could also lead to exclusions, marginalisation, and creation of landlessness and poverty" (2019: 133). The Tamale water supply project highlighted above is a case in point. That position by donors and the state must change so that they can view customary owners as active players and participants in any development project in their localities. Engaging with them and genuinely encouraging them to participate in the design and implementation of projects would go a long way in enabling WRM, particularly in rural communities in the country.

Recommendations

- Review existing data from ongoing projects and programmes or recently completed ones and, where necessary, undertake a detailed analysis of specific WRM issues to determine challenges and possibilities in the area of interest. These factors are important to any programme design.
- Use the adaptive programming approach to pilot one or two projects using existing systems, mechanisms, and structures at the national, provincial, and community levels. This ensures that MPs, MPAs, and community level leaders and groups (including landowning clans, church leaders and women's groups) welcome and support the programme. It will also allow AWP to ascertain what works and what can be accommodated to make the original design work. Convincing leaders and communities of the programme's importance and genuine intentions would go a long way in ensuring its success and sustainability.
- Specific WRM interventions on customary land must be done according to the protocols of the area concerned, factoring in the informal structures and prominent positions of customary landowners and other community groups. Rather than viewing customary land tenure as a stumbling block, programme design should consider it as a critical factor in the programme's success. Participation and input from the community and leaders should be accommodated for successful implementation and sustainability.
- WRM programme designs and implementation will need to factor in forecasted medium-term changes to the government system/structure in the country. As indicated earlier, the Solomon Islands government intends to move away from the provincial government structure into a federal arrangement, which will include more control over land and water resources and development activities (see SIG, 2018).

Vanuatu

Introduction

Vanuatu is a 650 km-long Y-shaped chain of islands in the South Western Pacific with a population of about 300,000 people. The country has a total land area of 12,199 km^2 (Table 5) consisting of 13 principal islands and many smaller islands. It is located about 800 kms west of Fiji and 1,770 km east of Australia, 500 kms northeast of New Caledonia and shares a maritime border with the Solomon Islands in the South. Vanuatu was known as the New Hebrides during the colonial period. It was jointly colonised/administered by the French and the British in 1906 and remained a condominium until independence in 1980.

Political Context

At least 81 different languages and many more dialects are actively spoken in the country (Lynch and Crowley, 2001). The number of languages, like in other Melanesian countries, is an indication of the country's cultural diversity. In line with this, there are variations in worldviews and land tenure systems that determine how people perceive water resources and management. For instance, land inheritance in matrilineal societies of North Pentecost and South Efate is through mothers/females. Although siblings theoretically have equal rights over land, women are often disadvantaged in decision-making over resources (Naupa and Simo, 2008). This is common in most Pacific societies and something to consider when designing WRM interventions.

Population

Vanuatu has six provinces: (i) Malampa, (ii) Penama, (iii) Sanma, (iv) Shefa, (v) Tafea, and (vi) Torba. The country's total population in 2020 was 300,019 people with 151,597 males and 148,422 females (VNSO, 2020). As outlined in Table 5, the population growth rate is 2.4%, and the population density is 25 people per square km. The birth rate per 1,000 is 29, and the median age is 21.1. Table 22 below summarises the population as per provinces and the rural and urban populations.

The country is divided into 18 electoral constituencies: Ambae (3 seats), Ambrym (2 seats), Banks (1 MP), Efate (5 MPs), Epi (2 MPs), Luganville (2 MPs), Maewo (1 MP), Malekula (7 MPs), Malo-Aore (1 MP), Paama (1 MP), Pentecost (4 MPs), Port Vila (5 MPs), Santo (7 MPs), Shepherds (1 MP), Southern Outer Islands (1 MP), Tanna (7 MPs), Tongoa (1 MP), and Torres (1 MP) (VEO, 2021). Note that the numbers in parenthesis indicate the number of parliamentarians representing each constituency listed in parliament. This will be discussed further in the sections dedicated to institutions, structures and key actors below.

Table 22: Population of Vanuatu as per key indicators

INDICATOR	VANUATU	URBAN	PORT VILA	LUGANVILLE	RURAL	TORBA	SANMA	PENAMA	MALAMPA	SHEFA	TAFEA
Total Population	300,019	66,753	49,034	17,719	233,266	11,330	43,165	35,607	42,499	54,953	45,714
Males	151,597	33,606	24,641	8,965	117,991	5,711	22,316	18,033	21,495	27,574	22,862
Females	148,422	33,147	24,393	8,754	115,275	5,619	20,848	17,574	21,004	27,379	22,851
Total Population (Private HHs)	293,963	65,868	48,461	17,407	228,095	11,215	42,245	34,123	41,506	54,107	44,899
Males	148,354	32,998	24,259	8,739	115,356	5,645	21,834	17,283	20,969	27,157	22,468
Females	145,609	32,870	24,202	8,668	112,739	5,570	20,411	16,840	20,537	26,950	22,431
Av. Popn growth rate (%pa)	2.3	1.4	1.0	2.7	2.5	1.7	2.3	1.3	1.3	4.0	3.1
Popn Density (persons/km2)	24	1,376	2,077	712	19	13	14	30	15	69	28

(Source: VNSO, 2020)

Like other Pacific Island countries, Vanuatu's scores on governance indicators are below expectations and standards. In a 2020 World Bank report, using a scale of -2.5 to +2.5, Vanuatu scored -0.46 in Government Effectiveness and -0.43 in Regulatory Quality. These scores show that the country is one of the most fragile states in the Pacific region.

Economy

Vanuatu relies mainly on agricultural products such as cocoa, copra and coconut oil. Other prominent sources of national revenue include fish, beef, kava and the tourism sector, with visitors mainly from Australia and New Zealand (Lanteigne, 2016). Between 2016 and 2019, when Covid-19 affected the global economy, Vanuatu enjoyed an average economic growth rate of 4.5%. These annual growth rates resulted from huge public investments following the devastation caused by tropical cyclone Pam in 2015, favourable increases in agricultural exports, remittances and increases in tourism receipts. In recent years, Vanuatu has also received revenue from its Economic Citizenship Programme (ECP), through which the government offers passports/citizenship in exchange for investments in the country (IMF, 2021: 5). Table 23 below provides an overview of Vanuatu's Gross Domestic Product by production in 2019.

In 1985, Vanuatu was classified as one of the region's Least Developed Countries. However, in the past decade, it has made steady progress in economic growth, especially in services, agriculture, forestry and fishing; though the tourism industry has declined because of the adverse effects of Covid-19 (VNSO, 2021). Successive growth since 2012 resulted in Vanuatu's graduation from the LDC group of countries in 2020 (see UNCTAD, 2020; Brien, 2019).

The World Bank reported that in 2020, Vanuatu's national GDP was USD 855 million, with a GDP per capita of USD 2,830. As shown in Table 1, Vanuatu's current debt is at USD 420 million, which is 45.28% of GDP and a deficit equivalent to 0.4% of GDP. The World Bank also assessed Vanuatu's debt sustainability as 'moderate risk'. In 2019, Vanuatu's net ODA receipt was at 13.27% of GDP, while remittances received were 8% of GDP. The country's MVI is 13 and is regarded as 'high vulnerability' by UNDP.

It is also essential to report on Vanuatu's socio-economic data at this stage. As demonstrated in Table 3, Vanuatu's life expectancy after birth is 70.5 years old, and the expected years of schooling are 11.7 years, while the mean years of schooling are 7.1 years. The degree of urbanisation in the country is 25.4 and the average rate of change in the urban population is 2.67%. In 2020, the skilled labour force made up 10.1% of the total labour force, while the HDI for the country was 0.609. Regarding gender representation in parliament, 9.4% are women, compared to 18% board/deputy chairs in the private sector and SOEs and 15% in senior management and executive positions in private sector organisations or SOEs.

Table 23: Vanuatu Gross Domestic Product by Production

At Constant 2006 Prices	Rate of change (%)		Contribution to change in GDP (%)		Share of GDP (%)	
INDUSTRY	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
AGRICULTURE, FISHING & FORESTRY	**0.9**	**6.2**	**0.2**	**1.1**	**17.7**	**18.3**
Crop Production	0.7	7.0	0.1	1.0	14.2	14.7
Animal Production	1.9	5.7	0.0	0.1	1.3	1.3
Forestry	0.5	0.5	0.0	0.0	1.4	1.4
Fishing	4.0	4.1	0.0	0.0	0.9	0.9
INDUSTRY	**4.9**	**-8.3**	**0.5**	**-0.9**	**10.7**	**9.5**
Mining and Quarrying	10.0	7.2	0.0	0.0	0.0	0.0
Manufacturing	3.8	5.0	0.1	0.1	2.5	2.6
Electricity and Water Supply	0.7	15.4	0.0	0.3	2.0	2.3
Construction	6.8	-22.0	0.4	-1.3	6.1	4.6
SERVICES	**0.8**	**6.1**	**0.5**	**3.8**	**63.2**	**65.0**
Wholesale, Retail Trade, repair of Motorvehicles	1.7	10.0	0.0	0.1	1.2	1.2
Other Wholesale Trade	1.3	2.8	0.0	0.1	3.3	3.3
Retail Trade	1.4	6.2	0.2	0.8	12.9	13.2
Transport	-10.9	3.2	-0.5	0.1	4.2	4.2
Accommodation and Food Services	2.0	7.3	0.1	0.3	4.5	4.7
Information and Communication	2.5	9.6	0.2	0.7	7.0	7.4
Finance and Insurance	2.6	9.6	0.2	0.6	6.7	7.1
Real Estate	1.8	7.4	0.1	0.6	7.8	8.1
Professional, Scientific, Technical and Adm/Services	-1.0	2.4	0.0	0.1	2.9	2.8
Government services	0.6	3.3	0.1	0.4	11.3	11.3
Education, Health, Recreation, and Other Service	9.7	3.2	0.2	0.1	1.7	1.7
Plus Taxes less Subsidies on Products	12.9	1.5	1.4	0.2	11.7	11.5
Less imputed Bank Service Charge	-9.1	29.5	-0.3	1.0	3.4	4.2
Gross Domestic Product	2.9	3.2	2.9	3.2	100.0	100.0

Sources: Vanuatu National Statistics Office, 2019

Health and WASH

The country's most recent census focussed on the number of people who smoke and drink alcohol and kava. However, global health indicators provided by the WHO can be used to ascertain health and wellbeing in Vanuatu. The government spends around 2.1% of GDP on health services. The mortality rate for neonatal (per 1,000 live births) is 11.4; the mortality rate for infants (per 1,000 live births) is 21.9, and the mortality rate for under-5 is 25.9. Vanuatu's average of 13 International Health Regulations and capacities is 54.5 (Table 6).

According to the 2020 National Population and Housing Census, a majority of the population in rural communities still use water from rivers, lakes and springs that are not protected sources of drinking water. This, of course, depends on the availability of such sources of water. For instance, the national average accessibility rate is 12%, but in places like Erromango and Tanna, where water springs are common, it is indicated at 70% of their population (VNSO, 2020). Table 24 and Table 25 below provide overviews of the number of private households with their main drinking and washing water sources in Vanuatu as recorded by the 2020 national census.

Table 24: Number of private households by the primary source of drinking water

Drinking Water											
Region	**Total**	**Piped - shared**	**Piped - private**	**Village standpipe**	**Well - protected**	**Well - unprotect-ed**	**Rainwater tank - shared**	**Rainwater tank - private**	**Bottled water**	**River, lake or spring**	**Others**
VANUATU	**63,365**	**15,741**	**12,994**	**2,199**	**4,061**	**1,076**	**12,370**	**9,979**	**1,001**	**3,751**	**192**
URBAN	14,702	5,457	6,401	13	208	83	902	1,093	510	18	15
Port Vila	11,118	4,667	4,969	4	134	77	443	417	383	14	10
Luganville	3,584	790	1,432	9	75	6	460	676	127	4	5
RURAL	48,663	10,284	6,593	2,186	3,852	992	11,468	8,886	491	3,733	177

(Source: VNSO, 2020)

Table 25: Number of private households by the primary source of washing water

Washing Water										
Region	**Total**	**Piped - shared**	**Piped - Private**	**Village standpipe**	**Well - protected**	**Well - unprotected**	**Shared tank**	**Household's own tank**	**River, lake or spring**	**Other**
VANUATU	**63,365**	**18,906**	**16,570**	**3,070**	**4,735**	**2,958**	**4,219**	**3,857**	**8,639**	**411**
URBAN	14,702	5,927	7,965	18	180	168	63	118	228	35
Port Vila	11,118	4,889	5,603	13	152	114	39	79	211	18
Luganville	3,584	1,038	2,362	5	28	54	24	38	17	17
RURAL	48,663	12,979	8,605	3,052	4,555	2,790	4,156	3,739	8,411	376

(Source: VNSO, 2020)

While the 2020 census report did not disaggregate data on water sources, the 2009 census reports provides helpful information. It reported the percentage of households sourcing their drinking water from household tanks and shared tanks per province and in the two urban centres as follows: Torba (57.5%), Sanma (43.7%), Penama (60.5%), Malampa (42.1%), Shefa (42.8%), Tafea (10.6%), Port Vila (7.8%) and Luganville (26.9%) (VNSO, 2009). 46% of all households in Vanuatu obtained their drinking water as piped water, 34% from tank water, while 14% got their drinking water from a river, lake or spring (ibid: xiv).

The 2009 census, supported by the 2020 population and household census, also recorded the types of toilets used by people in Vanuatu (Table 26). It is reported that most people either use pit toilets or no toilets outside of the urban centres. Pit latrines were used by 40% of the population. In Penama province, 83% and 100% of those living in Pentecost, Maewo and Ambae used pit latrines, while the lowest rates of pit latrines use (4.7% - 19.1%) were recorded in Efate (Port Vila, Malorua and North Efate), and in other area councils such as Motalava, Tongariki and North Tongoa (VNSO, 2009). The percentage of households per province whose main toilet facility is the pit latrine or none is 46.4% (Torba), 61.1% (Sanma), 88.4% (Penama), 58.3% (Malampa), 40.2% (Shefa), 53.9% (Tafea), 9.6% (Port Vila) and 22.3% (Luganville) (ibid).

Sanitation in Vanuatu is a concern (Table 26), and this is closely related to the availability of and access to running water. Table 6 indicates Vanuatu's in terms of sanitation compared to other PICs. Despite improvements noted between the 2009 and 2020 national population and household censuses, more can be done in water, sanitation and hygiene.

Table 26: Overview of types of toilet facilities used in Vanuatu

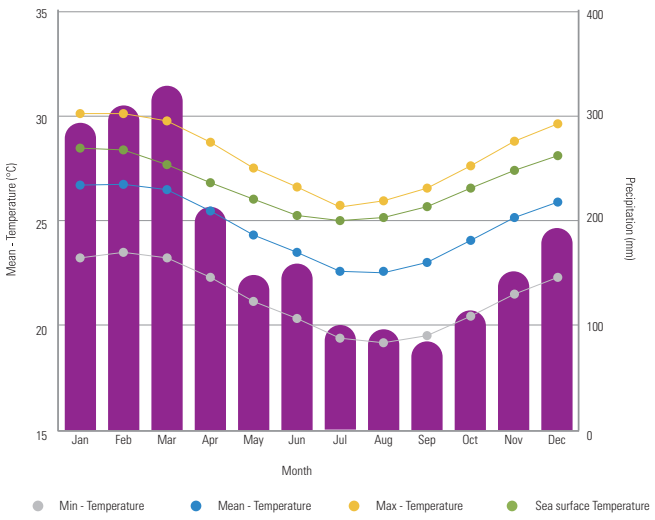
	Main Toilet						
Region	**Total**	**Pit latrine - private**	**Pit latrine - shared**	**Ventilated improved pit latrine (VIP) - private**	**Ventilated improved pit latrine (VIP) - shared**	**Flush toilet inside house - private**	**Flush toilet - shared**
VANUATU	**63,365**	**22,906**	**6,916**	**7,776**	**3,008**	**7,289**	**4,567**
URBAN	14,702	836	591	360	340	5,302	3,558
Port Vila	11,118	505	446	99	233	4,263	3,193
Luganville	3,584	331	144	261	107	1,039	365
RURAL	48,663	22,070	6,326	7,416	2,668	1,987	1,009

(Source: VNSO, 2020)

Physical Dimension – Climate, Climate Change, Water Availability

Vanuatu has a sub-tropical climate with two seasons, the warm but rainy season between November to April and the cooler dry season between May and October (VNMGHD, 2011). Most tropical cyclones appear to hit Vanuatu in the region between November and April. The graph below (Figure 4) provides an overview of temperatures and rainfall in Vanuatu in a typical year.

Figure 4: Temperatures and rainfalls in Vanuatu in a typical year



(Source: VMGHD, 2011)

Vanuatu ranked 1st as the country most vulnerable to natural hazards in 2020 among 171 countries (IMF, 2021: 5; GCF, 2021: 20) (Table 4). According to the Green Climate Fund, key climate change impacts projected to affect the nation are: "(i) sea-level rise; (ii) variations in air and ocean temperatures; (ii) intensification of extreme weather phenomena, such as cyclones; (iv) changes in precipitation patterns; and (v) ocean acidification" (GCF, 2021:17). These risks are expected to be exacerbated by climate change and will ultimately negatively impact the country's efforts towards sustainable development.

Weather and climate change in Vanuatu determine and affect the water availability in Vanuatu. The bigger mountainous islands have streams, rivers and lakes, while the low-lying islands depend on limited groundwater and rain harvesting. The high percentage of households accessing natural sources of water such as rivers, lakes and springs for drinking water indicates adequate water availability. However, ensuring accessible and safe water in urban and rural areas requires effective WRM. Vanuatu scored medium-low (36) and medium-high (53) for 'enabling environment' in 2017 and 2020 in terms of IWRM implementation status and progress (Table 9). The results also reflect Vanuatu's lack of formal IWRM regulations and finance.

The OECDD assessed the status of water governance in the PICs using 11 indicators: 1. Roles & responsibilities; 2. Appropriate scales; 3. Policy coherence; 4. Capacity; 5. Data & information; 6. Financing; 7. Regulation frameworks; 8. Integrity & transparency; 9. Stakeholder engagement; 10. Trade-offs; and 11. Monitoring and evaluation. Vanuatu has not provided or lacks information for several indicators: Capacity (peer-to-peer dialogue platforms across river basin organisations); Networks of utilities and basin organisations at a national level; Data and information (IWRM information system harmonised, integrated, standardised); Regulation frameworks (mechanisms to solve water-related disputes); and Stakeholder engagement (stakeholder mapping carried out; Formal and informal mechanisms to engage stakeholders). Five areas are not in place: Dedicated water quality and preservation policy; Prioritisation among water uses in case of scarcity/emergency; Groundwater extractions monitored and allocated; Agreed-upon key performance indicators; and Existing monitoring and reporting mechanisms. These are significant governance failings and require immediate government attention.

Water security is affected by poor governance. The ADB has assessed PICs' water security status (Table 11), revealing that Vanuatu ranked 9th among 14 PICs with a 49.9 score or within the 'engaged range'. These analyses demonstrate that there is a significant failing in WRM in Vanuatu.

Structures and Institutions

Knowledge and consideration of institutions and structures around land titles are central to any development process. Section 71 of the constitution clearly states that all land in Vanuatu belongs to indigenous custom owners and their dependents (Larmour, 1988: 169; Farran, 2002: 215). The state owns only 2% of land in Vanuatu, while 98%, is customary owned. (Fitzpatrick 2013: 12) Because of this, development interventions in Vanuatu, including undertakings in WRM, will inevitably deal with local landowning structures and institutions prevalent in a given province or community. The local landowning tribe, clan or unit is an important institution(s) to consult. Their support should be secured for major water resource management projects to be implemented in local communities.

The customary decision-making body at the national level is the House of Chiefs (*Malvatumauri*). Any interventions involving customary land and water resources on such land requires their consultation and endorsement. As an indigenous institution adapted to the modern national structure at independence, the *Malvatumauri* influenced the development of land and water resources. This is not peculiar to Vanuatu and is similar to the Council of Iroij in the Marshall Islands and the Great Council of Chiefs previously in Fiji (Larmour, 1988). The structure of the *Malvatumauri* under the *Chiefs Act of 2006* comprises custom chiefs elected by the Island Council of Chiefs and the Urban Council of Chiefs. The Act states that "[t]he *Malvatumauri* Council aims to preserve and promote culture and languages, support and encourage customary practice, uphold custom and tradition and ensure the effective operation of *Malvatumauri* through appropriate resources" (VNMJCS, 2021). Customary land tenure is cultural, and therefore development undertakings that may impact local cultural practices and ways of life are of interest to this institution.

It is also important to note that Vanuatu's electoral system has both single-seat and multi-seat constituencies, as mentioned above. Out of the 18 constituencies in Vanuatu, only 7 have single MPs representing them in parliament. Therefore, it is critical to bear in mind the number of representatives that must be consulted in each constituency when designing and implementing WRM programmes in urban and rural communities. Political representatives in those constituencies would have to be consulted or informed to gain their support. This may be difficult, especially where MPs from the same constituency do not work together.

The provincial governments, municipalities, and local councils are also part of the state structure at the local level. Under the Decentralisation and Local Government Regions Act of 1994, the local governments (provinces) can make by-laws and construct, maintain and manage public facilities, including water supplies. They can also create rules and regulations on hygiene and public health matters. They are also responsible for making by-laws on environmental protection zones, including natural parks and reserves. Like many other decentralised systems in Melanesia and the Pacific, the central government retains overall governing power. A recent amendment to municipal elections in Vanuatu provided Temporary Special Measures (TSMs) for women's representation in the municipal councils. The said amendment reserves three out of the 14 seats in the Port Vila Municipal Council and three out of 13 seats in the Luganville Municipal Council (Palmieri, 2016: 20). There is, therefore, some form of gender representation in municipal councils in Vanuatu that may be considered, especially when designing WRM interventions in urban areas.

Key Actors

A list of key actors when it comes to WRM in Vanuatu would include the following:

Table 27: Key Actors involved in WRM in Vanuatu.

Key Actors	Role Relative to WRM
National Parliament of Vanuatu (NPAL)	Overall legislation on national issues including those related to water resources and management.
Cabinet & Government Ministries	The Cabinet, particularly ministries that work in the area of water resources, discusses and approves or rejects programmes earmarking WRM and sanitation.
Municipal Governments (MPAL)	Responsible for water and sanitation services in urban areas.
Provincial Governments (PG) and Local Governments (LG)	Responsible for providing water services to residents in their respective provinces. They can also make by-laws in various areas, including WRM.
Members of Parliament (MPs)	Members of Parliament represent their constituencies. Many constituencies may have more than one MP.
State owned enterprises (SOE)	Provide water and other services to urban populations.
Landowners (LOs)	Own customary land and water sources needed to provide water services.
Chiefs/village leaders/tribal leaders (CFS)	Responsible for order and stability in their respective communities. Some are LOs as well.
Malvatumauri (MLVTRI)	The Vanuatu Council of Chiefs is part of the formal government structure. They make decisions on matters affecting local communities, tradition and culture. Land and water resources are considered part of culture.
Village structure (VLJ)	Can be useful for WRM at the village level.
Franco & Anglo	Polarity in Vanuatu stems from its colonial history. These forces can support or inhibit WRM efforts.
Churches	Can influence their followers, some of whom control land and water resources. The Roman Catholic Church, the Presbyterian church and the Anglican Church of Melanesia command a large following.

Overview of WRM – Status, Constraints and Drivers

The above descriptions of sources of and access to drinking and washing water show a genuine need for AWP to work in this area, especially to complement efforts currently in place.

The technical designs and considerations may be influenced by factors such as topography and the makeup of each island. Past and recent studies by technical experts may form the starting point to understand the nature of specific islands and water-related issues. For example, diagnostic studies on IWRM commissioned by the SOPAC (now SPC) in 2007 contains important data and information in three volumes (see SOPAC, 2007a; SOPAC, 2007b; SOPAC, 2007c).

Availability versus scarcity of groundwater sources and rainfall needs to be considered. The small islands may not have much underground groundwater, making rainwater harvesting a priority. The most effective WRM intervention would depend on the island type and the community.

Customary landowners and custodians of groundwater sources, lakes, rivers and springs are essential players. If informed and engaged well, the groups can drive change in WRM. On the other hand, they can also be stumbling blocks who can withhold support if they are not adequately informed of interventions.

Financial and possibly technical limitations (i.e., lack of trained technical people) in water resources management in the country exist. This may be the case for many other Pacific Island countries, with slow progress in the area of WRM.

Policy and legal competence over water resources may have to be strengthened and clearly defined to empower important stakeholders who can drive development in this area. A review of existing legislation and policies would allow this to be rectified, if needed.

Other issues to consider to enable WRM and the political economy include:

- There may be a need to look at policies and legislation dealing with WRM and related areas. For example, the *Decentralisation and Local Government Regions Act of 1994* provided for establishing local levels of government. However, the legislative powers given to provinces/local councils to make by-laws and engage with water resources are limited. This is an area that requires attention. Examining existing legislation and ensuring that they encourage/facilitate development in this sector may be an essential undertaking to support.
- Rainwater tanks and installation may not be a problem. These are mostly attached to personal houses, community buildings or purposely built houses for rainwater collection (except for small island communities).
- Initial investigations would be helpful to convince people of the need for proper WRM and facilities. In some places in Vanuatu and other Pacific island countries, people have become accustomed to particular ways of doing things and do not see the need to improve or change things. For example, people may have become accustomed to collecting water from springs and consider it normal. It would take some effort to convince such individuals of the benefits of piping water to villages and the implications of costs and their contribution to such a project.
- Community members should be engaged to instil a sense of ownership and ensure the sustainability of infrastructure and facilities after the programme's life. This is where recognising gendered representation in the leadership and implementation of WRM projects is critical. Working through church structures in the community to build WRM strategies can strengthen sense of ownership and contribute to sustainability (or approaches to maintaining infrastructure/facilities after the programme's life).

Recommendations

1. When designing the WRM programme, it is critical to recognise the importance of customary landowning clans in rural and maritime communities and provinces. This is because water sources will be located on land they own. In addition, when water supplies are developed, water supply pipes may also run through other groups' land. While these groups are often ignored or merely paid lip service, they have a critical role in the success of any water resource management undertaking on customary land, as they own 98% of the land. Therefore, it is recommended to engage with customary landowners and get their support at the initial stages.
2. Furthermore, these local landowning groups may either be matrilineal or patrilineal. The local dynamics of ownership or control over land and water resources must be factored into WRM design.
3. Engaging with female members of communities when dealing with water resource management will be crucial. In local and urban communities, women tend to use water more for various family needs than men. They are also key players when it comes to sanitation and hygiene concerns. Gender consideration in the implementation, sustenance and maintenance of water resources, especially water supplies and sanitation projects, will be key.
4. Stakeholders and key actors in WRM must consider the legal and policy frameworks on which designs are premised to ensure they are empowered to act, as well as to know which levels of government are responsible for these domains. For example, the Vanuatu National Water Policy, 2017-2030, may inform part of the design of WRM programmes (PRF, 2017).
5. In the WRM design, sustaining positive changes after the project's life must be thought out. A common challenge is the community's ability to generate revenue to meet occasional maintenance costs. Community members should be supported to afford the cost of maintaining these critical facilities.
6. Previous reports by regional and international organisations on IWRM and WASH projects provide useful suggestions. A few listed below remain relevant for donors contemplating interventions in Vanuatu.
7. (i) having a thorough understanding of context, including culture and politics; (ii) building universal ownership for development results; (iii) requiring participation in project design and implementation, not just consultation; (iv) ensuring institutions and planning structures effectively support change; (v) proving that change can work, through reinforcement and practical application; and (vi) continually communicating well to support understanding of all stakeholders" (ADB, 2015:3).

Photo courtesy of Dave Hebblethwaite, SPC

Fiji

Introduction

Fiji is an archipelago of 332 islands with a total area of 18,725 km^2. The majority of people in Fiji live on the two main islands, Viti Levu and Vanua Levu. The two main ethnicities are the indigenous Fijians (iTaukei), who own 84% of the land and the Indo-Fijians, who lease the native land for agricultural purposes. According to the 2019-2020 HIES, some 30% of the population lives in poverty, of which 75% are of iTaukei ethnicity (FBS, 2021). Fiji's natural environment has played a crucial role in the tourism sector, the country's largest revenue generation and foreign exchange earner. The islands are endowed with coastal ecosystems that include coral reefs, seagrass beds, mangroves, and native forests that host abundant biodiversity on the terrestrial side. The major rivers and catchments are found on the larger islands, with urban centres located in the floodplains.

Political Context

Fiji has a unicameral parliamentary system of government with a prime minister as head of government and a president as head of state. Parliament comprises 50 members elected for a four-year term. A peculiarity of the Fiji electoral system is that there are no electoral constituencies like in other PICs. Instead, it is a single constituency with MPs representing the entire country rather than electoral constituencies. Fiji's political landscape has been marred by four military coups, with the first staged in 1987 and the most recent in 2006. There are 14 provinces, each with a provincial council that looks after the interests of the iTaukei community.

In contrast, district advisory councilors look after the interests of the Indo-Fijian community in each province. Government administration divides the country into four divisions, each headed by a commissioner. Previously, cities and towns had elected municipal councilors; they are now administered by government-appointed administrators.

Economy

Fiji's economy is the second largest among the PICs and depends heavily on tourism and agriculture, with the former accounting for 40% of GDP. Diminished tourism due to Covid-19 is estimated to have decreased Fiji's GDP by 19% from 2019 to 2020. Natural disasters are a significant drain on the economy, and the country ranks 14th in the 2012 World Risk Report.[12] Cyclone Winston in 2016 is estimated to have cost 28% of Fiji's GDP. These destructive events accompanied by severe flooding devastate infrastructure and contaminate surface water and water supply networks, negatively impacting health and wellbeing.

Real GDP in 2019 was USD 4,494 million, and GDP per capita was USD 5,013. Its debt was at 71% of GDP, the highest amongst the PICS and it is considered a moderate risk (Table 1). Net ODA was 2.76% of GNI in 2019. It has an MVI index of 26 (high vulnerability).

Socioeconomic

Fiji's socioeconomic indicators lie in the mid to low range in the Pacific, and its HDI was 0.743, with a global ranking in 2019 of 93 (Table 3). 56.8% of the population is considered urban, growing at 2.67% per annum. Fiji has a relatively high proportion (19.6%) of women in Parliament but a relatively low representation of women in leadership roles in government and industry (Table 3).

Population

According to the 2019 census, the population is 896,444 with 56% living in urban areas. Annual population growth is around 0.7%. National population density is 49 persons/km^2. The birth rate is 20.4/1,000, and the median age is 27.9 (Table 6). Table 28 shows other aspects of Fiji's population as estimated by the 2021 HIES survey.

[12] https://reliefweb.int/sites/reliefweb.int/files/resources/2021-world-risk-report.pdf

Table 28: Population distribution by sex, locality and subpopulation

Area	Estimate total population	%	Male	%	Female	%
National	864,132	100.0%	434,914	50.3%	429,218	49.7%
Rural	386,632	44.7%	201,137	23.3%	185,495	21.5%
Urban	477,500	55.3%	233,777	27.1%	243,722	28.2%
Sub population						
iTaukei	535,554	62.0%	270,675	31.3%	264,879	30.7%
Indo-Fijian	295,326	34.2%	148,603	17.2%	146,724	17.0%
Others	33,251	3.8%	15,637	1.8%	17,615	2.0%
Geographical Division						
Central	361,459	41.8%	178,878	20.7%	182,581	21.1%
Eastern	36,274	4.2%	19,984	2.3%	16,290	1.9%
Northern	135,965	15.7%	70,078	8.1%	65,888	7.6%
Western	330,434	38.2%	165,975	19.2%	164,458	19.0%
Geographical Areas						
Rural Central	101,422	11.7%	52,462	6.1%	48,960	5.7%
Rural Eastern	32,724	3.8%	18,134	2.1%	14,591	1.7%
Rural Northern	98,550	11.4%	51,269	5.9%	47,282	5.5%
Rural Western	153,936	17.8%	79,273	9.2%	74,662	8.6%
Urban Central	260,037	30.1%	126,416	14.6%	133,621	15.5%
Urban Eastern	3,550	0.4%	1,850	0.2%	1,699	0.2%
Urban Northern	37,415	4.3%	18,809	2.2%	18,606	2.2%
Urban Western	176,498	20.4%	86,702	10.0%	89,796	10.4%

The above table shows that more people reside in the Central division followed by the Western, Northern and Eastern divisions respectively. There are more males (50.3%) than females (49.7%) in Fiji. In terms of the ethnic composition of the population, 62% of the people are iTaukei, 34.2% Indo-Fijian and 3.8% fall under "others". The Fijian population is more urbanised (55.3%) than rural (44.7%). As such, water and sanitation for the urban population are as much a concern for the government as for rural areas.

Health and WASH

Due to limited SDG 3 data for the PICs, selected WHO global health indicators were examined to analyse the health and well-being of Fiji's inhabitants (Table 7). Fiji's public health expenditure is 2.3% of GDP, the third lowest among PICs. It ranks 6th among PICs for the various infant mortality indicators. While Fiji has a universal health coverage policy that allows citizens to access health and medical services in government-funded clinics and hospitals, the 2021 HIES report highlighted that "…almost one in ten adults in Fiji cannot afford to buy all the medicines prescribed by their doctor when they are sick" (FBS, 2021: 32). To improve universal health coverage, other types of health or medical support cover one in 10 adults who cannot afford their prescribed medications.

Most people have access to improved drinking water sources (94.3%), while 100% reportedly have access to improved sanitation facilities (Table 8). The 2021 HIES report shows that 66% of the population have access to metered water, 25% through communal standpipes, 5% through boreholes and less than 3%

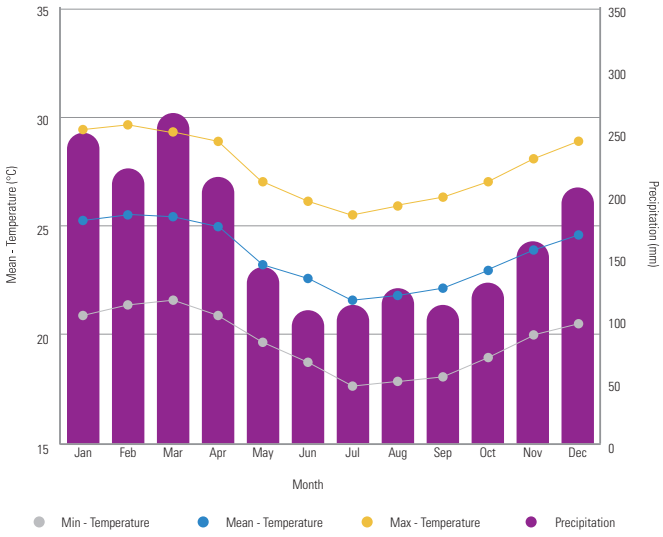
through roof RWH, well, and river/creek as their primary source of water supply (FBS, 2021: 22). The report further stated that over half of the population who access roof tanks, wells, and rivers/creeks were living below the poverty line in 2019-20.

Fiji has a better record than other PICs in terms of sanitation facilities. For instance, 95% of the population has exclusive toilet facilities at the national level, with only 5% accessing shared facilities and 1% with no toilet facilities (ibid: 23). Notably, 64% of those without toilet facilities have high poverty rates compared to 30% with exclusive toilet facilities. Moreover, 43% of those using shared facilities lived below the poverty line in 2019-20 (ibid).

Climate

Fiji has a tropical climate with high humidity. The summer months are from November to April, when temperatures can rise to 34-35°C, but the average is 26-27°C. November to April is the cyclone season, with sometimes multiple systems impacting the group in one year. The cooler months are from May to October when temperatures can fall to 20°C, but the average temperature is 23-25oC, and rainfall is reduced. A more significant variation is seen in rainfall patterns in the summer and cooler months (Figure 5). Droughts occur during El Niño years.

Figure 5: Fiji's average temperature and precipitation 1991 - 2020



Source: Climate Change Knowledge Portal (worldbank.org)

Climate Change trends

- Surface air temperatures are predicted to rise by 1°C by 2030 relative to 1995 (very high confidence).
- The frequency and intensity of extreme rainfall events are predicted to increase (low confidence about the magnitude of change).
- The frequency of severe tropical cyclones (Category 5) increased (TC Winston in 2016, TC Harold and TC Yasa in 2020 and TC Ana in 2021).

Water Availability

Fiji's islands vary significantly in their geomorphology, from large mountainous islands to tiny atolls and cays. Water availability varies accordingly from the large mountainous islands' abundant surface and groundwater resources to a dependency on rainwater and shallow freshwater lenses on the remote atoll islands.

Government data indicates that Fiji has made great strides in water and sanitation. Fiji achieved its MDG 7 targets for water and sanitation, with the proportion of the urban population having access to safe water increasing from 94% in 1990 to 100% by 2012. In addition, 97% have access to piped water. According to 2017 census data, 35% of Fiji's population is connected to a reticulated sewerage system, 59% have septic tanks, 1.7% have water-sealed toilets, and 3.4% have pit toilets. Rapid urbanisation, however, has seen a sharp increase in informal settlements in urban and peri-urban areas. The aging infrastructure has not been able to cope with the increased demand for piped water, so gains made pre-2015 have been steadily lost. Water cuts have become the norm in the Greater Suva Area, including the nation's capital and the towns of Lami, Nausori and Nasinu, which accounts for 57% of the country's urban population of roughly 280,000 residents. It is estimated that in 2015, a staggering 43% of water supplied annually through WAF's network was non-revenue water due to leakages and illegal connections (ADB. 2016. Urban Water and Wastewater Management Investment Program (RRP FIJ 49001-002)).

Structures and Institutions

The Prime Minister and 10 ministers look after 27 portfolios between them, with many ministers overseeing multiple ministries. Of 26 ministries, 8 have some involvement with water and sanitation services. For example, the Water Authority of Fiji is one of 37 government institutions.

The eight ministries that are part of the institutional framework for water resource management are:

- Waterways and Environment
- Lands and Mineral Resources
- Agriculture
- Forestry
- Health and Medical Services
- iTaukei Affairs
- Rural and Maritime Development and Disaster Management
- Economy

The key legislation and policies that impact WRM are listed in Appendix 3.

Apart from these formal institutions, traditional landowners have specific attitudes towards their resources. Water rights, like fishing rights, are perceived differently by landowners from what is stated in legislation. As far as traditional landowners are concerned, the stretch of the river adjacent to their village is their property, and therefore permission must be sought for any use of that section of the river. Gravel extraction from rivers near urban centres in Fiji has become increasingly common with landowners making easy cash from companies that supply the construction industry. The environmental consequences, however, can be significant. Gravel extraction WASH implicated in significant flood events in 2009 and 2012 in Nadi town as streams and rivers turned into culverts during heavy rainfall. There is also poor knowledge of causal mechanisms of waterborne diseases and its link to poor land and animal husbandry practices of both landowners and their lessees. There is little incentive for the latter group to improve current practices because of insecurities surrounding lease renewal.

Key WRM Actors in Fiji

Table 29: Key Actors involved with WRM in Fiji

Key Actors	Role relative to WRM
Ministry of Lands & Mineral Resources	Govern the use of surface and groundwater for water supplies; groundwater assessment and borehole drilling; authorize extraction of surface water
Ministry of Waterways and Environment	Monitors environmental regulations
Ministry of Infrastructure, Transport and Meteorology	Provide policy direction for water and sanitation services and for establishing rural water schemes
Ministry of Rural and Maritime Development and Disaster Management	Assist in establishment of rural water schemes
Ministry of Economy	Determines funding available to water sector
Water Authority of Fiji	Extraction, treatment and distribution of potable water to consumers and for wastewater treatment
Rotary Pacific Water for Life Foundation	NGO assisting rural communities with construction of water supply systems and sanitation facilities

The assessed power dynamics of WRM in Fiji reveals widespread institutional support for WRM. Like other countries, the lack of finance to implement WRM is the major factor, and requires support from the Ministry of Economy..

Overview of WRM (Status, Constraints and Drivers)

Status

The 5-year National Development Plan (2017-2021) reflects the government's aspirations for the water sector:

> 'In the next five years, Government will undertake significant investments to cater for long-term water supply needs. Resources will be allocated to construct new water treatment plants, reticulation systems and reservoirs to increase supply capacity. In addition, an aggressive leakage reduction programme to eliminate water loss will be pursued. Regarding the development of potential new water sources, the Government—with assistance from the Asian Development Bank (ADB), Green Climate Fund (GCF) and European Investment Bank (EIB)—is embarking on the construction of a new, 40-megalitre treatment plant on the Rewa River to meet the increasing demand for water in the greater Suva and Nausori areas. Furthermore, the Water Authority of Fiji (WAF) is exploring options for other new dam sites such as at Waibogi in the upper reaches of Navua River and the upper Waimanu River and in the Western Division to meet the increasing demand in the Nadi-to-Lautoka corridor. In addition, investments will be made to renew existing water infrastructure, including pipeline replacement, construction and upgrade of water reticulation systems, electrical upgrades, valve replacements, reservoir upgrades and reducing non-revenue water.' (2017:18)

The construction of the 40 mega-litre treatment plant at Viria, in the upper reaches of the Rewa River, commenced in 2017, and the main contractor is Sinohydro, with funding from ADB, GCF and EIB. The Covid-19 pandemic significantly disrupted construction, pushing the commissioning of the first part of the plant to early 2023. The treatment plant, once in operation, should negate the need for any additional reservoirs/dams to service the Greater Suva Area and the Central Division. Phase 1 of the ADB/GCF/EIB project addressed the leakage issue in 2016-2017. National elections were held in 2018. Close to 2,000 workers were laid off from WAF in 2019 due to budgetary cuts, and the leakage issue in 2022 now makes up 45% of non-revenue water. The WAF was addressing the leakage issue in 2022 using the Central Event Management software developed by Israeli firm TaKaDu. This will allow WAF to detect the location of leaks in real-time at an early stage before the problem worsens. The cloud-based system will also enable WAF to identify, analyse and manage other incidents such as burst mains and other operational issues and lift their service delivery.

To renew existing infrastructure, significant funding is required. Unfortunately, WAF is funded totally by government grants, and with budgetary shortfalls caused by the pandemic, rehabilitation projects have been shelved.

Constraints

WAF's service delivery has been severely impacted by current water tariffs not meeting the costs of supplying safe water. In 2013, revenue earned by WAF covered only 44% of its operating costs. It depends entirely on government grants, and there is not enough investment in infrastructure replacement or rehabilitation (ADB 2016). During the economic downturn due to the pandemic in 2020-21, the FJD15 million grant to WAF was diverted by the Ministry of Economy, without any consultation with WAF senior management, to cover shortfalls elsewhere. Other constraints impacting the delivery of consistent water supply are:

- Low reservoir levels during dry periods
- Old undersized water mains leading to frequent burst mains
- Mechanical failures
- High electricity costs
- Poor municipal planning and forecasting of demand to cater for new housing subdivisions in the Greater Suva Area
- Illegal connections to mains, especially in informal settlements
- Inadequate maintenance
- Lack of staff technical capacity at WAF

Drivers

Rapid urbanisation and ageing infrastructure unable to cope with increased demand have led to frequent water supply disruptions in main urban centres. There is also a lack of technical expertise across the spectrum of WRM in relevant agencies like WAF.

The ongoing issues with Fiji's water sector, namely the inability to provide a constant, reliable supply of water to residents, can be attributed to crumbling physical infrastructure, the unnecessarily complicated institutional framework and the extensive cast of key actors. Some 15 years ago, the Ministry of Agriculture (MoA) started drafting a national Water Policy to govern the use of surface and groundwater. However, the policy remains in draft form. The Ministry of Infrastructure, Transport and Meteorology (MITM), where the previous Department of Water and Sewerage used to sit, administers the Rural Water & Sanitation Policy and is responsible for rural water schemes. The Environment Management Act also governs activities in rivers and streams through EIA guidelines and promotes IWRM.

In an attempt to consolidate the different policies on water resource management, the Ministry of Waterways and Environment's (MWE) Strategic Plan 2020-2024 has as one of the key outcomes for the Department of Waterways, a national Waterways Policy. A senior official in the department explained the rationale for the new national policy: there has been a significant injection of funds into strengthening the physical infrastructure of the water sector in the past two years; thus, the time is right to get the institutional framework in place. The national Waterways Policy will guide sectoral policies and provide the legal mandate to the MWE to look holistically at streams, rivers, and riparian vegetation. In addition, the policy will include an extraction framework, which will consider e-flows and locations for water extraction. There is currently no Water Act nor a flood management policy. A national waterways policy will also mandate MWE to access donor funding for the ecosystem-based approach to water management. Once the policy has been drafted, the most significant implementation challenge will be to get buy-in from government stakeholders in the water sector. The MWE has a minor role in the water sector, with only the Irrigation and Drainage Acts under their administration. The MWE is a small ministry with limited clout compared to the MLMR, which administers the Rivers and Streams Act that covers the management of all sources of potable water.

Ultimately, however, the funding required to fix infrastructure and promote IWRM rests with the Ministry of Economy (MoE), who, since 2014, has had the most influence over sectors in Fiji. The withdrawal of the FJD15 million grant from WAF by MoE during the height of the economic fallout from the pandemic dramatically highlighted the need for WAF to become less dependent on government grants and become a commercially viable entity. Income generation can only be increased by raising water tariffs. Water tariffs have not increased since 2008, although incomes have changed, and households that earn a combined annual income of FJD30,000 or less per year are subsidised 250 litres of water/day. Controlling the price of water is a major political requirement for the ruling party, so this is unlikely to change while they are in power.

The 2019-2020 Household Income and Expenditure Survey Report showed that the top four non-food consumption items per average household are housing and utilities (rent, repairs and fuel/energy), transport, communication and education. Water is not mentioned under utilities as the amount spent on water is negligible because it is very affordable. The report also showed that of the segment of the population classified as poor or near poor (44.9%) sourced their water mainly from rivers, creeks and wells. Thus, the population's socioeconomic status will further impact WAF's revenue.

Relational issues in rural communities are also critical in enabling IWRM. Land tenure and the relationships between land and resources, especially where water sources are located, should be understood. As noted in the experience of Nabaka village (13 km from Suva), which was surveyed by SPC SOPAC in 2012, villagers were unable to increase their access to water despite the large 25,000 litre storage tank due to land tenure issues (SPC SOPAC, 2013:13). The village has a Village Development Committee (VDC) headed by the *Turaga ni koro* (village headman) comprising the water sub-committee, education sub-committee, health sub-committee, and climate change sub-committee. One of their governance concerns which is also relational, was the lack of women and youth representatives in the VDC. From their community analysis, they "… strongly recommend having women and youth as part of the development committee or the WASH/health sub-committee as they (women and youths) are the major water users in the village and homes" (ibid: 14). They would also be instrumental in raising general community awareness and training communities on proper waste and hygiene. Relationships and inclusiveness are critical in enabling IWRM and PEA in Fiji, as in other PICs.

Recommendations

- Strengthen WAF's technical capacity and management skills by providing training in utility management, asset strengthening, long-term capital planning, catchment management and environmental monitoring. Short-term training for WAF may cover policy requirements, e.g., environmental discharge, and business continuity plan development.
- Support MoHMS to strengthen WASH surveillance and reporting.
- Foster further development of a catchment-based approach for surface water sources to preserve and improve water quality.
- Support rural and small island water supply schemes by building community capacity to maintain and manage water source quantity and quality.
- Support for MWE in implementing environmental regulatory requirements and the promotion of IWRM.
- Finance infrastructure upgrades.
- Strengthen water quality and wastewater quality standards, monitoring and regulatory systems.

Tonga

Introduction

The Kingdom of Tonga is an archipelago of 172 coral and volcanic islands divided into four groups: Tongatapu, Ha'apai, Vava'u and Niuá. It has a land area of 749 km^2 and a population of 104,497, of whom roughly 75% live on Tongatapu. Tonga has an educated population (see Table 3), similar to Fiji, which has a bearing on water resource management. Tonga is one of the most disaster-prone countries in the world and experiences tropical cyclones and associated storm surges, earthquakes (due to its proximity to the seismically active Tonga Trench), tsunamis, floods, droughts and volcanic eruptions, the most recent of which occured in January 2022 with the Hunga Tonga eruption and tsunami.

Political context

The Kingdom of Tonga is a constitutional monarchy where the monarch is the head of state. The monarch, a king in recent decades, appoints the prime minister from the members of parliament. The prime minister, however, must have the support of the majority of members. Tonga has a unicameral Legislative Assembly comprised of 26 members, 16 of whom represent the commoners and 9 of whom represent the nobles. The prime minister can nominate four extra cabinet members whom the king then appoints. Political reforms in 2010 changed the political landscape of Tonga, with the people being allowed to elect 17 representatives.

Prior to 2010, the monarch appointed much of the Legislative Assembly, with only nine representatives chosen by the people. The Crown owns all land in Tonga. It is the only country in the region not to have been colonized and is still very traditional with great respect for the monarchy. Tonga is rated positively for Government Effectiveness (see Table 2), along with Samoa and Fiji.

Economy

The economy is primarily based on agriculture and tourism, but remittances from expatriate Tongan communities in New Zealand, Australia and USA make up 37% of the GDP (see Table 1). Tonga is exposed to destructive cyclones, volcanic activity and earthquakes. It ranks 2nd in the 2020 World Risk Report.[13] Real GDP in 2019 was USD 519 million, and GDP per capita was USD 4,903. Its debt, at 11.3% of GDP, is at the lower end among PICs and is considered high risk (Table 1). Net ODA was 20.08% of GNI in 2019. It has an MVI index of 5 (very high vulnerability).

Socioeconomic

Tonga's socioeconomic indicators lie in the mid to high range in the Pacific. Its HDI was 0.725, with a global ranking in 2019 of 104 (Table 3). Only 23.1% of the population is considered urban, growing at 0.32% per annum. Compared to other PICs, Tonga has a low proportion (7.4%) of women in Parliament and a mid-range representation of women in leadership roles in government and industry (Table 3).

Population

The population in 2019 was 104,497, with 23% living in urban areas. Annual population growth is around 1.1%. The national populations' density is 147 persons/km^2. The birth rate is 24/1000, and the median age is 22.4 (Table 6).

Health and WASH

SDG 3 data for the PICs is poor, so selected WHO global health indicators were examined to compare the health and wellbeing of Tonga's inhabitants (Table 7). Tonga's public health expenditure is 3.2% of GDP, the fourth lowest of all PICs. However, it ranks in the top 3 PICs for the various infant mortality indicators, also reflected in the relatively high health core capacity indicator.

Most people have access to improved drinking water sources (99.6%), while 98.3% reportedly have access to improved sanitation facilities (Table 8).

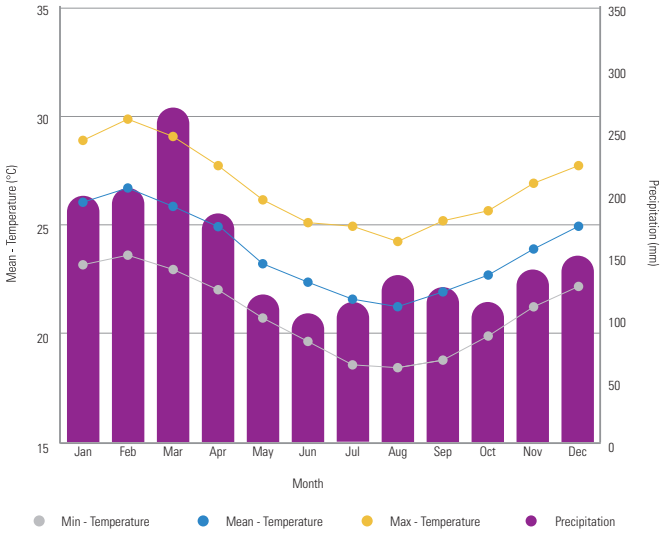
[13] https://reliefweb.int/sites/reliefweb.int/files/resources/2021-world-risk-report.pdf

Physical Dimensions

Climate

Tonga has a tropical climate with a wet season from November to April and a dry season from May to October (Figure 6). Rainfall increases from the southern to the northern part of the country, with an annual rainfall of 1500 mm in the south to 2300 mm in the north. The mean annual temperature ranges from 23° C-26°C.

Figure 6: Mean Temperature and Precipitation for Tonga 1991-2020.



Climate Change

- El Niño and La Niña events will continue to occur in the future (very high confidence)
- No long-term trends in available annual rainfall; however, there will be more extreme rainfall events (high confidence)
- Drought frequency is projected to decrease slightly (low confidence)
- Sea level will continue to rise (very high confidence) (Dore, 2021)

Water availability

There are four primary water sources for domestic use: piped water, well water from a freshwater lens overlying seawater in carbonate islands, rainwater and bottled water. Piped water is supplied by the Tonga Water Board and is sourced from groundwater. Due to the high rainfall in Tonga, rainwater is used for drinking, while other domestic water uses (bathing, washing and sanitation) are sourced from piped water. Rainfall and the subsequent recharge of groundwater determine water availability.

More than 60% of Tonga's population prefer drinking rainwater to piped water, and roughly 20% of drinking water in Tonga is sourced from neighbours' or community rain tanks. (White et al., 2020). However, there are some significant differences between urban and rural populations. Urban households' access piped water for drinking 31% more than rural households who prefer rainwater and drink bottled water four times more than rural folks. Local groundwater is more likely to be contaminated by sanitation facilities such as pit latrines or poorly maintained septic tanks, hence the preference for rainwater as a source of potable water.

Structures and Institutions

There are five key ministries and agencies involved in the management of water resources in Tonga. These include:

- Ministry of Lands and Natural Resources (MLNR)
- Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (MEIDECC)
- Tonga Water Board
- Ministry of Health (MoH) and
- Ministry of Finance and National Planning (MFNP)

Key legislation and policies are listed in Appendix 3.

Key Actors in Tonga

Table 30: Key Actors involved with WRM in Tonga

Key Actors	Role Relative to WRM
Ministry of Lands and Natural Resources	Responsible for managing, protecting and conserving the country's water resources.
Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications	Responsible for looking after all matters related to climate change and protecting coastal and wetland areas.
Tonga Water Board	Responsible for water supplies in the urban centres.
Ministry of Health	Responsible for the supply of potable water and waste disposal. Village Water Committees look after water supplies in rural areas and come under the MoH.
Ministry of Finance and National Planning	Responsible for implementing key donor projects related to national development and climate change. Water is being increasingly tied to the climate change agenda, strengthening its profile.
ADB	Provides funds and technical expertise to improve urban water supply and sanitation facilities in Nuku'alofa.

Overview of WRM (Status, Constraints, Drivers)

Status

The Tonga Strategic Development Framework (2015-2025) mentions improved infrastructure services as a significant component of the development plan. However, water supply is not mentioned nor has the Government prioritised it. The implications are that SDG6 will not be achieved despite 84% of villages ranking it as a priority and 56% ranking water supply as their highest priority (White et al., 2020). The ADB and governments of Australia and Tonga pooled funds to implement the Nuku'alofa Urban Development Sector Project (2012-2020) that saw the rehabilitation of 17 wellfields, construction of 12 new wellfields and the installation of a new 4 million litre reservoir and several pumping stations, which provided residents a regular water supply. The project also built new sanitation facilities in poor households and new public conveniences along the waterfront and other public spaces. The waste management utility, Waste Authority Limited (WAL), also upgraded its truck fleet and expanded the waste management landfill.

Constraints

Governance, urbanisation and increased demand pose short-term risks to water supplies. The continued impacts of cyclones also put a great strain on water supply systems and rain tanks. Tonga has no reticulated centralised sewerage system, so wastewater management rests with the community. Those that live in Nuku'alofa and in the rural villages of Tongatapu received a boost with the ADB/GoA/GoT project mentioned previously which improved the collection of septage by WAL through the acquisition of specialised trucks that could pump out sewage. A study by Igore et al. (2020) on the risk factors associated with the prevalence and intensity of parasitic gastrointestinal infections in Tongan households was linked to water quality, hygiene and sanitation practices, and environmental and climatic conditions.

Drivers

The lack of priority given to WRM by the government, rapid urbanisation and population growth, repeated climate events, and increased demand put a strain on water resources.

With the passage of the Water Resources Act in 2020, the water sector has found its voice in the national agenda, with the MLMR being responsible for its administration. White et al. (2020) highlighted the disconnect between the Tonga Strategic Development Framework (2015-2025), which was developed after high-level consultations over three months, and the priorities of villages

as stated in the 136 Community Development Plans crafted over nine years. Four reasons were provided for the mismatch between national and local planning priorities with respect to water and sanitation. Firstly, the significant improvements in water and sanitation services seen before the 2016 census relegated the sector to a lower priority. Secondly, in Tonga, sanitation is considered the responsibility of the individual household, and not the government. The third reason is that most government ministries and agencies responsible for the Strategic Development Framework are situated in Tongatapu, where water supplies are not an issue and where cistern flush sanitation systems are the norm. The last reason is the short consultation period for the national planning document, which resulted in severely limited public consultations. The implementation of the new Water Resources Act will require technical skills and hiring graduates and will take time to roll out. However, with Tonga's vulnerability to natural disasters and its effects on water supply infrastructure, there should be some urgency to its implementation.

Recommendations

- Assist the Tonga Water Board with reticulated water supply to villages and upgrade water treatment facilities.
- Support the review of water safety plans.
- Support Ministry of Health with waterborne disease surveillance planning.
- Support coordination and partnership within the WASH sector and the development and implementation of a strategic WASH communication plan. (ADB, 2021).

Niue

Introduction

Niue is the single uplifted high carbonate island known as "The Rock", located 19° 2' S and 169° 52' W. The 64 km coastline has two distinct levels: a limited coastal terrace of approximately 0.5 km with an elevation of around 25 metres that slopes down to the ocean edge and a higher plateau that provides the limestone cliffs and the remainder of the coast with a central elevation of around 60 metres. The island has an area of 269 km^2 and is surrounded by a coral reef.

There are two land categories in Niue – Niuean Land (comprising 95% of the area) and Crown Land (1% is government land and 4% is held under lease in perpetuity by the Crown). For all land in Niue vested in the Crown, custom prevails (Levi & Boydell 2003)

Political Context

Since 1974, Niue has been a self-governing state in free association with New Zealand. Niue's constitution specifies that the head of state is Her Majesty Queen Elizabeth II, represented by the governor-general of New Zealand. However, the Queen and the governor-general have little to do with Niue in practice. Executive authority is exercised on behalf of Her Majesty by the Niue Cabinet of Ministers. The cabinet is comprised of the premier and three ministers. The 20-member assembly elects the premier. In addition, the premier nominates three members of the assembly as ministers.[14]

Economy

Being a geographically isolated small island state with few resources and a population of around 1,719 (March 2017), Niue has few industries. There is some local passionfruit, honey, and coconut oil processing. Agriculture is mainly subsistence gardening. The sale of Niue postage stamps to collectors, tourism, and the leasing of Niue's unique four-digit telephone numbers are important sources of revenue. New Zealand provides administrative and direct budget support and project aid. GDP in 2016 was USD 24.9 million and GDP per capita was USD 15,586 million.[15] It has a budget deficit of 4.9% of GDP (2020) and received 77% of its GDP in 2019 from ODA (Table 1).

Socioeconomics

Niue's socioeconomic indicators are among the Pacific's highest (Table 3). Due to its free association with New Zealand, some statistics are not available on global databases. Female participation in positions of formal power is also high among PICs.

Population

Niue's population was estimated at 1,651 in November 2021, ranking it 233 out of 235 globally with an annual growth rate of 0.68%.[16] Its median age is 27, with a relatively low birth rate/1000 of 17.2 (Table 6).

Health

SDG3 good health and wellbeing data for PICs is poor, so selected WHO global health indicators were examined to compare the health and wellbeing of Niue's inhabitants (Table 7). Niue's reported indicators are significantly better than the global averages. Rotavirus is a significant cause of infant diarrhea, primarily transmitted through faecal-oral contact, and can lead to death. Rotavirus vaccination rates (%) for infants less than 1-year-old in Niue are around 99%.

Water Sanitation and Hygiene (WASH)

Niue has adopted National and Village Drinking Water Safety Plans that identify and highlight the risks associated with its water system and how these can be mitigated to ensure water quality is maintained at an acceptable quality. Water is predominantly

[14] https://gov.nu/government-and-political-system/

[15] https://pacifictradeinvest.com/explore-our-work/insights/country-profile-niue

[16] United Nations Population Division estimates

sourced from groundwater through protected wells or bores utilising submersible pumps and supplied to households through either pressure pumps or gravity reticulation. Monitoring bores are used to assess water quality and quantity. The Department of Health monitors water on a quarterly basis for Total Coliform and *E.coli*. Households are urged to boil their drinking water.

Households use septic systems to treat sewage. Regulatory powers are in place to ensure compliance in the design and operation and proximity to wells and bores. Most Niueans have access to improved drinking water and sanitation facilities (Table 8). No data is available for the availability of handwashing facilities.

Physical Dimension – Climate, Climate Change, Water Availability

Climate

Niue has a tropical marine climate with two distinct seasons: a wet season around November to April and a dry season around May to October (Table 31). The surrounding sea surface temperatures and the South Pacific Convergence Zone influence Niue's climate. Rainfall averages around 2,000mm per annum.

Table 31: Mean monthly rainfall and rainy days for Alofi, Niue.[17]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Tot
mm	254	222	232	182	147	83	95	80	99	122	135	196	1847
days	16	15	17	14	11	8	8	9	9	11	12	14	144

Climate Change

Climate variability in Niue is associated with El Niño-Southern Oscillation (ENSO). There can be a fourfold difference in annual rainfall between the wettest and driest years. As with other PICs, El Niño brings below-average rainfall while La Niña results in wetter conditions. The intensity of the events determines the degree of variability.

A warming trend has been evident since 1950. Rainfall shows no long-term trend. Climate change projections are that Niue's temperature will continue its upward trend (high confidence). The impact of climate change on ENSO is uncertain. There is moderate confidence that rainfall will increase. However, as ENSO is the predominant determinant of variability and the impact of climate change on ENSO is uncertain, Niue can expect similar levels of climate variability. There is very high confidence that the mean sea level will continue to rise.[18]

Water Availability

Niue is primarily dependent on its freshwater lens for water, and has no surface water. The lens is extensive and deep, with a thickness ranging from 30-60 metres over about 200 km^2. The estimated annual recharge is 132 million m^3/year with a qualified estimated sustainable annual yield of 39.7 million m^3/year (GWP, 2008). The estimates are qualified as the permeability of the limestone, and therefore transmissivity is not entirely understood. This is required to determine the actual temporal pattern of recharge and discharge. The geomorphology of the island is not a typical karst system but similar to a rock mass dominated system, which would mean significantly higher storage volumes of recharge. Despite the lack of an effective recharge over the six months "dry season", there is sufficient storage to cope with prolonged droughts (op.cit.). However, extraction rates need to be controlled for deeper boreholes to avoid saline upcoming.

[17] https://www.pacificclimatechangescience.org/wp-content/uploads/2013/09/Niue

[18] https://www.pacificclimatechangescience.org/wp-content/uploads/2013/09/Niue.pdf

As the groundwater is pumped, supply relies on electricity, and any failure due to a generator breakdown or a natural disaster threatens the water supply. Storage tanks on the upper plateau help ensure water availability. In addition, the government has promoted household RWH to supplement groundwater supply.

Structures and Institutions

Customary Law

Water rights to groundwater are vested in the Crown.

Water Policy

Niue's 2016-2026 National Strategic Plan's water strategy is to "maintain safe extraction of the groundwater system and increasing capacities in rainwater catchment and household water tanks to ensure there is sufficient supply of freshwater during emergencies and build resilience to climate change".

Key Actors

The key actors involved in WRM in Niue were identified (Table 31), and their relative support or opposition was assessed, along with their influence on the implementation of WRM.

Table 32: Key Actors involved in WRM in Niue

Actor	Function
Premier (PR)	Head of government
Minister- Ministry of Finance and Infrastructure	Cabinet Minister and Hon. Minister responsible for the policy and operations of all infrastructure services
Public Works (PW)	Responsible for the planning, creation and maintenance of major public civil works infrastructure throughout Niue
Natural Resources (NR)	to ensure the effective and efficient management of natural resources for sustainable development
Environment (ENV)	Responsible for environment and natural resources management
Public Health (PH)	Responsible for providing health care and health education
Met Office (MO)	Responsible for climate measurement and forecasting
Community Affairs (CA)	Helps communities realise their development potential
Department of Agriculture Forestry and Fisheries (DAFF)	Agriculture and forestry impacts on recharge water quality
Water Supply (WS)	Responsible for supply of water to households
Chamber of Commerce (CC)	Represents local business owners
Treasury (TRES)	Budget allocations and donor focal point
Niue Island (Umbrella) Association of NGOs (NIUANGO)	Umbrella organisation for Niue's NGOs
National Council of Women in Niue (NCWC)	Supports women and families in Niue
Village Chairs (VC)	Head of village councils

Overview of WRM – Status, Constraints and Drivers

Status

Niue did not participate in the UN Environment's survey of the degree of IWRM implementation to establish global baselines for SDG 6 Indicator 6.5.1. The Water Act 2012 provides the powers for the effective management of Niue water resources; part 7 provides for the preparation and implementation of IWRM plans for designated areas. National and village level water safety plans (WSPs) minimise the risks of groundwater contamination and to supply infrastructure. Cases of traveller diarrhoea have been reported when village level drinking water is consumed untreated. Adequate recurrent funding is required for ongoing and routine maintenance to mitigate the identified risks. The Water Safety Planning approach is contingent upon periodic auditing of the controls used to minimise the identified risks. There is no published evidence of this occurring since the commencement of the WSPs.

The recharge mechanism is very rapid, so the lens is susceptible to surface activity. Poorly operating septic systems, solid and liquid waste disposal, and agricultural chemicals can quickly get into the lens. Bores around the Alofi area have in the past demonstrated this. The government has been proactive with its legislation to manage these threats, but adequate community awareness and compliance resources are needed to preserve groundwater quality.

Niue's freshwater lens is an enviable asset that appears to provide adequate water supply even through prolonged drought periods. The National Strategic Plan promotes household RWH to increase water security.

Constraints

Niue was not involved in OECD's Water Governance Survey. However, the governance framework is in place, and the importance of water security is well embedded in the community and its leaders. ADB's 2020 water security scores for Niue confirm this engagement in ensuring water security (Table 12).

Niue's dimensions scores are some of the highest among PICs. However, its Economic dimension score is the lowest in the Pacific. This is to be expected though as its economic size and poor soil will automatically ensure a low score.

The principal constraints are financial resources and skill availability. However, the water supply system continues to meet demand.

Drivers

Primary pressures on Niue's water resources are human activity relating to land use, waste disposal and geomorphology of the island. The drivers are economic, socioeconomic, and climate change and variability. Population growth is currently positive, but Niueans are also New Zealand citizens, so population trends are unpredictable because of movement between countries.

Economic conditions have deteriorated through the global Covid outbreak, with the absence of tourism impacting national GDP, households, and businesses. Niue's socioeconomic indicators are among the highest among PICs, but the economic decline will impact these. In addition, declining national revenues will mean a smaller budget and increased pressure on recurrent funding for monitoring, compliance, maintenance and repair of water and sanitation infrastructure.

Climate change and variability will increase pressures on water security, but Niue has mechanisms in place to address these, provided it has the financial resources to implement them.

Enabling WRM and the Political Economy

The enabling environment to achieve a sustainable balance between the social, economic, and environmental needs for water can be defined by policies and legislative frameworks, financing, and implementation. Governance is strong with appropriate legislative instruments and policy instruments in place for WRM. There is no opposition to WRM, which is evident in the National Strategic Plan. The socioeconomic indicators for Niue show a comparatively high standard of living compared to other PICs. GDP per capita is among the highest in the PICs. However, limited financial and capacity resources have hindered WRM implementation.

Water quality is a priority issue, and any diminishment of this will have cross-cutting consequences on health, economic activity and water security. In addition, financial and capacity limits need to be addressed.

Recommendations

1. The Water Safety Planning approach is contingent upon periodic auditing of the controls used to minimise the identified risks. Therefore, routine and transparent audit processes need to be established.
2. Financial and human capacity limit full implementation of water safety planning and a possible mechanism for additional revenue through water supply charges should be considered to provide the needed financial resources.
3. Minimising the pollution of the freshwater lens is an ongoing process that requires a continuing community awareness programme supported by adequate compliance resources.
4. Women traditionally have had a primary role in the growth and health of children and animals. Christian religions in the Pacific have actively promoted women's groups, and women's fellowships and provide a base for engaging women in WRM in Niue.

Cook Islands

Introduction

The Cook Islands is composed of 15 widely scattered islands located in the central Pacific Ocean between 14° S and 22° S, and 159° W and 164° W. Its EEZ of 1,960,027 km2 is the fifth largest amongst PICs and 20th globally; it has a total land area of 236 km2. There are two main island groups: the Southern Group and the Northern Group. The Southern Group's geomorphology comprises the high mountainous island of Rarotonga, four raised coral islands with volcanic cores (Mangaia, Mauke, Mitiaro and Atiu), one atoll (Manuae), one near atoll with a volcanic core (Aitutaki), and a sand-cay on a coral foundation (Takutea). The Northern group consists of the atolls Manihiki, Penrhyn, Pukapuka, Rakahanga and Suwarrow, and a sandy cay Nassau.

Land in the Cook Islands is divided into two categories: customary land and native freehold land. Natives of the Cook Islands hold customary land. Customary land can also be kept under a person's title as a high chief (*Ariki*).

PoliticalContext

Self-government was realised in 1965. The Cook Islands is a unicameral parliamentary democracy under free association with New Zealand. The Queen of England is the Head of State, and the prime minister is the head of government who appoints the cabinet. Legislative power vests with both the government and the Parliament. Twenty-four elected members make up the Parliament. Ten are elected from Rarotonga, three each from Aitutaki and Mangaia, two from Atiu, and one each from Manihiki, Mauke, Mitiaro, Penrhyn, Pukapuka and Rakahanga. The House of Ariki, composed of six Ariki from Rarotonga and nine from the outer islands, advises the government on land use and custom. The inhabited outer islands have local governments headed by a mayor.

Economy

With few natural resources, little arable land and its geographic isolation from markets, the Cook Islands' economy has few primary industries. GDP in 2020 was USD 384 million, and GDP per capita was 21,884,[19] the highest among PICs. About 72% of GDP is derived from the service sector, driven mainly through tourism, and primary industries comprise 3% of GDP. Debt to GDP was 43.8% in 2021(Table 1). Covid's impact on tourism has seen a decline in GDP, and the reopening of international travel will be critical to the Cook Islands' economy. As a high-income country, the Cook Islands has been ineligible to receive ODA since 1 January 2020.

Socioeconomics

Cook Island's socioeconomic indicators are among the highest in the Pacific (Table 3). Due to its free association with New Zealand, some statistics are not available on global databases. Around 76% of the country's population is considered urban. Female participation in positions of formal power leads other PICs.

Population

The national population was estimated at 17,564 in 2020[20] with an annual growth rate of .03%, ranking it 223rd globally. It has a population density of 73/km^2. The majority (70%) of the population is on Rarotonga. Its median age is 38.7, the highest among PICs, with a relatively low birth rate of 12.8/1,000 (Table 6).

Health

SDG3 good health and wellbeing data for PICs is poor, so selected WHO global health indicators were used to compare the health and wellbeing of the Cook Islands' inhabitants (Table 7). Cook Islands' reported indicators are significantly better than the global averages. Rotavirus is a significant cause of infant diarrhea, primarily transmitted through faecal-oral contact, and can lead to death. Rotavirus vaccination rates for infants less than 1-year-old in the Cook Islands are around 99%.

[19] http://unctadstat.unctad.org/countryprofile/generalprofile/en-gb/184/index.html

[20] https://www.worldometers.info/world-population/cook-islands-population/

Water Sanitation and Hygiene (WASH)

Virtually 100% of the population has access to improved drinking water and sanitation (Table 8). However, the availability of safe drinking water has been an issue, and the Government recommends water treatment. One of the Cook Islands 2016 National Water Policy (CINWP) objectives to "ensure access to reliable, safe drinking water for all who reside in the Cook Islands and establish standards for water quality and resource management." The Ministry of Health is responsible for water quality testing at its hospital laboratory but suffers from competing demands and resource issues. As a result, the frequency and timeliness of sampling and results have been problematic. In the outer islands, H2S tests are used with good results.[21] Therefore, issues still exist in ensuring access to safe drinking water.

In Rarotonga, household septic systems treat sewage, which are regularly checked by health officers. In rural islands, septic systems are common, but cesspits and compost toilets are also used.

Physical Dimension – Climate, Climate Change, Water Availability

Climate

As with other island PICs, sea surface temperature strongly influences air temperature. High annual rainfall occurs throughout the Cook Islands. The climate in the Northern group is tropical, with an average temperature of 28°C. There is a distinct wet season from November to April and a dry season from April to November. The Southern Group is about 4°C cooler and has a distinct cooler period from May to November, corresponding to its dry season (Table 33). The South Pacific Convergence Zone (SPCZ) strongly influences both groups' rainfall. June to October are the driest months and corresponds to the SPCZ being weak and inactive over the Cook Islands.

The Cook Islands has significant interannual rainfall variation driven by the El Niño-Southern Oscillation (ENSO). There is a substantial correlation between ENSO events and intensity and wet and dry season rainfall with decreased rainfall under El Niño in Rarotonga and increased rainfall in Penrhyn.[22]

Table 33: Mean monthly rainfall and rainy days for Penrhyn and Avarua, Cook Islands

Penrhyn	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Precipitation / Rainfall mm	236	255	234	158	151	144	138	145	120	147	172	216	2116
Rainy days (d)	18	17	18	13	9	6	6	5	6	6	7	1	112
Rarotonga (Avarua)													
Precipitation / Rainfall mm	246	117	238	188	153	102	100	111	103	116	140	205	1819
Rainy days (d)	15	14	15	12	11	8	7	7	8	8	9	12	126

Climate Change

The average annual air temperature has increased in Rarotonga by around 0.06°C per decade since 1950. No trend in temperature is detected in Penrhyn; similarly, no statistically significant trends in rainfall are evident in Rarotonga and Penrhyn. There is high confidence[23] that rainfall and intensity will increase, and drought is projected to decrease as global warming continues. ENSO driven variability will still be the principal determinant of rainfall in the Cook Islands.

During the wet season, the Cook Islands are exposed to tropical cyclones. Their frequency correlates with ENSO with a higher frequency during El Niño. The impact of climate change on ENSO is

[21] https://cdn.who.int/media/docs/default-source/WASH-documents/glaas/glaas-2013-14/glaas-2013-14-country-highlights/cook-islands.pdf?sfvrsn=263039e8_8

[22] https://www.preventionweb.net/files/27076_vol2ch2cooksislands.pdf

[23] https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf

not well understood or modelled. Sea surface temperatures have warmed at about 0.12°C per decade since 1970, and this will continue to escalate with global warming. There is high confidence that the average sea level will rise by 5-15 cm by 2030. The extent of sea-level rise for the remainder of the decade is projected to be between 20-60 cm, although various models exceed this.

Water Availability

Rarotonga is a high island of volcanic origin, with Mount Te Manga at 658 metres being the island's highest point. The island's centre receives an annual average rainfall of 4,000 mm, which feeds into 12 catchments. Small dams on the creeks hold water, which are piped to the supply network. The Te Mato Vai project has upgraded 10 of these intakes to increase storage capacity, constructed treatment plants and replaced the trunk mains, ring mains and distribution to the boundaries of all properties currently serviced. The project was officially completed in May 2021. It commenced in February 2014 and cost NZ$ 89.7 million. The new water network will provide consistent availability of quality drinking water.

Aitutaki relies on RWH for potable water; households collect and store water in household tanks while centrally located community tanks collect water from community buildings. Water from community tanks is UV treated. In addition, six infiltration galleries supply non-potable water to storage tanks from which water is reticulated to households. Local businesses also use private infiltration galleries (Andreas et al., 2018).

The remainder of the Southern group islands and the Northern Group islands' water supply are detailed in Table 34. Again, RWH is the primary source of potable water.

Table 34: Island characteristics and water availability of the Cook Islands[24,25]

Island	Area (km2)	Popn (2016)	Density (km2)	Dist from Rarotonga (km)	Island Type	Mean Annual Rainfall (mm)	Water Supply	Water Quality
Southern Group								
Rarotonga	67	13,007	194	0	High Volcanic	2,100	Reticulated stream sourced	E.coli issues
Aituki,	18	3,326	106	220	High Volcanic + lagoon	1,944	Reticulated from galleries + HRWH	Variable salinity issue
Atiu	27	434	16	215		n.a.	Reticulated from Wells + HRWH	Good
Mangaia	52	499	10	203	Makatea	1,904	Reticulated stream and bores	E.coli issues
Manuae	6	0	0	124	Atoll	n.a.	n.a.	
Mauke	18	297	16	278	Makatea	1,574	Reticulated from bores	Good
Mitiaro	22	155	7	263	Makatea	1,828	Reticulated cave sourced	Salinity issue
Takutea	1.3	0	0	n.a	Atoll	n.a.	n.a.	
Palmerston	2		28	500	Atoll	1,988	HRWH	Good
Northern Group								
Manihiki	5	212	39	1204	Atoll	n.a.	HRWH	Good
Nassau,	1.3	78	60	1160	cay	n.a.	HRWH	Good
Penrhyn	10	226	23	1365	Atoll	1,868	HRWH	Good
Pukapuka	1.3	444	342	1324	Atoll	2,816	HRWH	Good
Rakahanga	4	83	20	1248	Atoll	2,352	HRWH	Good
Suwarrow	0.4	0	0	950	Atoll	n.a.	shallow well	Good

[24] The Cook Island Islands Census 2016, http://www.mfem.gov.ck/census

[25] National Integrated Water Resource Management Diagnostic Report. COOK ISLANDS. SOPAC Miscellaneous Report 635. November 2007.

Structures and Institutions

Customary Law

The House of Ariki, composed of six Ariki from Rarotonga and nine from the outer islands, advises the government on land use and custom.

Water Policy

The Cook Islands Cabinet endorsed the IWRM Policy in 2014 and the National Sanitation Policies in 2012 and 2016. However, there has been little progress in implementation. The decision to build a new water supply system on Rarotonga, i.e., Te Mato Vai, provided renewed impetus for WRM and the need for a multisectoral approach. Other related activities in sanitation improvement, WRM planning, including underground water investigation, rainwater harvesting and ridge to reef water management, reinforced this momentum. An emerging recognition of the cross-cutting nature of WRM with climate change, tourism, agricultural practices and increasing development pressures demonstrates the need for a multisectoral approach to WRM.

The CINWP consolidated previous policies and embedded IWRM. The policy "integrates aspects of the sanitation and IWRM policies, bringing together government policies for water resources management, infrastructure, water supply, drinking-water safety planning and sanitation."[26] The CINWP seeks to ensure that:

- All national water resources are protected from contamination sources and are managed in an integrated, equitable and sustainable way;
- All the population has access to safe drinking water;
- All public health risks associated with unsafe drinking water are identified and managed commensurate with local circumstances and in a timely manner.

The Te Mato Vai Water Supply Master Plan for Rarotonga details the major infrastructure project required to deliver potable water reliably to all properties connected to the existing water supply network. Its linkages with strategic planning[27] were:

Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all.

SDG 6.1 By 2030, achieve universal and equitable access to safe & affordable drinking water for all;

SDG 6.2 By 2030, achieving access to adequate and equitable sanitation and hygiene for all and end open defecation, paying particular attention to the needs of women and girls and those in vulnerable situations.

Healthy Islands Vision- Pacific Ministers of Health ideal vision: Ecological balance is a source of pride.

Cook Islands NSDP 2016-2020 Goal 4: Sustainable management of water and sanitation

- Goal 4.1: Percentage of population with access to sufficient and safe water in their homes; and
- Goal 4.2: Percentage of properties using sanitation systems that meet approved standards

[26] Cook Islands National Water Policy 2016

[27] *op cit*

Key Actors

The key actors involved in WRM in the Cook Islands were identified (Table 35Table 35), and their relative support or opposition was assessed, along with their influence on the implementation of WRM.

Table 35: Key Actors involved in WRM in the Cook Islands.

Actor	Relevance to WRM
Prime Minister	Head of Government
Ministry of Infrastructure (MOI)	Responsible for planning, installation, operation and maintenance of public water systems in selected outer islands, including Atiu, Mangaia, and Aitutaki.
Public Health Division (PHD)	Responsible for monitoring and surveillance of the biological quality of public water supply schemes, managing and approving septic tanks
Vaka Councils (VC)	Local government institutions responsible for the development and administration of districts
Cook Islands Association of NGOs (CIANGO)	Responsible for community development projects with a role in water management through their relationship with communities
Ministry of Finance & Economic Management (MFEM)	Responsible for preparing the national budget and thus has an impact on capital and recurrent funding for water management
Office of the Ministry of Island Administration (OMIA)	Responsible for overall coordination and monitoring of water management projects in outer islands
National Environment Service (NES)	Responsible for environmental issues and concerns, including pollution, conservation, waste management, climate change and Environmental Impact Assessments for development projects
Meteorological Office (MO)	Forecast and monitoring of long-term weather patterns and climate change issues
To Tatou Vai Authority (TTVA)	The management of the Rarotonga water supply network
Cook Islands Chamber of Commerce (CICC)	To promote a business-enabling environment in the Cook Islands.

Overview of WRM – Status, Constraints and Drivers

Status

The Cook Islands did not participate in the UN Environment's degree of IWRM implementation global baseline for SDG 6 Indicator 6.5.1 survey. However, the Cook Islands Cabinet endorsed the IWRM Policy in 2014. The National Sanitation Policy in 2012 and 2016 established an integrated policy framework, which was incorporated in the Te Mato Vai Water Supply Master Plan for Rarotonga. The To Tatou Vai Authority Bill 2021 has as its basis an IWRM approach incorporating catchment management to maintain water quality for the network.

The 2004-2005 cyclone season caused significant damage to the Northern Group atoll infrastructure, dramatically impacting RWH, the primary drinking water source (Table 6). The government developed a Cyclone Reconstruction Plan, with priority given to the Northern Water Harvesting Project. Despite this, the project did not commence until 2011. Once started, the project was completed within 18 months with HRWH repaired or replaced, i.e., roofing guttering downpipes and tanks, on 260 houses on Pukapuk, Nassau, Rakahanga and Penrhyn. The project used a private contractor, emphasising local decision-making and using local labour. The Completion Report[28] notes that "(t)his on-the-ground local decision-making contributed to some of the friction between the central government in Rarotonga and the Project Manager." Indeed, the institutional issues resulted in $650,000 in New Zealand and Australian funding for community water tanks being reallocated to sanitation. The report also notes that "(p)ower relationships are complex even in small community development projects. Distance and values multiply the risk of miscommunication between levels such as between central Government, private contractors and even within local communities." Subsequently, the community water tanks were funded under the EU-GIZ ACSE: Cook Islands Northern Water Project (Phase 2).

[28] https://mfem.gov.ck/images/MFEM_Documents/DCD_Docs/FINAL_NWater_Completion_Report.pdf

Communities outside of Rarotonga were further supported through the Adaptation Fund Pa Enua Action for Resilient Livelihoods (Pearl) Project,[29] whose Component One's objective was to "build and implement an integrated approach to further increase the adaptive capacity of remote island communities and ecosystems to disaster risk and climate change impacts." Component Two's objective was "establishing climate-resilient water management instruments using integrated and community-based approach." The component outcome was "strengthened drinking water security including increased institutional capacity and coordination for integrated water management."

Over the past decade, the Cook Islands Government has been proactive in seeking to address water security and sanitation issues on its inhabited atolls, and significant progress has been made.

The OECD Water Governance Survey provides an overview of Cook Island's water governance (Table 12). However, much of the survey was incomplete and may not accurately reflect water governance, particularly in Rarotonga. The situation in other inhabited islands suggests governance in WRM is limited (op.cit.).

Constraints

As with other PICs, WRM is an issue in remote islands, with water quality and availability central to this. Some islands rely entirely on RWH and adequate storage to ensure water security becomes the preeminent issue. ADB's water security scores confirm that the Cook Islands can address these water security issues (Table 12). However, the Cook Islands ranks second among PICs.

The constraints facing WRM on the Cook Islands Atolls are succinctly expressed in the Pa Enua Action for Resilient Livelihoods (Pearl) Project proposal to the Adaptation Fund:

> "Currently the water sector in the Pa Enua is managed by each island Government with no central agency and no co-ordinated cost-effective implementation of water infrastructure across the islands. Water infrastructure has been driven in an ad-hoc manner by government and development partners. These base challenges have resulted in inappropriate water use and wastage, inadequate planning and preparedness, poorly configured and maintained infrastructure, under exploitation of surfaces suitable for rainwater collection, inadequate awareness, and inadequate information and understanding of resource constraints on the Pa Enua. As a result, their water security is at risk."

The establishment of the Water Security Fund to "support water infrastructure from sourcing, distribution, storage and disposal covering both water quantity and quality projects located in Pa Enua"[17] is an innovative approach. The Fund provides opportunities for Atoll Administrations, NGOs, CBOs and national agencies to obtain funding to support local WRM and assist in sustainability.

The lack of financial resources and skills to maintain existing systems will continue to be primary constraints. In addition, water pricing has been a significant issue with the new metered network in Rarotonga. The sustainability of this will depend on adequate revenue return.

Drivers

The enabling environment to achieve a sustainable balance between the social, economic, and environmental needs for water can be defined by policies and legislative frameworks, financing, and implementation. The Cook Islands has appropriate policy instruments, but these are not formalised through legislative instruments except for the To Tatou Vai Authority Bill 2021. There is little opposition to WRM, and this is reflected in the Cook Islands NSDP 2016-2020 Goal 4. The socioeconomic indicators and GDP per capita for the Cook Islands are among the highest in the Pacific. The new water network in Rarotonga represents the single most significant infrastructure spend ever in the Cook Islands. However, financial resources and capacity are limited.

Water security and quality is a priority issue in areas outside of Rarotonga, and any diminishment of this will have cross-cutting consequences on health, economic activity and water security. In addition, declining economic activity due to the global pandemic will negatively impact WRM in rural areas. Cook Island's water resources are primarily impacted by human activity relating to land use, waste disposal and geomorphology of the islands. The drivers are economic, socioeconomic, and climate change and variability. Population growth is currently positive (0.03%), but Cook Islanders are also New Zealand citizens, so population trends relate to the state of the economy.

The tourism sector is the primary non-government sector, and this has stopped through the global covid outbreak; this has and

[29] https://www.adaptation-fund.org/projects-document-view/?URL=en/836191532122431180/6531-Proposal-for-Cook-Islands.pdf

will continue to impact GDP, households and businesses. The Cook Islands' socioeconomic indicators are amongst the highest amongst PICs, but the economic decline will impact these. In addition, declining national revenue will mean smaller budgets and increased pressure on recurrent funding for monitoring, compliance, maintenance and repair of water and sanitation infrastructure in islands outside of Rarotonga.

Recommendations

Atoll specific responsibility for WRM needs to be supported with adequate resources. While the Water Security Fund will assist with funding infrastructure development and maintenance, the capacity to maintain infrastructure requires both human and financial resources on a continuing basis. A finite Water Security Fund will not achieve this. A programme that supports the Water Security Fund with a Repairs and Maintenance Fund component would empower atoll administrations to manage their water resources sustainably.

Water pricing will be critical to sustain the To Tatou Vai 's water and sanitation networks. In addition, periodic independent reviews of the efficiency and effectiveness of the To Tatou Vai Authority, which include addressing the adequacy of its revenue, could ensure the network is adequately maintained.

The quality of Rarotonga's water sources will rely on individual local catchment committees managing land use. Voluntary commitments have a finite life unless supported and motivated. Funding a programme that fosters local catchment committees' motivation would be helpful, particularly as the new water network has just been commissioned.

Samoa

Introduction

Samoa has a land area of 2,934 km^2 and a population of 198,646. The two main islands of Savai'i and Upolu are both high volcanic islands with some 40 river systems. The islands have forests and waterfalls in the interior and mangroves and coral reefs on the coastline. The fertile soil and relatively pristine waters mean that Samoa has a thriving agriculture sector and healthy fisheries that support the communities that live mainly on the coast. The primary industries are forestry, agriculture, fisheries, tourism and food processing.

Political context

Samoa has a unicameral system, the *Fono*, with a head of state and a prime minister as the head of government. There are 49 seats in the *Fono*, 47 elected from 41 constituencies, which only candidates with *Matai* titles or their kin are allowed to contest. Two are elected from those of foreign descent. In 2021, the country was in the international spotlight due to a very closely contested election that was mired in controversy. The now-former Prime Minister had been at the helm since 1998 and didn't accept the election results. The dispute was finally settled in court, and the FAST party led by the former Deputy PM, now comprised the government. The country was severely impacted by a measles outbreak in 2019 which led to 83 deaths and was attributed to low vaccination rates associated with a misinformation campaign. It was in lockdown for two weeks in March 2022 after having managed to stay Covid free for close to two years. In the World Bank's Governance ranking of Pacific Island countries, Samoa ranked at the top regarding Government Effectiveness (see Table 2), which has a positive bearing on water resource management.

Economy

Samoa's economy is primarily based on government services, tourism and subsistence agriculture. ODA (15% of GNI) and overseas remittances (18% of GDP) comprise significant contributors to the economy. The Covid pandemic combined with a measles outbreak saw a decline in GDP of 6.6% in 2019. Samoa is exposed to destructive cyclones and ranks 98th in the 2020 World Risk Report.[31] Real GDP in 2019 was USD 812 million, and GDP per capita was USD 4,093. Debt is at 46.5% of GDP, at the higher end among PICs and is considered high risk (Table 1). Net ODA was 15.5% of GNI in 2019. Foreign remittances from the diaspora in NZ, Australia and the US make up 18.0% of GDP. It has an MVI index of 49 (high vulnerability).

Socioeconomic

Samoa's socioeconomic indicators lie in the mid to high range in the Pacific, its HDI was 0.715, with a global ranking in 2019 of 111 (Table 3). Only 18.1% of the population is considered urban, with a 0.4% per annum ruralisation rate. Samoa has a low proportion (10.0%) of women in Parliament but a relatively high representation of women in leadership roles in government and industry, including the female Prime Minister.

Population

The population was 198,410 in 2019, with 18.1% living in urban areas. Annual population growth is around 0.7%. The population density is 70 persons/km^2. The birth rate is 24.1/1,000, and the median age is 21.8 (Table 6).

Health and WASH

SDG 3 data for the PICs is poor, so selected WHO global health indicators were examined to compare the health and wellbeing of Samoa's inhabitants (Table 7). Samoa's public health expenditure is 3.8 % of GDP, at the lower end of all PICs. Its infant mortality indicators are among the lowest in the Pacific.

Most people have access to improved drinking water and sanitation sources at 98.4% and 99.5%, respectively (Table 8).

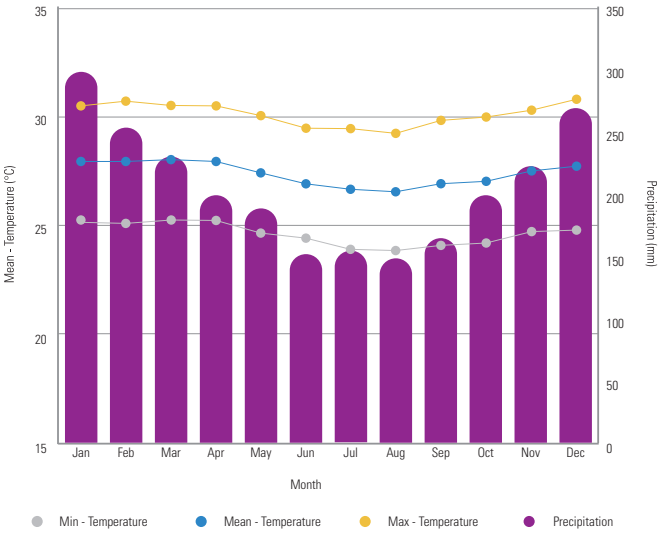
[31] https://reliefweb.int/sites/reliefweb.int/files/resources/2021-world-risk-report.pdf

Physical Dimensions

Climate

Samoa's climate is typical of small islands in the tropics, with almost constant surface air temperatures throughout the year, high humidity and high rainfall. The period from November-April is cyclone season, and cyclones and extensive flooding events have impacted Samoa. Mean annual patterns in temperature and rainfall[32] are shown in Figure 7.

Figure 7: Mean Temperature and Precipitation for Samoa 1991-2020.



Climate Change trends

- Very high confidence that surface air temperatures will rise
- More frequent and intense rainfall events are predicted

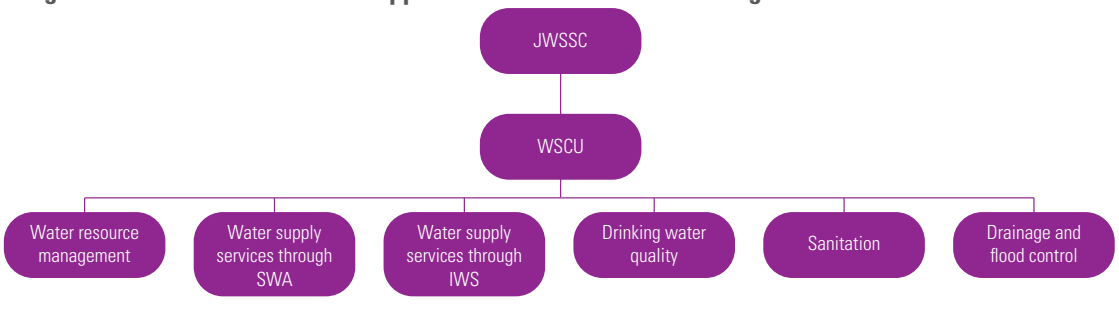
Water Availability

Samoa's water resources are particularly vulnerable to the impacts of climate change. There are water shortages during periods of low rainfall and damaged infrastructure during flooding, which also compromises both water quantity and quality. Saltwater intrusion from sea level rise has also contaminated groundwater. As a consequence of ENSO events, droughts have led to water rationing. Samoa Water Authority and independent water schemes provide piped water to roughly 95% of the population, with the remainder dependent on groundwater and small rainfall reservoirs. Although access is high, consistent and safe supplies are still a challenge. Access to water in Samoa is comparable to developed countries, achieving MDG targets for the water sector. They were deemed one of the top performers among the Pacific Island countries. However, hygiene standards still lag behind developed countries, even though 97% of the population uses improved sanitation facilities.

Structures and Institutions

The Joint Water Sector Steering Committee (JWSSC) is the apex body that reviews and makes decisions concerning the water sector, and decisions are forwarded to Cabinet for final approval. The JWSSC is comprised of government ministries and agencies, civil society, and donors. Beneath the JWSSC is the Water Sector Coordination Unit (WSCU), a unit within MNRE that looks after the day-to-day leadership of the water sector and provides administrative and technical support to the JWSSC. The WSCU chairs the Technical Committee that oversees six subcommittees (see Figure 8), each chaired by a different ministry.

Figure 8: Organisation of the sector-wide approach to water resource management in Samoa



[32] 15821-WB_Samoa Country Profile-WEB.pdf (worldbank.org)

Key WRM Actors in Samoa

Table 36: Key Actors involved in WRM in Samoa

Key Actors	Role Relative to WRM
Ministry of Natural Resources and the Environment	Provides overall leadership and coordination for the water sector. Also responsible for WRM, waste disposal, public toilets and environmental regulation.
Ministry of Health	Monitors and regulates water quality and sanitation.
Ministry of Women, Community and Social Development	Coordinates government support for community-managed water schemes. The support is channeled through the Independent Water Schemes Association (IWSA).
Ministry of Works, Transport and Infrastructure	Responsible for coordination, policy and regulatory support for drainage and flood control and the building code that regulates sanitation systems.
Samoa Water Authority	SOE responsible for providing water supply services to 80% of the population and for the sewerage system in Apia.
Samoa Tourism Authority	Monitors sanitation facilities in hotels and resorts.
Independent Water Schemes Association	Provides advice and management for the Independent Water Schemes that provide water for some 17% of the population.

Overview of WRM (Status, Constraints and Drivers)

Status

Surface water and groundwater are used for water supplies, and isolated and rural communities harvest rainwater. The main island of Upolu has surface water intakes serving northern, eastern and southern Upolu, while western Upolu depends on groundwater. Piped water supply is accessed by 90-95% of the population. The same proportion of improved sanitation services makes Samoa one of the top-performing countries in the region in the provision of water and sanitation services (Water for Life, 2016-2020). Although access to improved sanitation services is high, hygiene standards need improvement, as evidenced by high rates of diarrhea and typhoid, the latter being endemic in Samoa.

Constraints

There are competing uses in critical economic catchments near Apia like Vaisigano and Fuluasou, where public water supply competes with public power supply. There is competition for the same water sources with no natural water storage. The Vaisagano catchment behind Apia supports three of the five hydropower plants in the country. Still, the lack of natural water storage sees low flow levels during periods of dry weather and rapid flooding events, with peak levels being reached in a very short time during cyclonic weather. Flooding in Apia is consequently a recurring problem. Hydropower generation ceased in the Fuluasou catchment because of erosion undermining plant operations.

Land tenure issues and land use practices have also been ongoing issues for the same two catchments near Apia, resulting in sedimentation and pollution of water sources (Tauaa, 2017).

The shortage of skilled labour is a challenge shared by Samoa with other countries in the region. The lack of water quality monitoring for wastewater and solid waste disposal in waterways are an additional challenge for the authorities. SWA carries out water quality monitoring for drinking quality, but IWSA supplies the water. It is untreated, and a crude measure of quality is used. Consumers supplied by IWSA are advised to treat their water before consumption.

Non-revenue water or water leakage is a significant problem for SWA. This is due to aging infrastructure, illegal connections, and unregistered customers. The quality and maintenance of septic tanks are also a problem as they can impact groundwater quality.

Drivers

The water resources of Samoa are under increasing pressure from population growth, increased urbanisation, and industrial development such as that of the tourism industry, which has led to increased land degradation, water demand and wastewater disposal. Climate variability has also contributed to flooding from cyclonic rainfall and droughts associated with ENSO events. The impacts are readily felt with small catchments with steep slopes and no natural reservoirs.

In the UN-Water listing of countries and their progress towards achieving SDG6, Samoa made the most progress among Pacific Islands countries from 2017-2020 (see Table 9). This is mainly due to the governance structure of their water sector (Figure 8).

The WSCU is the "glue" that holds the sector together and provides technical support to facilitate sector processes. Still, the ultimate decision-making power in this sector lies with the JWSSC. The Water Resources Division (WRD) of the MNRE is responsible for watershed protection and conservation. Apart from rehabilitating catchments by reforestation, a concerted effort has been made to develop, implement, and enforce Watershed Management Plans (WMP). Although these have been developed for 15 catchments, the in-house staffing shortage in WRD has precluded implementation on the ground. Actions included in WMPs are fencing off catchment areas, establishing village nurseries, and placing garbage disposal bins.

Recommendations

- Support the Ministry of Health in monitoring drinking water quality
- Strengthen rainwater harvesting program of water sub-sector by providing information on status of rainwater tanks (condition, level of maintenance, optimum size according to household size, water quality etc.) to encourage adoption and maintenance by households
- Strengthen community awareness raising on hygiene and sanitation practices to counter high incidence of typhoid and diarrhoea
- Improve design, quality and maintenance of septic tanks by monitoring and enforcing new building codes and strengthening maintenance of septic tanks at household level
- Strengthen community disaster preparedness and risk reduction to mitigate impacts of climate change by holistic catchment management and conservation and water quality monitoring
- Support SWA to reduce water leakage and pumping costs
- Capacity building of local technicians in water sector to address skills shortage
- Strengthen information sharing between key agencies and Ministries (ADB, 2021)
- Strengthen wastewater management by upgrading wastewater treatment facilities

Photo courtesy of Dave Hebblethwaite, SPC

Nauru

Introduction

Nauru is an isolated uplifted limestone island located south of the equator at 0°32'S and 166°55'E. It shares maritime boundaries with Kiribati, Solomon Islands, Papua New Guinea and FSM. The total land area is 22 km^2, surrounded by a fringing reef that drops sharply to around 4000m. A narrow coastal plain between 100-300 metres in width encircles a central limestone escarpment that rises about 30 metres to a central plateau comprising around 70% of the island. This area consists of coral-limestone pinnacles and limestone outcrops interspersed with soil and high-grade tricalcic phosphate rock (Viviani 1970), most of which has been mined over the past 100 years.

Political Context

Nauru became an independent republic in 1968 with a 19-member unicameral parliament headed by the president, who is both head of state and government. The president is elected by parliament and appoints a cabinet. There is no local government structure in Nauru, with 14 administrative districts grouped into eight electoral constituencies.

Economy

Limited phosphate mining continues in Nauru, but this is increasingly a marginal proposition. There is little other industry save for some coconut products and subsistence agriculture. Fishing licence fees account for 26% of Nauru's total government revenue in 2020/21. Most of Nauru's needs are imported. GDP was estimated at USD 118 million and per capita at USD 10,983 in 2019.[33] Debt is 59% of Nauru's GDP (2020) and is considered unsustainable (Table 1); net ODA comprised 31% of GDP in 2019.

Socioeconomics

Nauru's socioeconomic indicators are among the Pacific's lowest (Table 3). Nauru doesn't report on some global statistics. 100% of the country's population is considered urban. Female participation in positions of leadership in the public sector are low but high in the private sector.

Population

The estimated population of Nauru was 10,876[34] in 2021 with an annual growth rate of 0.75%, ranking 157th. Its population density of 544/km^2, ranked 22nd globally. Its median age is low at 21.5, one of the lowest among PICs, with a birth rate of 21.5/1,000 (Table 6).

Health

Selected WHO global health indicators have been used to assess the health and wellbeing of Nauru's population. Nauru's indicators are marginally better than the global averages for the selected indicators (Table 7). In 2010 Nauru ranked first globally for the adult prevalence of diabetes (30.9%).[35] By 2019, this had increased by 10.2%.[36]

Water, Sanitation and Hygiene (WASH)

All Nauruans have access to improved drinking water (Table 8). Freshwater is primarily sourced through seawater desalination, supplemented with RWH from roofs with imported bottled water used mainly for drinking. A small groundwater lens is also used, although it is heavily impacted by low and variable rainfall. As is the case in most PICs, sanitation is a household responsibility and typically comprises septic systems, cess spits and some open defecation, resulting in contamination of any groundwater present.

[33] https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=NR accessed Nov 2021

[34] https://worldpopulationreview.com/countries/nauru-population accessed Nov 2021

[35] http://ghdx.healthmetricsandevaluation.org/record/global-burden-disease-study-2010-gbd-2010-results-cause-1990-2010 accessed Nov 2021.

[36] http://www.healthdata.org/republic-nauru accessed Nov 2021.

Nauru does not have water quality standards or guidelines. The Draft National Water, Sanitation and Hygiene Implementation Plan (2012) mentions Health (Water) Regulations under the draft Public Health Bill, which "specify powers of the Minister and Director of Public Health for ensuring the wholesomeness of supplies of potable water from groundwater, rainwater, desalinated and imported water, including exercising control overall sources of supply of potable waters in Nauru." However, the draft regulation never came into force.

Physical Dimension – Climate, Climate Change, Water Availability

Climate

Nauru's temperature is closely linked to the surrounding ocean surface temperatures and remains relatively constant throughout the year. The Intertropical Convergence

Zone, and the South Pacific Convergence Zone influence rainfall (Table 37). The El Niño-Southern Oscillation creates extreme variability in rainfall (standard deviation 1,151 mm[37]). El Niño episodes result in warmer temperatures and higher rainfall (up to 4,500 mm), and La Niña delays the onset of the wet season, resulting in lower rainfall and sometimes prolonged droughts (as low as 500 mm). Nauru does not experience tropical cyclones.

Table 37: Mean monthly rainfall and rainy days for Yaren, Nauru.[38]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
mm	204	143	208	220	154	151	161	152	135	129	147	256	2060
rainy days	13	12	14	16	15	15	16	15	14	12	12	15	169

Climate Change trends

Long-term trends in Nauru's temperature are not available due to a lack of records. However, there is very high confidence that surface temperatures will increase. Similarly, there is a high confidence level that rainfall will increase, although variability through ENSO is likely to continue. The impact of climate change on ENSO is uncertain. There is moderate confidence that drought events will decrease due to increased rainfall. There is very high confidence that the mean sea level will continue to rise.[39]

Water Availability

Buada Lagoon is a slightly brackish freshwater lake located in the south-central area of the island with an elevation of 5 metres above sea level. The freshwater lens is also slightly brackish, depending on the amount of rainfall. The freshwater layer is only 4-5 metres and precludes the use of pumping bores, resulting in upcoming saltwater (Jacobson and Hill 1988). Freshwater is derived from three primary sources, RWH from domestic and public building roofs, desalination of saltwater and limited extraction from the freshwater lens, with the latter being heavily contaminated by sewage. Imported bottled water is also used for drinking.

The Nauru Utility Company operates the desalination plant, which has a maximum capacity of 2,110 kl/day. This water is trucked into households and pumped into household tanks. However, the 2011 Nauruan Census revealed that 15% of Nauruan households did not have a water storage tank.

[37] https://www.pacificclimatechangescience.org/wp-content/uploads/2013/09/Nauru.pdf

[38] https://en.climate-data.org/oceania/nauru/yaren/yaren-788661/ accessed Nov 2021

[39] https://www.pacificclimatechangescience.org/wp-content/uploads/2013/09/Nauru.pdf

Structures and Institutions

Customary Law

The Nauruan Constitution now contains provisions to recognise customary law. However, the Custom and Adopted Laws Act 1971 provides that "institutions, customs and usages of the [indigenous] Nauruans" existing before the commencement of the Act shall have "full force and effect of law" to regulate specific issues of land ownership, other issues of property and inheritance, and more generally "any matters affecting [indigenous] Nauruan's only."[40] Statute law prevails over custom.

Water Policy

The National Water, Sanitation and Hygiene Policy (NWSHP) sets out the government's vision, goals, and objectives for water, sanitation, and hygiene. Implementation of this policy is described in the National Water, Sanitation and Hygiene Implementation Plan (NWSHIP) – a 15-year plan with the vision of "Reliable, safe, affordable, secure and sustainable water supplies to meet socioeconomic development needs and appropriate sanitation systems for healthy communities and environments." In addition, the National Development Strategy (NSDS) outlines water and sanitation goals and key performance indicators:

- Proportion of population accessing regular and safe drinking water and improved sanitation facilities (MDG);
- Proportion of rain and groundwater harvesting to total water production; and
- Potable water available to each person in Nauru daily.

A Nauru Water Supply and Sanitation Master Plan (NWSSMP) was subsequently developed, covering 2015 – 2035. The plan proposes the full reticulation of Nauru using a combination of gravity feed and pumps from storage tanks on the plateau. In addition, a 20-year capital works programme is outlined. The plan also proposed establishing a common effluent disposal system utilising existing septic tanks and replacing cesspits with septics. Collected sewage would be treated before discharge.

Key Actors

The key actors involved in WRM in Nauru were identified (Table 38), and their relative support or opposition was assessed, along with their influence on the implementation of WRM.

Table 38: Key Actors involved in WRM in Nauru

Key Actors	Role Relative to WRM
President (PRES)	Head of state and government
Minister for Climate Change, Minister for Commerce, Industry and Environment, and Minister for Infrastructure Development (MINCIE)	Responsible for climate change, environment and infrastructure, including the water division
Department of Commerce, Industry and Environment (CIE)	Responsible for administration of commerce, infrastructure and environment. Houses the Water Division
Minister for Health (MOH)	Provides quality essential health and nutrition services for all people of Nauru
Public Health (PH)	Provides quality essential health and nutrition services for all people of Nauru
Minister for Finance and Sustainable Development (MIND)	Has overall responsibility for the Finance portfolio
Department of Finance (DOF)	Mandated to oversee and coordinate the effective management of public finance and resources in Nauru
Planning and Aid Division (PAD)	Leads the implementation of the National Sustainable Development Strategy and manages international development assistance provided to Nauru
Nauru Island Association of NGOs (NIANGO)	Facilitates action of NGOs in Nauru
National Council of Women (NCW)	Supports women in society and development
EcoNauru Foundation	Dedicated to achieving sustainable development and management of Nauru's finite resources for current and future generations of Nauru
Administrative Districts (AD)	Represents Nauruan Communities
Nauru Utilities Corporation (NUC)	Responsible for the provision of public utilities in Nauru, including water and sanitation
Nauru Rehab Corporation (NRC)	Its primary mission is to rehabilitate land destroyed by the phosphate industry.

[40] https://en.wikipedia.org/wiki/Law_of_Nauru

Overview of WRM – Status, Constraints and Drivers

Status

To meet environmental and water needs, Nauru requires enabling policies and legislative frameworks, financing, and implementation. Governance is weak (Table 7). The socioeconomic indicators for Nauru (Table 1) show a high standard of living compared to PICs, although government and public utilities struggle to provide essential WatSan services. There is no human development index calculated for Nauru due to a lack of data. Nauru's debt percentage to GDP is 59.34% (2020), the second highest amongst PICs; consequently, Nauru has significant financing problems. The human right to water means, at minimum, there is sufficient capacity to meet basic needs (drinking, washing, cleaning, cooking, and sanitation). It also means the water is safe (free of pathogens and not dangerous to health) and accessible. There are evident failures in all parameters, i.e., the sufficiency of water, the safety of water, and accessibility of water, which suggests a failure of implementation.

The GEF Pacific IWRM Project's Nauru Country Project produced a National Water, Sanitation and Hygiene Policy (NWSHP). An extensive consultative process was undertaken in developing the policy, endorsed by Cabinet in 2012. The National Water, Sanitation and Hygiene Implementation Plan (NWSHIP) was developed from the policy, but not implemented. Subsequently, the Nauru Water Supply and Sanitation Master Plan 2015 -2035 (NWSSMP) was created and reviewed in 2021. The OECD Water Governance Survey assesses Nauru water governance as poor, providing a valuable overview of where Nauru's water governance is failing (Table 11). However, the survey also illustrates a recurring problem in attempting to critically appraise and compare data using global indicators generated through questionnaires and self-reporting, i.e., the information is incomplete. In the case of the Pacific, some global indicators are not relevant. UN-Water has compiled baseline country data to enable reporting on global progress toward SDG6 and, as part of that baseline, has established the degree of IWRM implementation (indicator 6.5.1). However, Nauru provided no data to the UN on the degree of IWRM implementation.

Constraints

Household RWH and groundwater are widely used where potable water is not required. There are no legislative or regulatory provisions enabling any management of these. In Nauru, groundwater extraction is the customary right of the landowner and, therefore, unregulated. Sanitation is similarly unregulated, with unlined cesspits and septic discharge directly polluting groundwater. Virtually all the coastal domestic wells have faecal contamination.[41]

Customary groundwater rights of landowners mean no regulatory framework is available to control extraction rates. NUC provides potable water from the desalination of seawater. Water is trucked into household storage tanks. Sanitation is primarily a household responsibility and, as a result, heavily pollutes the coastal plains and groundwater. The NWSSMP proposed a reticulated water system for households and a small-bore sewage system collecting waste from household septic systems for treatment and ocean disposal. The cost of these two systems is substantial and beyond the capacity of Nauru to fund without considerable donor assistance. Issues of poor governance further compound WRM in Nauru.

There has been significant engagement in developing WRM policy, implementation plans, and masterplans over the last 10 years, all with high-level community and government participation. There appears to be little opposition to WRM, yet groundwork has not progressed. Realising Nauru policy and plans require effective and transparent governance, adequate financing, and implementation. While governance is an issue acknowledged by the Government itself,[16] the lack of financing is the primary obstacle to implementation, at least for infrastructure.

Drivers

Nauru's annual population growth rate of 0.75% and high population density results in significant pressures on water resources and the environment generated through human activity. The lack of sustainable water resources, land use planning, geomorphology, climate change and variability compound economic, socioeconomic and cultural drivers.

Water supply in Nauru is a juxtaposition; on the one hand, households are traditionally responsible for water supply, and landowners have customary rights to groundwater, yet the State operates desalination plants to supply households with potable water. Households are also heavily reliant on RWH in an environment

[41] Draft National Water, Sanitation and Hygiene Implementation Plan 2012

with substantial interannual rainfall variation. There are no water or sanitation standards; the only legislation available is the Sanitary Inspectors' Ordinance 1921. Nauru's voluntary national review in implementing SDGs[42] cites "access to clean water as a key priority" and priority infrastructure improvements to "improve the supply and quality of water and sanitation to improve health outcomes and support economic diversification." It also acknowledges that "a sewage and water waste treatment facility is required to protect public health".

The review highlights three cross-cutting issues:

1. Strengthening and reforming the governance institutions.
2. Land issues constrain implementation; the requirement that at least 75% of landowners consent to gain access to land is a major blockage to progress.
3. Climate change and climate variability undermines sustainable development.

ADB's water security scores for Nauru confirm this engagement in ensuring water security (Table 12). This is reflected in the plethora of robust WRM policies, implementation plans and masterplans. However, the lack of implementation underscores the lack of effective governance around WRM, recognised by Nauru's voluntary national review.

The safety of water is a governance issue. There are no water quality standards or guidelines in Nauru despite the existence of related draft regulations. There appears to be no capacity to monitor water quality, so Nauruans rely on the quality of the desalinated water and household level treatment of harvested rainwater and groundwater. Likewise, the safe treatment and disposal of sewage is a governance issue. Both water and sanitation are confounded by landowner rights and the customary responsibility of households for the supply of water and handling of sewage. Landowners' customary rights are a significant impediment to a 'whole of society' approach to water and sanitation. As there is no provision for compulsory acquisition in the Lands Act, the path to a collective approach will be long and difficult unless some reforms of the Lands Act are enacted.

Recommendations

Water quality standards need to be formally regulated and appropriate monitoring capacity resourced. This would include establishing a basic testing facility and building expertise to undertake and analyse the testing results.

Given the distribution of the population in Nauru, a reticulated water network is the best long-term option to ensure consumptive water quality, access and security. However, the capital resources required would be significant, as would the issue of installing the network on customary land. A business analysis should be undertaken to establish the capital and ongoing operational and maintenance costs of such a system. The water supply cost must be determined to ensure that this is adequately funded on an ongoing basis, either through appropriate user billing or continued government funding.

Water security could be improved with a stronger focus on household water collection. Women traditionally have had a primary role in the growth and health of children and animals. Christian religions in the Pacific have actively promoted women's groups, and women's fellowships and these provide a base for engaging women in WRM in Nauru. Any scheme to promote an increase in household RWH should be inclusive and be nudged through water charges for the freshwater supplied through desalination. Increased use of shallow aquifers for non-consumption water is possible and should be investigated.

Aligned with the use of shallow aquifers is the need to improve the safe treatment of sewage. A centralised collection and treatment system has been proposed. In the long term, this is perhaps the only realistic option given the impact of the current septic systems on the Nauruan environment. A business analysis should be undertaken to establish the capital cost and ongoing operational and maintenance costs of such a system to determine if users and or the Government can cover the capital cost and ongoings.

[42] https://www.theprif.org/sites/default/files/2020-08/Nauru%20VNR%202019.pdf

Tuvalu

Introduction

Tuvalu is geographically the fourth smallest country in the world. It comprises nine low-lying limestone islands with a land area of around 26 square kilometres. The coastline is only 24 kms but covers a huge ocean area of around 1.3 million km^2. It is located between 5° and 10.5° S latitude and 176°and 179.5° E longitude with the nearest countries being Kiribati and Fiji (Rotuma). Because of the spread of the islands, Tuvalu has an EEZ of 900,000 km^2. The population of Tuvalu in 2017 was 10,645 with half of the population in Funafuti. The population density in Tuvalu is 425/ km^2 and in Funafuti, it was estimated to be over 2,000/ km^2.

Political context

Tuvalu was previously known as the Ellice Islands during the colonial period and was administered with the Gilbert group of islands by Great Britain. Traditionally, the various atoll islands were controlled/ruled by separate chieftainships similar to the chiefly systems in Tonga and Samoa. Indeed, the inhabitants were believed to have originated from Tonga and Samoa. It is a stratified society, and as Isala (1983: 20) puts it, "[p]olitically, each island was independent, and to a large extent, so was each village." In the late 19th century, they were brought together with the Gilbert Islands and became a British protectorate and, in 1916, a British colony of the Gilbert and Ellice Islands. In the lead up to political independence (1975), 95% of Tuvaluans voted to be separated from the Gilbert Islands, and it became an independent country in October 1978 (Macdonald, 1994: 187). Tuvalu adopted the Westminster system of democracy, with the governor-general representing the British monarch as its head of state (ibid: 49). Further details about the political structure and institutions are discussed later.

Population

The name Tuvalu means 'eight together' in the local language, and it has eight electoral districts with a unicameral parliament elected directly by the people. Seven of the eight electoral districts return (or vote into parliament) two Members of Parliament each, while one constituency, Nukulaelae, returns only 1 MP (Corbett and Fraenkel, 2016). The seven islands that have two MPs each are Funafuti, Nanumea, Niutao, Vaitupu, Nanumaga and Nui. The Parliament's life is four years, and since independence, political instability has been high. This instability can partly be explained by the absence of institutionalised political parties and the predominance of coalition governments. Corbett and Fraenkel (2016: 356) reported in 2016 that there had been 17 governments since independence and 6 of these were the consequences of successful motions of no confidence. In 2020, Tuvalu was listed as one of the PICs classified under High Institutional and Social Fragility. Moreover, as shown in Table 2, in the World Bank's report on two governance indicators, Government Effectiveness and Regulatory Quality, using a governance scale of -0.25 to + 0.25, Tuvalu scored poorly with -0.65 and -0.49, respectively.

Tuvalu is a small atoll island nation with a land area of 26 km^2 comprising nine atolls. It has around 10,507 residents (Tuvalu Statistics Office, 2020). The distribution of the population by island appears below (Table 39) with a very high population density of around 408/ km^2, with half of the population living in Funafuti (IPS, 2020; Corbett and Fraenkel, 2016; Fairbarn, 1987). Table 5 shows that the population growth rate in Tuvalu was 1.2% per annum, with a birthrate of 23/1,000, and a median age of 27.6.

Table 39: Tuvalu population by place of enumeration and sex

Island	Usual place of residence								
	Tuvalu			Other country			Total		
	T	M	F	T	M	F	T	M	F
Total	10,507	5,403	5,104	138	83	55	10,645	5,486	5,159
Nanumea	495	259	236	12	4	8	507	263	244
Nanumaga	384	216	168	1	-	1	385	216	169
Niutao	499	238	261	2	1	1	501	239	262
Nui	494	246	248	7	4	3	501	250	251
Vaitupu	1,190	568	622	5	4	1	1,195	572	623
Nukufetau	531	264	267	6	4	2	537	268	269
Funafuti	6,611	3,451	3,160	105	66	39	6,716	3,517	3,199
Nukulaelae	260	129	131	-	-	-	260	129	131
Niulakita	43	32	11	-	-	-	43	32	11

(Source, Tuvalu Census, 2017)

Because of the country's small landmass and high population density, the provision of water and sanitation services to the population is a challenging task. This is complicated by the country's dependence on rainwater and the limited availability of groundwater.

Economy

Tuvalu has minimal land resources but considerable potential in marine resources, especially fish. As can be seen in Table 1, Tuvalu has a GDP per capita of USD 4,147 and a USD 6 million debt which is 11.53% of GDP. Its deficit as a percentage of GDP in 2020 is 9.1%, and debt sustainability is classified as 'high risk'. Tuvalu is one of the LDCs in the Pacific with net ODA comprising 55.84 as a percentage of GNI in 2019 and 1.9% of its GDP from remittances. It ranked 6 (very high vulnerability) in the MVI. Tuvalu has a coastline of 590 km and an EEZ of 900,000 km^2.[43] However, the fisheries sector, especially tuna exports and onshore processing, are yet to be fully developed or realised. The FAO reported that "[f]isheries contribution to GDP in 2014 was 5% estimated as USD 1.9 million. In 2013, exports of fish and fishery products were estimated at USD 18.6 million and imports at USD 0.2 million" (ibid). A comparison of tuna resource endowments and benefits to other Pacific neighbours can be seen below (Table 40).

[43] https://www.fao.org/fishery/facp/TUV/en

Table 40: Tuna resource endowments and benefits compared to other PICs

	Value in US$ million				Onshore porcessing volumes (mt)b	Employment
	Tuna catch in national waters	Tuna catch by national fleet	Tuna Exportsa	Tuna fishery access and licences fees		
Cook Is.	72	17	4	15	362	89
Fiji	47	74	142	2	50,297	4,078
FSM	407	250	71	70	5,331	1,105
Kiribati	824	317	107	121	373	1,114
Marshall Is.	80	146	38	32	8,447	899
Nauru	200	17	-	32	-	85
Niue	1	-	1	1	-	4
Palau	61	22	19	8	609	94
PNG	677	517	296	140	79,106	11,371
Samoa	7	10	10	1	6,031	288
Solomon Is.	272	134	76	42	21,250	3,224
Tokelau	52	-	-	14	-	6
Tonga	9	2	2	1	1,446	285
Tuvalu	162	15	12	28	-	91
Vanuatu	36	84	75	3	-	69
Total	2,907	1,605	850	510	173,252	22,803

Notes: a. For 2016-18. Based on import data from the 4 major export destinations for tuna from the region (EU, Japan, Thailand and USA) and exports to other countries provided in the UN Comtrade database. Includes catch by nationally registered vessels that may not have been landad onshore. b. For 2016-18.

The table above demonstrates that the country does not have an onshore tuna processing plant. It depends mostly on tuna fishery access and license fees, particularly revenues generated under the Parties to the Nauru Agreement (PNA) arrangement. It also derives income from seafarers working overseas through remittances and the internet domain name 'tv'. It also benefits from a Trust Fund established by its leaders at independence. The Trust Fund is now sustaining the Government's expenses (Corbett and Fraenkel, 2016). Tuvalu is one of the 'MIRAB' economies in the Pacific that relies on international migration, remittances, foreign aid and bureaucracy (Watters, 1987: 41). The biggest employer in Tuvalu is the government bureaucracy, which employs more than 1,000 people (Corbett and Fraenkel, 2016: 352).

Health and WASH

Health, water, sanitation and hygiene in Tuvalu require serious attention. Table 6 shows that the Tuvalu Government's health expenditure (% of GDP) is around 15.2%. In addition, mortality rate, neonatal (per 1,000 live births) is 16, mortality rate, infant (per 1,000 live births) is 20.2, and mortality rate, under-5 (per 1,000 live births) is 23.9. In terms of Average 13 International Health Regulations core capacity scores, Tuvalu scored 54.5. As shown in Table 3, life expectancy in Tuvalu is 66.2 years.

Given the limited availability of underground water, rainwater harvesting is critical for health, sanitation, and hygiene. Funafuti, the capital of Tuvalu and the other islands, generally faces many challenges with water supply, sanitation services and an increasingly high rate of communicable diseases. Most households in Funafuti rely on onsite sanitation facilities as there are no central sewer systems. While reports indicated that 86% of households in Funafuti have flush toilets, most septic tanks are poorly constructed, which may cause problems (breached) during floods. Open defecation is also a problem in Tuvalu, and the behaviour is very much influenced by the lack of water and sanitation facilities (ADB, 2020). This is especially serious during droughts, like the one experienced in 2011. The types of toilets, discharge and latrines used in Tuvalu in 2017, when the latest population and household census was undertaken, are shown below (Table 41).

Table 41: Number of private Tuvaluan households by island and type of toilet, discharge and latrine

	Island									
	Total	Nanumea	Nanumaga	Niutao	Nui	Vaitupu	Nukufetau	Funafuti	Nukulae-lae	Niulakita
Toilet type										
Total	1,626	105	93	116	97	187	112	849	57	10
Flush / pour flush toilet	1,438	94	89	101	87	155	106	753	46	7
Pit latrine	63	-	-	-	-	16	2	32	10	3
Compost toilet	29	-	-	1	-	7	-	21	-	-
No facility / bush / beach / ocean	83	8	4	14	10	9	2	35	1	-
Other	13	3	-	-	-	-	2	8	-	-
Toilet discharge										
Total	1,438	94	89	101	87	155	106	753	46	7
Septic tank	1,379	87	79	83	67	155	106	749	46	7
Dug pit	54	7	9	16	20	-	-	2	-	-
Ocean	2	-	-	2	-	-	-	-	-	-
Other	3	-	1	-	-	-	-	2	-	-
Latrine type										
Total	63	-	-	-	-	16	2	32	10	3
Ventilated improved pit latrine	43	-	-	-	-	1	1	28	10	3
Pit latrine with slab	17	-	-	-	-	13	1	3	-	-
Latrine to open pit	3	-	-	-	-	2	-	1	-	-

Sources of drinking water throughout the islands of Tuvalu are shown below (Table 42). Three desalination plants can produce 100 cubic meters of water per day in Tuvalu and are operated by the Public Works Department (PWD). However, these cannot meet demand during prolonged droughts (ibid). During the 2011 drought, Australia provided 607 water tanks for residents in Funafuti, 150 water tanks for schools on outer islands and three desalination plants, one of which was jointly funded with the United States and United Kingdom (Reliefweb, 6 December 2012). The Japanese Government, through JICA, also provided funds for spare parts to repair one desalination plant. With increasing sea-level rise, WASH issues in Tuvalu will continue to be a concern.

Table 42: Number of private Tuvaluan households by island and source of drinking water, piping and well status

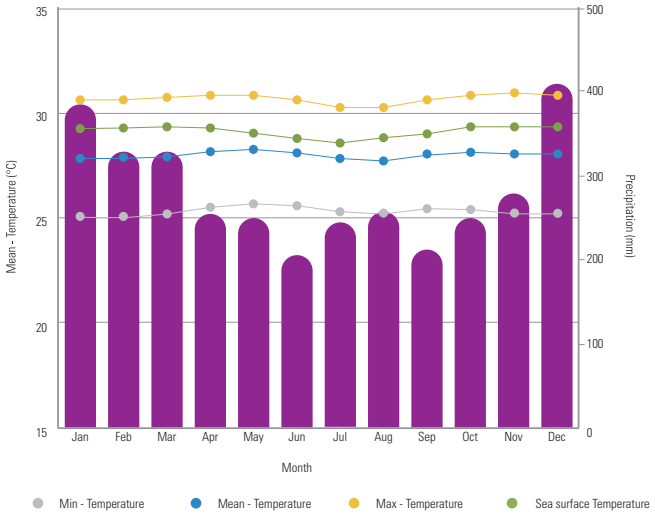
	Island									
	Total	Nanumea	Nanumaga	Niutao	Nui	Vaitupu	Nukufetau	Funafuti	Nukulae-lae	Niulakita
Main source of drinking water										
Total	1,626	105	93	116	97	187	112	849	57	10
PVC / Fiberglass / Cement tank	1,533	96	92	113	95	151	110	810	56	10
Cistern	68	6	1	1	1	36	2	21	-	-
Dug well	-	-	-	-	-	-	-	-	-	-
Tanker truck	8	-	-	1	1	-	-	6	-	-
Bottled water	7	-	-	-	-	-	-	7	-	-
Other	10	3	-	1	-	-	-	5	1	-
Tank / Cistern tapped and piped										
Total	1,601	102	93	114	96	187	112	831	56	10
Piped into the dwelling	1,016	64	87	82	22	171	20	557	10	3
Piped to the dwelling's yard	580	37	5	32	74	16	90	273	46	7
Community waterspout / tap	2	1	-	-	-	-	-	1	-	-
Neighbour's waterspout / tap	3	-	-	-	-	-	2	-	-	-
Dug well status										
Total	-	-	-	-	-	-	-	-	-	-
Yes - Protected / covered	-	-	-	-	-	-	-	-	-	-
No - unprotected / uncovered	-	-	-	-	-	-	-	-	-	-

Physical dimension - climate, climate change, water availability

Tuvalu is a small island country and is highly vulnerable to the effects of climate change, particularly sea-level rise (Table 43), with its highest altitude less than 2 metres above sea level. Acknowledging the worst-case scenario where the country disappears as sea levels rise and land submerges, the Tuvalu Government launched *Tuvalu's Future Now Project* (or Te Ataeao Nei Project in Tuvaluan) in November 2021 (Kofe, 2021). The three major initiatives under this project include "… promoting values-based diplomacy, ensuring the permanency of statehood and maritime boundaries despite the effects of sea-level rise, and building a digital nation" (ibid, 1).

Climate change, particularly sea-level rise, is an existential threat to the country. Tuvalu is within the southeast trade wind zone but 'on the edge of the southwest Pacific equatorial doldrum zone' (SPC, 2019: 6).

Figure 10: Seasonal rainfall and temperature at Funafuti, Tuvalu



The wet months are between December to May, and the dry period is between June and November every year. Tuvalu is a group of low-lying atolls and has very limited groundwater. However, many villages have groundwater beneath them, which may explain their location. Most of its water needs, especially drinking, come from rainwater collection. The islands further north usually have higher rainfall. The SPC reported that Tuvalu recorded its highest rainfall in 1987 with 4,900 mm of rain and its lowest rainfall in 2011 with 523 mm (ibid). Detailed data gathering and analysis of water availability, rainwater and drought in Tuvalu have been undertaken by SPC in its various reports, including the ones cited here.

Table 43: Number of private Tuvaluan households affected by natural disasters on the island

	Island									
	Total	Nanumea	Nanumaga	Niutao	Nui	Vaitupu	Nukufetau	Funafuti	Nukulae-lae	Niulakita
Affected by king tide										
Total	1,626	105	93	116	97	187	112	849	57	10
Yes	259	14	22	18	48	29	15	81	32	-
No	1,367	91	71	98	49	158	97	768	25	10
Affected by storm surge										
Total	1,626	105	93	116	97	187	112	849	57	10
Yes	288	8	25	18	30	43	8	122	34	-
No	1,338	97	68	98	67	144	104	727	23	10
Affected by natural disaster										
Total	1,626	105	93	116	97	187	112	849	57	10
Yes	425	24	33	20	37	58	46	166	41	-
No	1,201	81	60	96	60	129	66	683	16	10
Affected by erosion										
Total	1,626	105	93	116	97	187	112	849	57	10
Yes	300	43	13	35	68	34	46	41	20	-
No	1,326	62	80	81	29	153	66	808	37	10

Structures and institutions

It is essential to recognise that formal state, informal indigenous, and church institutions are present in Tuvalu, similar to other Pacific Island countries. At the same time, the country's relatively small size as an atoll island country must be put into perspective when looking at structures and institutions in Tuvalu. Understanding the role and influence of these formal and informal institutions on land and water resources in urban (Funafuti) and rural communities (other atolls) will be critical to any intervention in this area.

The most obvious structure is the state structure (SS) with its accompanying institutions. Some relevant policies and laws are in place. As a small island nation, WRM in Tuvalu cannot be detached from existential threats such as climate change and sea-level rise. Tuvalu's government ministries that can influence water resources and management include the: Department of Environment (DoE), Tuvalu Public Works Division (TPWD), Department of Agriculture (DoA), Department of Lands and Survey (DoLS), Department of Fisheries (DoF), Tuvalu Meteorological Service (TMS), Ministry of Home Affairs and Rural Development (MHARD), and Office of the Prime Minister (OPM), Climate Change Policy Unit (CCPU).

While the departments and institutions of the central Government are essential, it is also critical to note the presence of local government councils, which are closer to the people in the respective island atolls. Tuvalu inherited eight local government councils at independence as these were formal establishments under the colonial administration and, to an extent, resembled the autonomy of each atoll before contact. These local government councils are essential collaborators, especially when designing interventions in WRM. They were strengthened in the 1990s with the assistance of the UNDP. The effort resulted in the establishment of the People's Congress comprising local councillors, traditional leaders and NGO representatives, which recommended further devolution of power from Funafuti to island councils, closely reflecting traditional arrangements (Corbett and Fraenkel, 2016: 367). The recommendations paved the way for the development and enactment of the Falekaupule Act of 1997, which gave the eight local government assemblies complete jurisdiction over their administrative affairs. Richardson stated, "Tuvalu is a rarity in the Pacific, with its traditional and modern governance institutions formally harmonised through the *Falekaupule Act*" (Richardson, 2009: 124). The local government structure has three institutional bodies: (i) the *Falekaupule* (traditional Assembly), (ii) the *Falekaupule* Assembly (consultative forum), and (iii) the *kaupule* (the executive arm of the *Falekaupule*) (Aselu, 2015). The *Falekaupule* meets in 3-month intervals and is often dominated by elders, chiefs, and church pastors. Nevertheless, women are said to play increasingly influential roles in *Kaupule* committees (Corbett and Fraenkel, 2016: 354).

Apart from the national government ministries, institutions, and the *Falekaupule* (FLKP), it is crucial to be conscious of the informal/indigenous structure occupied by members of extended families and their leaders that control land and resources, including water resources. As Aselu (2015: 8) stated, "[t]raditionally the major social institutions have been family-based under the leadership of the *aliki* (ALK) (chiefs). Building relationships requires an appreciation of customary land and resource tenure and their connection to people's relationships." The success of any intervention in rural communities may be determined by effective maneuvering and convincing members of this informal structure. Like other PICs, most of the land in Tuvalu is under customary ownership.

The use, lease, transfer and inheritance of land are prescribed by two legislations: (i) the Native Lands Ordinance of 1957 as amended; and (ii) the Tuvalu Lands Code of 1962 (Pulea and Farrier, 1994). Under the Land Code, customary rights related to land usage and disposal can be held under '*kaitasi*' (people living or eating together) as joint owners of one estate. It may also be communally owned. Land can be used with the permission of the chief, and everyone may own it, and any resource produced (e.g., coconut) may be used on the land and not removed. The village land is also similar to communal land, but when the village is moved elsewhere, such land is reverted to the original owners (ibid, 1994: 19). When intervening in areas such as water resources management, it is crucial to understand these different tenures and note the state's power to compulsory acquire land for public purposes or lease.

It is also important to acknowledge the critical role of the church, especially the *Ekalesia Kelisiano* (EKT) Tuvalu church, in the daily lives of Tuvaluans. The church is a national religion with membership from 85-90 % of Tuvaluans (Aselu, 2015). Therefore, the support of the church is crucial in engaging with rural communities in areas such as WRM.

Key Actors

Table 44: Key Actors involved in WRM in Tuvalu

Key Actors	Role Relative to WRM
State Structure (SS)	The formal structure of the state and its institutions linking all government ministries, departments and agencies. WRM must adhere to this structure in terms of communication, approval, etc.
Office of the Prime Minister (OPM)	Head of Government; all WRM interventions require the endorsement of this office.
Tuvalu Metrological Service (TMS)	Provides data and information on weather, rainfall, droughts, etc. for WRM planning.
Department of Environment (DoE)	Administration of matters related to the environment, including WRM
Climate Change Policy Unit (CCPU)	Focuses on climate change issues, including the impacts of climate change on WRM
Department of Lands and Surveys (DoLS)	Holds overall responsibility over matters related to land use and survey.
Ministry of Home Affairs and Rural Development (MHARD)	Responsible for the welfare and needs of those living in rural communities, especially regarding rural development initiatives, including WRM.
Donors (DNRS)	Support development in WRM and build infrastructure to support water supply services.
Regional and Subregional Organisations (SBRO)	Typically support donors and the government with finance and technical expertise in the area of WRM.
Polynesian Leaders Group (PLG)	A sub-regional organisation and forum where Polynesian leaders meet to discuss development issues, including WRM.
Department of Agriculture (DoA)	The ministry works closely with other government ministries on WRM issues, although they do not directly deal with it.
Tuvalu Public Works Division (TPWD)	Provides support to construct water facilities and other infrastructure projects related to WRM.
Falekaupule Assembly (FLKPA)	A forum in the island council where leaders and community representatives discuss island issues including water.
FLKP (Falekaupule)	Local/island council responsible for each of the islands.
Aliki (ALK)	Traditional heads of islands who are also members of the falekaupule.
Ekalesia Kelisiano Tuvalu (EKT)	Engages with rural communities in areas such as WRM

Overview of WRM

Given the nature of atolls, rainwater is a critical source of drinking water, while underground water is limited and is being explored for possible further development. For example, under the Managing Coastal Aquifers Project (MCAP), the Pacific Community (SPC) conducted water resources assessments on outer islands and installed groundwater supply infrastructure. The project also strengthened institutional arrangements and established community-based water resources monitoring and management systems. Likewise, under the New Zealand funded Strengthening Water Security of Vulnerable Island States project (2014- 2019), the SPC built on lessons learnt to support the atoll countries such as Tuvalu "to build skills, systems, and basic infrastructure to better anticipate, respond to and withstand the impacts of drought" (Sinclair et al., 2021: 19). Under this project, water security management options were identified through the involvement of three key sectors - disaster management, water utilities, and weather services" (ibid). Table 45 below provides a summary of WRM projects and approaches in Tuvalu.

Table 45: Overview of current water-related projects in Tuvalu

Project/programme	Donor	PIC	Water sector interventions	Implementation period
Water Scarcity Program (SPC)	New Zealand's Ministry of Foreign Affairs and Trade (NZ-MFAT)	RMI, Tuvalu, Kiribati	Installation of drought-resilient water supply systems (rainwater/ groundwater) in outer islands. Improvement of skills and capacity and institutional arrangements to enhance water security.	2020-2024
Managing Coastal Aquifers Project MCAP (SPC)	Global environment facility (GEF)	RMI, Tuvalu	Water resources assessments in outer islands and installation of groundwater supply infrastructure. Strengthening of institutional arrangements and improved community-based water resources monitoring and management.	2020 – 2024
Global Climate Change Alliance Plus Scaling Up Pacific Adaptation GCCA+ SUPA (SPC)	European Union (EU)	RMI, Tuvalu, Kiribati, FSM	Strengthen sector-based climate change and disaster-risk-management strategies and plans through improved coordination and integration in implementing organisations and utilising a gender-sensitive / rights-based approach involving all stakeholders.	2019-2023
Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean	GCF	RMI, Tuvalu	Appropriate adaptation interventions to address climate change threats require tailored climate information and people-centred multi-hazard early warning services covering oceans and islands for all sectors. This program will build the capacity to provide such services for five vulnerable PICs using a multi-country approach.	
Funafuti Water and Sanitation Improvement	ADB	Tuvalu	Improvement of water supply and sanitation infrastructure and service to all households in Funafuti, and enhancement and sustained hygiene awareness and behaviour and water conservation.	2020-2023
IWRM - Water and Sanitation Governance Improvement (SPC)	NZ MFAT	Tuvalu	Finalise Water and Sanitation Policy and Drought Response Plan in Funafuti and adapt the implementation of these policies/plans in the outer islands.	2021-2023
Vaitupu Island Water Supply Project (SPC)	NZ-MFAT	Tuvalu	Construction of a groundwater supply in Vaitupu island and improved operation and sustainability through community-driven management structures.	2021-2022

(Sinclair et al., 2021)

SPC (2021:36) recently assessed the complexity of WRM support in Tuvalu, noting that:

> "...water vulnerability is not just a function of available storage and rainfall but includes social, cultural, economic and capacity considerations to guide decisions on where, and the type of interventions required. This evidence-based, objective approach was, however, a valuable first pass to help identify where interventions are needed and what type of interventions are likely to be most effective, on which an overlay of a country's identified social, cultural and economic considerations can guide project design and implementation.

The technical aspects of water resources management as well as the legal and policy requirements of Environmental Impact Assessment (EIA) and related processes must be adequately understood, especially in an atoll environment. Table 9 provides an assessment of PIC's IWRM (SDG 6.5.1) Implementation Status and Progress in 2017 and 2020. Tuvalu was assessed as follows: enabling environment (25 and 48); institution and participation (73 and 69); management instrument (45 and 38); financing (45 and 24); and the final IWRM Scores were (47 and 45) respectively. Table 10 also provides comparative data on Pacific Island Countries' OECD Water Governance Scores using 12 indicators. Sinclaire et al. (2021: 19-23) highlighted specific points for consideration when designing a WRM program for Tuvalu. These include:

- Managing the geographic reach of activities. This means that the design should not spread resources so thinly that focussing on the needs of target communities on the ground becomes difficult. On the other hand, it is also important to manage expectations on the ground.
- Managing complex procurement and supply chains. It is essential to understand the logistics and processes required to get materials to the islands, especially if the project is

extended to the outer islands. These considerations are crucial for maintaining community interest, motivation and commitment.

- Enabling necessary community engagement. Consultations and awareness raising processes may take longer than envisaged. However, remember that genuine collaboration results in an enabling environment in communities and, ultimately, the success of any intervention. It is also important to remember that there may be a limited number of skilled people to liaise with local communities, especially in the outer islands.
- Ensuring adequate technical and administrative support at all levels. Engaging local personnel is advisable. The role of the various island councils and institutions at these different levels cannot be overemphasised.
- Supporting local capacity and systems. This is critical to ensure proper management of water resources and infrastructure once programs and projects end. Mainstreaming Gender Equity and Social Inclusion (GESI) principles by listening to women, youth and traditionally excluded voices and accommodating their views and needs when designing WRM interventions is an important consideration. As a result, they may be better placed to continue this important undertaking after the end of the program/project.

Recommendations

Many studies have been undertaken in Tuvalu's water resources area. This is due to the centrality of water resources and WRM in the life and livelihood of Tuvaluans on the island. Donors need to consider past findings and recommendations in WRM and WASH in Tuvalu. The results of the 2011 study by SPC, for instance, recommended: (i) household participation in inception studies and reasonable incentives and interest in the positive outcomes and benefits of such studies and interventions be communicated to all stakeholders from planning to inception and implementation; (ii) the use of health and WASH outcomes as indicators to monitor; (iii) community support and feedback concerning cultural norms and practices are essential; and (iv) genuine collaboration by all stakeholders in the planning to inception, implementation, monitoring, evaluation and post-project follow-up (Lui et al., 2013: 12).

Genuinely collaborating and partnering with formal institutions and offices in Tuvalu from the start is advisable. In addition, the informal but influential institutions that deal with land and resources must always be acknowledged and approached to ensure buy-in. Moreover, the accommodation of GESI guidelines (see, for example, Sinclair et al., 2021: 43-45) in the design, implementation and monitoring of WRM would be helpful, especially in continuity.

Finally, the legislative and policy work in WRM and clear identification of who has power in Tuvalu are important. This is especially so for the formal, state institutions and structures. The AWP could initially support such essential processes to understand these dynamics before designing WRM intervention in Tuvalu. For instance, it is important to note that the national water and sanitation policy and plan for Tuvalu expired in 2021 and are currently being reviewed and in draft form. It's anticipated that the approval process will continue in 2022. Sinclair et al. (2021: 25-28 & 35) also highlights risks that AWP may consider or be when designing WRM activities:

There is no statutory basis for the island council to control and administer water or to impose and collect charges for the supply of water services in the outer islands.

1. Legal protection of water source areas and reserves.

2. Lack of ownership and engagement.

3. Capacity to pay for the use of communal water supply systems and water technicians.

Kiribati

Introduction

Kiribati is a low-lying atoll country with 33 islands of which 20 are inhabited. It has a coastline of 1,143 kilometres with coordinates 1°25'N 173°00'E / 1.417°N 173.000°E and a total area of 811 km^2. Kiribati covers a huge ocean area with an EEZ of 3.5 million km^2. The group of islands comprising of the Gilbert group, the Phoenix group and the Line group recorded a total population of 119,438 people in the 2020 national census. About 59% of the population reside in the urban area while 41% are in rural areas.

Political Context

Kiribati gained independence on 12 July 1979, moving the country away from traditional government structures to a hybrid system with a directly elected president. Kiribati has three main groups of islands consisting of 33 atolls and islands: Gilbert Islands (16 islands), Phoenix Islands (8 islands), and Line Islands (9 islands). It has one of the largest Exclusive Economic Zones globally, with a total sea area of 4.8 million km^2. The highest point above sea level for most atoll islands is between 2-4 metres. Its land area is around 811 km^2 (Oakes et al., 2016: 21).

The structure and institutions of the modern state operate at both the national and local levels in Kiribati. The national government is the major employer in and is located in Tarawa, the capital. There are 23 constituencies in Kiribati, with 44 elected representatives representing them in parliament. The details of these constituencies are provided under the section 'key actors' below. The country uses three electoral systems, one to elect members of parliament, one to nominate and elect presidential candidates, and the other to elect the president.

For the inhabited islands, there are five local districts: Northern Gilbert, Central Gilbert, Southern Gilbert, Line Islands, and Phoenix Group, with 17 elected island councils and two elected urban councils. The central government Ministry of Internal Affairs administers local governments under the Local Government Act of 2000. As Uakeia explains, "Councils are appointed from villages headed by a mayor elected from among members. Councils are assisted by appointed officials, including the Chief Executive Officer, a Treasurer, project officer and other personnel appointed from the Ministry of Internal Affairs" (2016: 124). The state operates at the national, district and local council levels. In 2022, the World Bank indicated that Kiribati is among six countries in the Pacific that are classified as having High Institutional and Social Fragility. As indicated in Table 2, on the two dimensions of the World Bank's Governance Indicators, Kirabati scored a -0.14 for Governance Effectiveness and a -0.57 for Regulatory Quality.

Economy

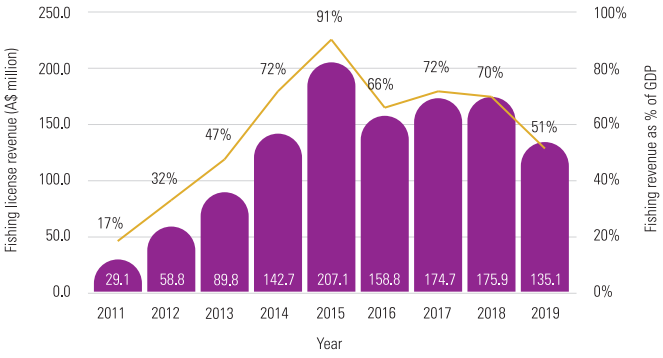
Land resources are limited by the type and size of atoll islands in Kiribati, except for coconut/copra exports and other livelihood activities. The current government made it one of its campaign promises to increase the buying price for copra from $1/kg to $2/kg and implemented it in mid-2016. As a result, copra exports (copra, crude oil, and copra meal) increased to A$11.4 million but dropped to A$4.1 million in 2018 (Webb, 2020: 18). It was an economic policy that could not be sustained.

As shown in Table 1, Kiribati has LDC status and access to IDA. It has an MVI index of 1 and very high vulnerability. It has a GDP of USD 200 million with a GDP per capita of USD 1,671. The national debt was at USD 36 million, which was about 18.10% of GDP. The country's deficit in 2020 was -0.7% of GDP, with debt sustainability labelled as 'high risk'. In 2019, the level of ODA received was 14.85% of GDP.

Fisheries are a significant source of revenue, especially after the introduction of the Vessel Day Scheme (VDS) under the Parties to the Nauru Agreement (PNA). The country's economy was shrinking by around 0.7% between 2006 and 2011 before the VDS was introduced in 2012. Between 2012 and 2017, the economy achieved 20.5% real growth. Fisheries contributed 32% to total GDP growth (ibid: 18). Other areas that contributed to the economy include wholesale and retail trade, government consumption

and administration, and financial intermediation (ibid). Figure 11 below shows Kiribati's fishing revenue as a proportion of GDP from 2011 to 2019.

Figure 11: Kiribati fishing revenue as a proportion of gross domestic product (GDP)



(Source, Webb, 2020)

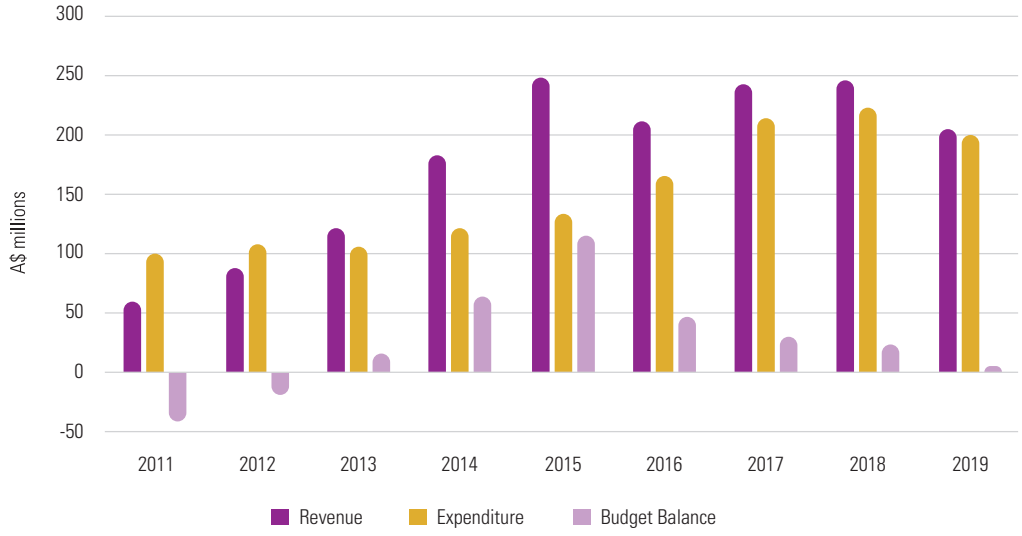
The Revenue Equalization Reserve Fund (RERF) was established by the British Colonial Administration Government of the Gilbert and Ellice Islands in 1956 with an initial sum of $555,580. By 1979, when Kiribati gained independence, it was valued at A$69 million. In 2018, the RERF was reported to have grown to A$997 million, and in 2021, the balance was A$1.310 billion (Duncan et al., 1995: 42; RNZ, 2018; Kiribati Government, 2021: 1). The Government of Kiribati can draw down from the RERF when necessary to fund budgetary shortfalls; but it did not make drawdowns in 2021. Like other microstates in the Pacific, Kiribati is regarded as a MIRAB economy, meaning it heavily relies on migration, remittances and aided bureaucracy to sustain its economy (Watters, 1987). Figure 12 below summarises the government's revenue, expenditure and budget balance from 2011 to 2019. It is important to note that total public expenditure includes donor projects.

I-Kiribati people migrate to other places to work, especially as seafarers, seasonal workers in New Zealand and Australia, and other regional and international organisations. This group sends remittances back to the country regularly. For instance, in 2020, the World Bank recorded that Kiribati received a total of USD 19,071,371, while in 2019, total remittances were recorded at USD 20,075,191.138 (World Bank, 2021). As indicated in Table 1, remittances received in 2019 were estimated to be about 10.7% of GDP. The Government of Kiribati is the largest employer.

As a MIRAB economy, Kiribati relies on aid donors and international agencies. One of their many donors, the ADB (2021:1), recently noted that since 1974, they had committed loans amounting to $34.1 million, grants totalling $90.8 million, technical assistance worth $18.5 million, and ADB-administered co-financing of $56 million for Kiribati. Cumulative loan and grant disbursements to Kiribati totalled $58.8 million, financed by concessional ordinary capital resources and the ADB.

The 2020 national population and the household census recorded a total population of 119,438 people in Kiribati, with 58,904 and 60,534 females. Moreover, 70,441 people live in urban areas, and 48,997 live in rural areas. A majority of the population lives in South Tarawa and Betio. It is important to note there are slightly more females than males in Kiribati. Table 46 below provides a summary of the population of Kiribati as recorded in the 2020 census.

Figure 12: Kiribati Government Fiscal Aggregates, 2011 – 2019



(Source: Webb, 2020)

Table 46: Population of Kiribati by division, island and sex

	Total	Male	Female
Urban/rural area			
Total	119,438	58,904	60,534
Urban	70,441	34,118	36,323
Rural	48,997	24,786	24,211
Division by islands			
Total	119,438	58,904	60,534
South Tarawa	63,072	30,281	32,791
South Tarawa	44,643	21,302	23,341
Betio	18,429	8,979	9,450
Northern Division	20,735	10,359	10,376
Makin	1,914	968	946
Butaritari	3,250	1,626	1,624
Marakei	2,738	1,350	1,388
Abaiang	5,815	2,972	2,843
North Tarawa	7,018	3,443	3,575
Central Division	8,344	4,219	4,125
Banaba	333	183	150
Maiana	2,345	1,193	1,152
Abemama	3,255	1,614	1,641
Kuria	1,190	605	585
Aranuka	1,221	624	597
Southern Division	15,994	8,134	7,860
Nonouti	2,749	1,415	1,334
North Tabiteuea	4,181	2,081	2,100
South Tabiteuea	1,356	674	682
Beru	2,214	1,117	1,097
Nikunau	2,055	1,089	966
Onotoa	1,417	732	685
Tamana	1,028	514	514
Arorae	994	512	482
Line islands & Phoenix Division	11,293	5,911	5,382
Teeraina	1,893	994	899
Tabuaeran	1,990	1,060	930
Kiritimati	7,369	3,837	3,532
Kanton	41	20	21

(Source: 2020 Census)

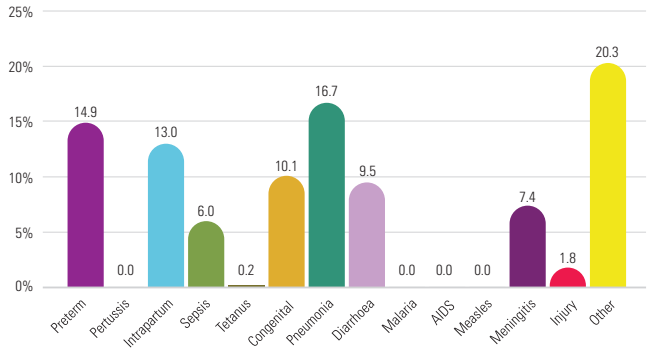
It is also important to note the socioeconomic indicators of Kiribati and its population. The population growth rate for Kiribati is 1.6% (Table 6). With the small land area, population density is very high and is currently at 147 persons/km2. The current birth rate per 1,000 is 27.4, and the median age is 23.

Life expectancy at birth for Kiribati is 68.4 years; expected school years are 11.8 years, and the mean years of schooling are 8 years. In addition, the degree of urbanisation is 54.8, while the rate of urban change between 2010 and 2015 was 3.53%. The percentage of skilled labour force in 2020 was 48.3%. Moreover, the HDI is 0.63, with 6.5% of representatives in parliament being women. Twenty-two women are chairs or deputy chairs of private sector or SOE boards, and 29 women are in senior and executive management positions in the private sector and SOEs (Table 3).

Health and WASH

Kiribati faces acute public health issues with high rates of communicable and non-communicable diseases. Contributing factors include high population density that results in poor sanitation levels. WHO reported that the number of leprosy and tuberculosis (TB) cases in Kiribati is among the highest in the Pacific as is the burden on non-communicable diseases (NCDs). WHO also highlighted problems with mental illness, domestic violence, injuries and gaps in the delivery of health services (WHO, 2017). The Kiribati Government spends around 9.3% of GDP on health. The mortality rate-neonatal (per 1,000 live births) is 22.1, while the mortality rate-infant (per 1,000 live births) and mortality rate-under-5 (per 1,000 live births) are 40.1 and 50.9, respectively. These are relatively high mortality rates and worrying indicators of health. Kiribati's Average 13 International Health Regulations core capacity score is 60 (see Table 6). In 2016, UNICEF carried out a study to determine the causes of all deaths in children under-five. As shown in Figure 13 below, the significant causes of death in Kiribati among children include pneumonia, preterm (premature birth), intrapartum, diarrhoea, congenital, sepsis and others.

Figure 13: Causes of all deaths in under-five children in Kiribati



Closely related to health concerns are water, sanitation and hygiene issues. According to the 2020 census, people in Kiribati mostly use groundwater through wells for drinking and washing. Table 47 shows that 12,300 urban and rural households rely on protected and unprotected wells for drinking, cooking and personal hygiene. This is a significant portion of the population. Also, note that many more households rely on water from unprotected wells than those using protected wells. This heavy dependence on underground wells is due to its availability, no matter the quality. In rural and informal communities, the cost of rainwater harvesting is prohibitive. Table 47 also show other sources of cooking and drinking water.

Table 7 provides the following statistics on the country's WASH status. The proportion of the population using improved sanitation facilities is 60.9%. The proportion of the population using improved drinking water sources is 80.9%, while the proportion of the population practising open defecation is 30.6%. Moreover, the proportion of population with a handwashing facility with soap and water available at home is 55.5%. These statistics give us a fair idea of the status of WASH in Kiribati.

Sanitation and hygiene in Kiribati also affect water quality and safety and are determined by availability of WASH resources. Most people in rural and outer islands use pit toilets and bush open defecation (Sinclair et al., 2015: 20). Over the years, there have been improvements, but more could be done, especially with approaches and strategies to discourage the extensive use of pit toilets and open defecation that can easily contaminate groundwater. Table 48 below shows the type and location of toilet facilities at the national and district level as reported in the 2020 census report.

The contamination of groundwater wells has been assessed through detailed studies and tests in various islands. They reveal that many wells were unprotected and contaminated by *E.coli* bacteria. For example, out of 225 wells tested in Nikunau, 81 showed *E.coli* contamination (Loco et al. 2015: 32). On Marakei island, out of 54 wells surveyed, 40 wells were contaminated (Sinclair, 2015: 30); of 83 wells and rain tanks tested in Maiana, 90% were contaminated (Loco et al., 2015: 40); while in Onotoa island, 58% of the 38 wells tested were contaminated with *E.coli* bacteria (Loco et al. 2020: 23).

Groundwater contamination is caused by waste disposal in atoll environments. Approaches to change people's mindsets to accept and practice better ways of disposing waste and the use of appropriate types of toilet facilities would go a long way to safeguard water sources, especially groundwater sources. The many prior studies and their recommendations should be carefully reviewed to address these WASH issues.

Table 47: Number of households by the primary source of drinking, cooking and personal hygiene water at national & district levels

Source of drinking / cooking water	Division						Urban/rural area		I-Kiribati head of house-hold
	Total	South Tarawa	Northern	Central	Southern	Line Islands & Phoenix	Urban	Rural	
Source of drinking water									
Piped into dwelling	788	510	25	32	60	161	665	123	725
Piped into compound, yard or plot	5,652	4,041	421	236	460	494	4,504	1,148	5,371
Public tap / standpipe	2,500	1,565	272	260	329	74	1,624	876	2,389
Piped to neighbour	1,257	725	189	34	239	70	792	465	1,215
Protected well	4,039	969	1,247	361	792	670	1,270	2,769	3,939
Unprotected well	7,000	1,678	2,042	1,001	1,758	521	1,899	5,101	6,792
Rain water with tank with tap inside	556	479	16	15	13	33	500	56	494
Rain water with tank with tap outside	2,731	2,248	171	115	89	108	2,299	432	2,548
Communal tank	2,478	513	904	169	696	196	632	1,846	2,392
Tanker truck	158	115	3	2	2	36	151	7	139
Bottled water	412	388	1	5	15	3	389	23	368
Desalinated water	34	19	2	-	13	-	19	15	32
PUB water	449	401	18	-	-	30	431	18	412
Rainwater from neighbour	99	56	5	1	13	24	73	26	94
Other sources of drinking water	107	47	23	2	20	15	57	50	106
Source of cooking water									
Piped into dwelling	801	499	30	35	60	177	672	129	734
Piped into compound, yard or plot	5,969	4,339	429	229	455	517	4,828	1,141	5,658
Public tap / standpipe	2,334	1,445	242	259	322	66	1,498	836	2,228
Piped to neighbour	1,182	648	184	39	240	71	712	470	1,146
Protected well	4,539	1,439	1,245	349	802	704	1,763	2,776	4,390
Unprotected well	8,187	2,645	2,106	1,007	1,848	581	2,929	5,258	7,910
Rain water with tank with tap inside	349	297	9	16	9	18	309	40	306
Rain water with tank with tap outside	1,651	1,350	86	107	68	40	1,374	277	1,536
Communal tank	1,133	299	304	124	328	78	353	780	1,100
Tanker truck	110	75	-	2	2	31	104	6	99
Bottled water	129	118	2	1	8	-	118	11	117
Other sources of drinking water	117	61	25	1	9	21	72	45	109

(Source: 2020 Census)

Table 48: Number of households in private dwellings by type of toilet facility & location

Source of drinking / cooking water	Division						Urban/rural area		I-Kiribati head of household
	Total	South Tarawa	Northern	Central	Southern	Line Islands & Phoenix	Urban	Rural	
Toilet facilities									
Flush to piped sewer system	712	686	-	-	-	26	712	-	643
Flush to septic tank	9,625	5,320	1,589	668	1,208	840	5,955	3,670	9,128
Flush to pit latrine	1,154	357	325	68	306	98	397	757	1,133
Flush to somewhere else	499	153	113	161	60	12	164	335	482
Pit latrine with slab	187	84	34	31	17	21	90	97	176
Pit latrine without slab - open pit	219	37	1	133	34	14	41	178	204
Water sealed	982	827	52	35	25	43	847	135	946
No facility, beach, bush etc	7,800	2,366	1,926	769	1,835	904	2,847	4,953	7,579
Other facilities	33	25	5	-	2	1	26	7	27
Share toilet									
Total	1,680	1,499	52	35	25	69	1,545	135	1,575
Yes	494	476	10	5	-	3	477	17	461
No	1,186	1,023	42	30	25	66	1,068	118	1,114
No. of households sharing toilet									
Total	494	476	10	5	-	3	477	17	461
1-2	254	239	8	5	-	2	240	14	235
3-4	158	155	2	-	-	1	155	3	147
5-6	60	60	-	-	-	-	60	-	58
7+	22	22	-	-	-	-	22	-	21

(Source: 2020 Census)

Physical Dimension – Climate, Climate Change, Water Availability

Kiribati is relatively small like Tuvalu, the Marshall Islands, and other small atoll island countries. As mentioned above, despite its huge ocean, the land area is only around 811 square km^2. Regarding land ownership and tenure, which has implications for WRM in the country, 50% of the land is public land or land owned by the state; 5% is freehold land, and 45% is under customary tenure (see Table 4). Legislative provisions cover compulsory acquisition for critical development projects. However, they are rarely used as they may create more problems than solutions. Instead, the state and its agents usually enter into lease arrangements with landowners regarding critical national projects, including WRM projects.

Kiribati is also highly vulnerable to the adverse effects of climate change. Indeed, climate change, especially sea-level rise, is an existential threat. There have been many studies and reports written by technical experts on the issue of climate and climate change. Most of the islands in the group are "located in the dry belt of the equatorial oceanic climatic zone" and that "[p]recipitation ranges from about 3,000 mm in the north (Butaritari) to 1,100 mm in the south (Tamana) in the Gilbert Group and from about 4,000 mm (Teraina) in the Line Islands to less than 800 mm on Kanton" (Thomas, 2009: 569). Prolonged drought seasons are also common across the islands, causing groundwater lenses to 'shrink' due to reduced rainfall. In a study of Beru island "[t]he drier season for rainfall is generally from May to November, with an average dry season rainfall of 648 based on monthly rainfall from 1945 to 2014" (Loco et al. 2015: 54). The lowest recorded annual rainfall was in 1950, with 247 mm (op cit.).

SPC commissioned reports that describe groundwater level, size of groundwater lens, potential issues and challenges for rainwater harvesting are listed at the end of this country profile and provide rich and detailed data and information on water availability in specific atolls. For example, Sinclair et al. (2020: 4) determined that 94% of people in the Gilbert group of islands access groundwater for their needs, and only 4% use rainwater. Although there may be potential to harvest and use rainwater, more people have access to groundwater despite quality considerations. Therefore, it is essential to study each island or group of islands, especially available data on water access and use, before designing specific interventions in WRM for Kiribati. Unfortunately, unlike other PICs, Kiribati did not have data on the status of IWRM (SDG 6.5.1) Implementation and Progress for 2017-2020 (see Table 9). Therefore, it is difficult to determine the implementation status and progress of IWRM, especially in terms of the enabling environment, institution and participation, management instruments, financing, and a final IWRM score that would allow for comparison with other countries.

Structures and Institutions

Kiribati follows both a modern system of government and a structure based on relationships that have been part of their culture and way of life from time immemorial. The structures and institutions under these two realms, plus the domain of churches/religion, must be understood when designing interventions in WRM. At times, the Roman Catholic Church (RCC), the Kiribati Uniting Church (KUC) and the Kiribati Protestant Church (KPC) and their followers have influenced political processes and outcomes in the country. The 2020 census reported 70,333 RCC, 25,322 KUC and 10,016 KPC members in Kiribati (NSO Kiribati, 2021: 18). They are the most influential churches in the country and therefore influence how national structures and institutions operate. The structures of the modern state are defined by the constitution and the various laws and policies used to govern Kiribati.

The National Parliament (or *Maneaba-ni-Maungatabu*) consists of 44 elected MPs and two appointed, representing 23 electoral constituencies. The modern government structure is a hybrid of presidential and prime ministerial systems. The appointed MPs include one representing the I-Kiribati people living on Rabi in Fiji, which was relocated because of phosphate mining during the colonial era. The speaker is elected by MPs from non-MPs. The President of Kiribati comprises two roles, the head of government and head of state. The president is nominated among at least three other MPs by MPs themselves before the voters vote for the president (Uakeia, 2016). The 44 MPs are elected using the Two Round System (TRS) of voting, while presidential candidates are voted for using a variation of the TRS. The election of the president uses First-Past-the-Post (FPTP) approach and whoever gets the majority votes then forms the government from the MPs.

Similar to Vanuatu and Tuvalu, there are both single and multiple representatives for each constituency in the country. A summary of the representatives for each constituency in Kiribati is as

follows:

- 7 constituencies return 1 MP = 7 MPs
- 11 constituencies return 2 MPs = 22 MPs
- 5 constituencies return 3 MPs – 15 MPs
- Total = 23 constituencies and 44 MPs

As in other PICs, gender representation is an issue in the Kiribati Parliament. As highlighted in Table 3, women's representation in parliament in Kiribati is only 6.5%. As part of the government structure and institutions, Kiribati also has 17 elected Island Councils, as earlier indicated. In theory, these local councils established by the Local Government Act of 1984 are fiscally empowered to deliver primary education, health, and utilities. However, in reality, they do not have control over the delivery of services nor the ability to raise enough funds to provide services (Richardson, 2009: 122). This is understandable given the limited economic opportunities and constraints faced by the central government.

Apart from the formal structures and institutions, it is crucial to appreciate the influence of informal/indigenous institutions. Such informal institutions include land tenure and how decisions are legitimately made and respected at the community level. For example, in the outer islands, the *Unimwane* (council of elders) exercise considerable influence over their people even though they are not recognised by the Local Government Act of 1984. The *Unimwane* ensures that no one is left in absolute poverty and that peace and order in the communities are maintained. However, this sometimes produces tensions between the local governments legally recognised as part of the modern state and the *Unimwane*, the institution highly regarded by local people in their respective communities.

Indigenous institutions such as the *Unimwane* control and determine decisions on land ownership and other livelihood issues. As such, they are critical institutions to engage when working in WRM in rural and outer island communities where the presence of the modern state is often absent. Familiarity with variations in land tenure systems and ownership in Kiribati, depending on the island or group of islands, is also essential. In the southern islands of Kiribati, traditional land titles are transferred through inheritance within the family based on age and gender, males before females. In the northern islands, a feudal, highly stratified culture is present, with high chiefs at the top and commoners at the bottom (see Taoaba, 2017: 84-85). For instance, chiefs can allocate land to supporters to become higher chiefs. When designing WRM interventions for specific communities/islands in Kiribati, knowledge of the social structure and land tenure systems in that part of Kiribati would be helpful to bear in mind.

Key Actors

Table 49: Key Actors involved in WRM in Kiribati

Key Actors	Role Relative to WRM
State Structure (SS)	Formal structure of the state including relevant government ministries and agencies that deal with WRM (ministries and departments).
President and Cabinet Ministers (PCM)	The President in Kiribati is both the head of government and head ofsState. Together with his cabinet ministers, they play a major role in endorsing interventions in WRM.
Member of Parliament (MPs); Individual MPs	MPs represent their constituencies. In the case of Kiribati, there may be more than one MP per constituency. Each MP should be convinced to support WRM, not just one MP.
Local Councils (LC)	Responsible for providing water and sanitation services to their constituents under the Local Government Act (LGA).
Technical experts (TE)	Responsible for designing and implementing WRM programmes and may come locally, regionally or from donor countries.
Churches (CHS)	Churches are very influential in local communities and can play an important role in WRM if requested.
Donors (DNRS)	Donors, including multilateral organisations provide financial and technical support to WRM projects in Kiribati.
Council of Elders or Unimwane (UNW)	They ensure stability and order in communities but are not recognised by the LGA. They are potentially useful in WRM implementation.

Overview of WRM – Status, Constraints and Drivers

The majority of the population relies on groundwater wells that require proper management to minimise contamination. In addition, there is potential to develop rainwater harvesting in local/outer island communities and urban centres. Suitable rain harvesting roofs and tanks are supplied and properly installed, the cost of which is prohibitive for ordinary citizens.

Many surveys and reports have been done on water resources in Kiribati. The various reports, some of which are specific to certain islands and communities, covered the status of water resources, water resource management constraints/challenges, and the possibilities to improve access, quality, and storage of water.

Risks and mitigation factors are outlined by Sinclair et al. in their 2015 reports commissioned by SPC. These reports assessed water resources, hygiene and sanitation situations, especially in the outer islands of Kiribati, for KIRIWATSAN (Water and Sanitation in the Outer Islands of the Republic of Kiribati). The project had three components: (i) hydrogeological assessment and design, (ii) rainwater harvesting (RWH), and (iii) community mobilisation and capacity building. The final progress report highlighted the following outcomes (SPC, 2015: 13):

- Delineation of the freshwater lens, preliminary estimates of sustainable yield, and identification of optimal areas for communal groundwater supply sources.
- Establishment of the groundwater and RWH infrastructural status and identification of appropriate technological improvements.
- Establishment of bacteriological contamination status of existing water supply systems.
- Identification of potential RWH infrastructure for communal water supply options considering the variability in rainfall CV and effects of ENSO processes.
- Assessment of sanitation systems and recommendation of appropriate sanitation options with consideration to the hydrogeological, environmental and social requirements.
- Preliminary design for appropriate groundwater and RWH technological options for water supply as per the WRA findings and community preferences.

KIRIWATSAN listed the challenges to sustainable outer island and rural water sanitation systems as follows:

- Lack of local community engagement in ownership and maintenance of water and sanitation projects.
- Uncertain statutory basis for managing and charging for water in outer islands.
- Lack of recognition of the relationship between health and hygiene.
- Limited applicability of developed world solutions.
- Limited agency and local island capacity.
- Failure to recognise and address connected water and land ownership issues.
- Improved health and hygiene involve behavioural change, a long-term process.
- Limited understanding of the unique and fragile nature of fresh groundwater in atolls.
- Centralised bureaucracy and a much-dispersed network of customers.
- Conflicting and uncooperative agencies.
- A lack of training and mentoring of island staff.
- The large proportion of aid funds spent on external technical assistance is viewed unfavourably. (Sinclair, Loco & Mataio, 2015: 6)

These are critical considerations and factors to take into account when designing WRM programmes for Kiribati and many other PICs. Recent and current water resources and sanitation-related projects that could be consulted when designing new WRM programmes are listed below (Table 50). The list is extracted from Sinclair et al. (2021: 23-25).

Table 50: Recently complete and existing water and sanitation projects

Project/ Programme	Donor	PIC	Water Sector Interventions	Period
Water Scarcity Programme (SPC)	New Zealand's Ministry of Foreign Affairs and trade (NZ-MFAT)	RMI, Tuvalu, Kiribati	Installation of drought-resilient water supply systems (rainwater/ groundwater) in outer islands. Improvement of skills and capacity and institutional arrangements to enhance water security.	2020-2024
Global Climate Change Alliance Plus Scaling Up Pacific Adaptation GCCA+ SUPA (SPC)	European Union (EU)	RMI, Tuvalu, Kiribati, FSM	Strengthening sector-based climate change and disaster-risk-management strategies and plans through improved coordination and integration in implementing organisations and utilising a gender-sensitive / rights-based approach and involving all stakeholders.	2019-2023
Climate Early Warning Systems in PICs (SSC) - Bonriki-Kiribati	India government funding	Kiribati	Installation of near-real-time salinity and flow meters on all Bonriki gallery wells and water treatment plants to optimise groundwater abstraction by the Public Utilities Board for the residents of South Tarawa, Kiribati, particularly during drought periods.	2020
Kiritimati Water Supply Project (SPC)	EU	Kiribati	Improved operation and management of water supply and sanitation scheme in Kiritimati Island and nearby outer islands through strengthened economic dialogue on Public Financial Management (PFM) reforms, improved access to safe and sustainable drinking water; strengthened the provision of adequate and equitable sanitation and hygiene facilities; and improved Community and household resilience.	2020-2024
South Tarawa Water Supply Project	World Bank with financing from Asian Development Bank (ADB) and Green Climate Fund (GCF)	Kiribati	Improvement of South Tarawa water supply through (1) Improvement of water supply services to increase resilience of the services to climate change. (2) Institutional strengthening and implementation support that contributes to the sustainability of water-related investments funded in 1 and to help improve the operational efficiency and financial viability of the Public Utilities Board. (3) Supporting the formulation and implementation of a comprehensive and intensive 5-year Water, Sanitation and Hygiene (WASH) Awareness program.	2020 - 2027

Enabling WRM and the Political Economy

To enable WRM and the political economy, dynamics between key actors and the situation on-the-ground must be considered. It is also critical to learn from what has been done, especially what works on the ground and to avoid or minimise constraints and stumbling blocks. The following points should be noted in this regard (see Sinclair et al., 2015: 7):

- remoteness and accessibility of materials
- transportation of materials
- access to tools, machinery and fuel
- cultural and societal setting
- land ownership
- low-cost and appropriate technologies
- replicable and sustainable systems
- affordability
- standardisation
- available skills and labour
-

It is essential that local people or expected beneficiaries of programmes/projects are involved in the design, implementation and maintenance of facilities/infrastructure after the life of the project. Some formal arrangements/understanding between the supplier or host of the water supply (church, school, etc.) and the water recipient (individual household) would be helpful. Their participation in the determination of the project enables them to suggest solutions based on their knowledge of the context and local experience.

The proactive engagement of various local actors in WRM at the local level should also be a priority. As highlighted above, the institutions of the state, the church and cultural leadership/ influences are all important in local communities. Engaging with all or most of such actors is necessary to ensure some feeling of responsibility and ownership over the developed infrastructure and for the maintenance and continuity of the services provided after the life of the programme/project. Strategies for community members to generate funds/contribute in-kind resources should be considered during programme design.

In Kiribati, land is limited and precious. It will be necessary to find ways to formalise consent to access land and water sources, especially during droughts. Sinclair et al. (2015) added that apart from the need for formal approvals and their enforcement, there is also a need to "identify mechanisms to be in place to ensure long-term access to the source and long-term management of the resource" (Sinclair et al. 2015: 22). Moreover, there should be proper and regular training at the community level on continuous monitoring and evaluation.

Recommendations

1. Water resources and sanitation issues have been well documented in many parts of the country, a review of best practices and works should be the starting point for designing any AWP support to WRM in Kiribati. The detailed data generated by the KIRIWATSAN project and their recommendations for particular islands and communities are realistic. Use existing knowledge, data, and information available through previous assessments and existing projects by other donors, as listed in Table 50.

2. In Kiribati, any intervention should incorporate behaviour change in its design and implementation. This will help stakeholders and beneficiaries to appreciate the direct connection between water resources management, sanitation and hygiene. An excellent example of this is UNICEF's community totalled sanitation (CLTS) approach that 'triggers' village communities to stop open defecation through raising awareness of health impacts through current sanitation practices" (Sinclair et al. 2015: 6).

3. Ownership and continuity should be factored into activity design, such as through coordinating committees that recognise the crucial influence and legitimacy of informal/ indigenous entities such as the *Unimwane* or churches in matters affecting their people. In some situations, these informal entities determine the success, continuity or failure of externally funded programmes and projects. The effort should also improve existing facilities/infrastructure and make them cleaner and safer.

4. It is also recommended that the programme or activity design avoid complex local-level politics that are connected to geopolitics, especially China and other donors. Political leaders are sensitive to such issues. There are also issues related to

'boomerang aid' highlighted in one of the reports cited above that must be addressed to ensure the country's acceptance of projects, especially at the local level. Engaging local skilled construction staff as the basis of construction teams, for instance, would be a welcome gesture in many Pacific Island countries. The point is to be conscious of how political leaders and local people perceive a new donor-funded intervention/programme in WRM. The success of programmes may be determined by such considerations and sensitivity to local perceptions.

Photo courtesy of Dave Hebblethwaite, SPC

Marshall Islands

Introduction

Comprised of 29 atolls, five islands, and around 1,150 islets, the Republic of the Marshall Islands (RMI) shares maritime borders with the Federated States of Micronesia, Kiribati, and Nauru. The atolls and islands are formed in two groups, Ratak (sunrise) and Ralik (sunset), located between 5°-15° Latitude North and 162°-173° Longitude East. Spread over an exclusive economic zone of 1.2 million km^2. Twenty-two of the atolls and 4 of the islands are uninhabited. The total land area is around 181.4 km^2, with Kwajalein being the largest (16 km^2). Majuro, the capital, comprises 64 islands. Likiep atoll has the highest elevation at 10 metres. With RMI's mean elevation above sea level being 2 metres, the country is ecologically vulnerable.

RMI traditionally has a *matriarchal* society, with land rights traditionally inherited along the *matrilineal* line. Non-Marshallese may lease but not own land. Land can be leased in perpetuity.

Political Context

RMI became self-governing in 1979 and attained full independence in 1986 upon the signing of its Compact of Free Association with the USA. The government is a mixed presidential-parliamentary system established by the Constitution of the Marshal Islands in 1979. The national government comprises the executive branch consisting of the head of state and head of government - the president, who parliament elects, and the cabinet, which the president appoints. The Legislature is a 33-seat unicameral parliament (Nitijela); the 12-member Council of Chiefs advises on matters affecting customary law and practice. In addition, there are 33 municipalities; each of which has a written constitution, an elected mayor, and council. Councils may make ordinances applicable to their area of jurisdiction provided these do not contravene any law and includes levying of taxes for the appropriation of funds for local purposes.

Economy

RMI's economy is heavily dependent on funding from the Compact and the annual lease payment for Kwajalein Island, which is used as a US military base. Subsistence agriculture and fishing supported by handicrafts, tuna processing, copra, and limited tourism contribute to GDP. Real GDP in 2019 was USD 240 million, and GDP per capita at USD 4,000.[44] Its debt is at 19% of GDP and is considered High Risk (Table 1). Net ODA was 22,5% of GNI in 2019. It is a member of the IDA and has an MVI index of 2 (very high vulnerability).

Socioeconomic

RMI's socioeconomic indicators lie in the upper range in the Pacific. Its HDI global ranking in 2019 was 117. Urbanisation is growing at 0.82% per annum. RMI's matrilineal society is reflected in the comparatively high proportion of women in leadership roles (Table 3).

Population

The national population was estimated at 59,610 in 2021[45] with an annual growth rate of 0.64% ranking it 140th globally. RMI has a highly urbanised population of 77.4% (op. cit.) with a density of 331 km^2 ranking it 41st globally. Majuro has a population of 25,400 and Ebeye 15,000, together accounting for 68% of the population. Majuro has a population density of 7,400 inhabitants/km^2, and Ebeye has 46,000 inhabitants/km^2, ranking it 6th globally. RMI's median age is 23.9, with a high birth rate of 22.4/1,000 (Table 6).

[44] CIA World Fact Book

[45] https://worldpopulationreview.com/countries/marshall-islands-population

Health

SDG 3 data for the PICs is poor, so selected WHO global health indicators were examined to compare the health and wellbeing of RMI's inhabitants (Table 7). RMI's reported indicators are slightly better than the global averages. Rotavirus is a significant cause of infant diarrhea, which is primarily transmitted through faecal-oral contact and can lead to death and. Rotavirus vaccination rates (%) for infants less than 1-year-old in RMI are around 40%.

The key finding for children under five years from the Integrated Child Health and Nutrition Survey (ICHNS, 2017) was that around 15% of children were moderately to severely underweight. At the same time, over 45% of children were moderately to severely stunted. In addition, diarrhea occurred in 9.3% of children (Table 51).

Table 51: Selected Indicators from the Integrated Child Health and Nutrition Survey (2017)[46]

Indicator	%
Underweight prevalence	
Percentage of children under age five who fall below minus two standard deviations (moderate and severe) of the median weight for age of the WHO standard	11.7
Percentage of children under age five who fall below minus three standard deviations (severe) of the median weight for age of the WHO standard	2.7
Stunting prevalence	
Percentage of children under age five who fall below minus two standard deviations (moderate and severe) of the median height for age of the WHO standard	35.3
Percentage of children under age five who fall below minus three standard deviations (severe) of the median height for age of the WHO standard	10.2
Child Health Care	
Percentage of children under age 5 with diarrhea in the last two weeks	9.3

Water Sanitation and Hygiene (WASH)

Virtually all Marshallese have access to improved drinking water sources (Table 8). However, improved drinking water does not mean it is safe and free of pathogens. MIEPA tested 142 groundwater wells of outer islands and found 36% of these were defective, i.e., conductivity levels exceeding 1,000µS/cm. Testing of rainwater catchments (tanks) in Majuro revealed 65% were contaminated.[8]

Most Marshallese (89.6%) have access to improved sanitation facilities. Disaggregation into urban and rural (Table 4) shows sanitation is an issue in the outer islands, with 33% practising open defecation. Access to handwashing facilities and soap is relatively high at 85%. The high incidence of stunting and the levels of diarrhea in children under 5 years suggests that access to safe drinking water is still a significant public health issue in the Marshall Islands.

[46] RMI Statistical Yearbook, 2017.

Physical Dimension – Climate, Climate Change, Water Availability

Climate

The average temperature is relatively constant throughout RMI, with slight variation between seasons. The Intertropical Convergence Zone brings rainfall throughout the year, with atolls to the south, i.e., closer to the equator receiving around 2,500mm annually and those to the north around 1,250mm annually (Table 52). Wetter conditions result when the West Pacific Monsoon is active over RMI. However, the climate varies considerably depending on the El Niño Southern Oscillation State. La Niña years are associated with wetter than normal conditions and El Niño with warmer, drier conditions, resulting in more intense typhoons. However, these are historically infrequent in RMI. Severe El Niño events can reduce rainfall by up to 80% in the first half of the year.

Table 52: Mean monthly rainfall and rainy days for Majuro and Ebeye[47]

Place	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Majuro	mm	214	188	211	256	292	305	320	302	295	320	324	307	3334
	rainy days	16	15	16	17	19	20	21	20	19	20	19	18	220
Ebeye	mm	49	44	71	102	116	121	150	157	184	203	180	116	1493
	rainy days	7	6	8	12	14	16	19	19	21	21	17	12	172

Climate Change

Average maximum temperatures have increased in Majuro (0.12°C) and Kwajalein (0.2°C) per decade since records commenced in 1960. Annual rainfall has decreased in Majuro and Kwajalein, and yearly variability has increased. Ocean expansion due to warming is causing sea-level rise. Satellite-derived data shows RMI has experienced a 0.3mm per year sea-level rise since 1993. IPCC AR6 projections are that rainfall may increase with fewer droughts (medium confidence) while temperatures will continue to rise (high confidence). Sea level rise will continue, and, when combined with year-to-year climate variability, will increase storm surges and coastal flooding, which will impact atoll freshwater lenses and decrease freshwater availability.

Water Availability

As an atoll nation, RMI's primary source of freshwater is rain, which percolates through the low-lying porous atoll ground (average height 2 metres) until it reaches the saturated zone, where it then leaks into the surrounding seawater. The freshwater is accessed through shallow hand-dug wells, and the extraction rate depends on the size of the lens, the rate of recharge (rainfall), and evapotranspiration. RWH is also a significant source of drinking water, usually collected in a tank from roof runoff. There is a high reliance on this source on the outer islands. In addition, Majuro's rainwater harvesting off the airport runway produces around 700 million litres annually. RMI has rainfall all year round, with some season peaking (Table 52) and north to south rainfall gradient. Once drought conditions set in, the supply of drinking water dries up. Consequently, desalination and water importation are used for supplementation during prolonged drought periods associated with intense El Niño conditions. Freshwater lenses are critical for water security during these conditions, and careful management of extraction rates is required to ensure water quality and lens integrity are maintained.

[47] https://www.pacificclimatechangescience.org/wp-content/uploads/2013/09/Marshall-Islands

Structures and Institutions

Customary Law

RMI traditionally has a *matriarchal* society, with land rights traditionally inherited along the *matrilineal* line, and women are heavily involved in decision-making. The Council of Chiefs, which advises on matters affecting customary law and practice, has significant influence, and the majority of RMIs' presidents have been paramount chiefs.

Water Policy

The RMI National Water and Sanitation Policy was approved by Cabinet in 2014 and signed by the President. The Policy's vision statement is "Enabling all citizens to access clean and adequate water supplies and a level of hygiene and sanitation comparable to world standards." The GEF Pacific IWRM RMI Project assisted in establishing the National Water and Sanitation Task Force, comprised of government agencies and community stakeholders who developed the policy. It established a masterplan that integrated efforts to meet the vision. Cooperating agencies at the time were Infrastructure, Outer Islands Development, Environment, and Resources and Development. Costed action plans were then developed through ministries, statutory agencies, and atoll local governments.

The WatSan Policy had five strategic goals.

1. Reduce the occurrence of waterborne illness.
2. Ensure water resource sustainability.
3. Ensure water and sanitation utilities are financially solvent.
4. Target service improvements to the disadvantaged.
5. Be resilient to climate variability and extreme events.

The WatSan Policy proposed a new institutional framework to guide the implementation. A WatSan commission was to oversee a new National Water Office responsible for coordination and implementation. In addition, community-based water committees were to manage local water resources.

It was a regional model of how IWRM could be implemented—consultative, cross-cutting, coordinating, and integrating resources to achieve stated and measurable outputs and outcomes. Still, it was not progressed beyond being a policy.

The Water and Sanitation Strategic Plan 2017–2027 relates to the strategic rehabilitation of Majuro Water Sewer Company (MWSC).

Other Related Policies

The National Environment Management Strategy 2017–2022 promotes sustainable development and integrates environment conservation and the proper governance of development efforts.

RMI's National Strategic Plan (NSP) 2020-2030 is designed to be the "apex planning document outlining the RMI's over-arching policy framework and objectives" and to align with the priorities and frameworks outlined in national policies, sectoral plans, and international agreements.

The National Climate Change Policy Framework (NCCPF) sets out the Government of the Republic of the Marshall Islands (RMI) commitments and responsibilities to address climate change. This framework will guide the development of adaptation and security measures that respond to the needs of the RMI and foster an environment in which the RMI can be better prepared to manage current climate variability and future climate projections.

Key Actors

The key actors involved in WRM in RMI were identified (Table 53), and their relative support or opposition was assessed, along with their influence on the implementation of WRM.

Table 53: Key Actors involved with WRM in RMI

Key Actors	Role Relative to WRM
President (P)	
Legislature (Nitijela)	Responsible for legislation
Municipal Mayors and Councils (MMC)	Responsible for the administration of municipal services
Ministry in Assistance and Environment (MAE)	Responsible for the sustainable use, development, and review of policies, laws, rules, and regulations related to the environment
Ministry of Finance, Banking and Postal Service (MFBPS)	Responsible for budget policy advice and process, review of government programs, regulation of banking and postal services
Ministry of Health and Human Services (MHHS)	Responsible for providing quality essential health and nutrition services for all people of the Marshall Islands
Ministry of Works, Infrastructure, and Utilities (MWIU)	Responsible for providing reliable and safe works, infrastructure, and services
Ministry of Natural Resources and Commerce (MNRC)	Responsible for the development of the economy through promoting agriculture, investment, trade, and energy development
Ministry of Culture and Internal Affairs MCIA)	Responsible for planning and implementing cultural policies and the internal security of the Marshall Islands
Marshal Islands Environment Protection Authority (MIEPA)	Responsible for water quality and environmental health, land and coastal management, conservation, waste and pollution, information management, and education and awareness
The Economic Policy, Planning and Statistics Office (EPPSO)	Responsible for the collection, collation, and analysis of government statistics to provide policy advice to the Government
The Office of Environmental Planning and Policy Coordination (OEPPC).	Responsible for protecting human health and the natural environment of the Marshall Islands by actively supporting a sustainable balance between RMI's Economy and its natural environment and to ensure improved coordination of all international and regional environmental programmes
The National Disaster Management Office (NDMO),	Coordinating the Implementation of the National Disaster Risk Management Arrangements (NDRMA)
Economic Policy, Planning and Statistics Office (EPPSO)	Serves as an economic advisor to the Republic of the Marshall Islands Government. It is responsible for Policy & Strategy Development, Statistics & Analysis, Performance Monitoring, Evaluation & Aid Co-ordination.
Kwajalein Atoll Joint Utilities Resources Inc (KAJUR)	Supply of water on Kwajalein
Majuro Water & Sewer Company, Inc. (MWSC)	The company provides water & sewer services to the residents of Majuro Atoll.
Marshall Islands Council of Non-Government Organizations (MICNGOs)	A coalition of non-government organisations (NGOs) that includes a total of over 190 local NGOs comprising civil society organizations (CSOs), community-based organisations (CBOs), the private sector, and faith-based organisations (FBOs).
Marshall Islands Conservation Society (MICS)	Builds awareness, support, and capacity for sustainable use of resources, conservation, and protection of biodiversity
Women United Together Marshall Islands (WUTMI)	Supports Marshallese women, and in so doing, strengthens Marshallese families

Overview of WRM – Status, Constraints, and Drivers

Status

As an atoll nation, the Marshal Islands is entirely reliant on rainfall through freshwater lenses and rainwater harvesting. The Marshall Islands enjoys high monthly rainfall throughout the year and, in a "normal climate year," collects sufficient water to meet its needs. However, climate variability and climate change result in few "normal climate years," meaning lens recharge and RWH systems become unreliable, and as a result, so does water supply. This situation holds for all the Marshall Islands but is particularly problematic in Majuro and Ebeye, which have high population densities.

Water supply in Majuro is sourced from the Laura lens (around 400,000 m^3 per annum), the airport catchment system (approx. 30 ha) discharging into reservoirs (130,000 m^3), and the hospital and capital building (150 m^3 per day). Only around 25% of residences are connected to the MWSC's piped network due to the cost of water and poor reliability of supply and quality. Water supply is available for four hours each morning and afternoon on Mondays, Wednesdays, and Fridays.

Most residences rely on household RWH. Monitoring of water quality by EPA demonstrates an inadequate supply system with around a 40% sample failure to meet standards. The piped network also has heavy water losses, which contribute to the poor quality of the supplied water; 38% of Majuro residents buy bottled water for drinking water.[48]

The MWSC system has two major supply issues, limited reservoirs and high leakage rates, which result in inefficient use of rainfall and collected water. Both limit the financial viability of MWSC. As a result, JICA has recently signed an agreement with the RMI Government to construct a reservoir of 113,500 m^3, convert an existing raw water reservoir into a treated water reservoir, and upgrade an associated treatment plant.

Ebeye's water supply is more problematic. It has minimal groundwater, and its high population density and lower and variable rainfall–about 50% of Majuro's (Table 52) –lowers the capacity of household RWH. Primary sources of potable water on Ebeye are the public water supply provided by KAJUR (78%), household RWH (21%), and bottled water (1%). KAJUR produces its water from seawater using reverse osmosis desalination. It produces 590 m^3 of freshwater per day, potentially providing 61.5 litres per person per day. Like Majuro, maintenance of the supply network is problematic on Ebeye, with about half of the supply being lost. Water is supplied to households for one hour per week through the network. Public standpipes are available and Kajur provides a water cartage service. KAJUR makes an annual loss of around $2 million, funded through grants from the Compact with the United States.

Ebeye has a high incidence of waterborne disease (primarily gastroenteritis), with the hospital reporting 1,200 cases a year over the last 20 years. The high incidence of waterborne diseases is attributed to limited access to safe water, ineffective hygiene (particularly for children), and a neglected sanitation system.[49] The ratio of students to functioning school toilets exceeds 150 to 1. The sewage treatment plant has not operated since 2001, and raw sewage is pumped directly into the ocean, as is the case in Majuro.

The outer islands rely on groundwater accessed through hand-dug wells and RWH for drinking water. Variable rainfall and severe drought significantly impact the outer islands, as of course, it does with all the Marshall Islands. Managing the extraction from freshwater lenses to ensure quality and integrity are maintained is an issue. When rain is plentiful, so too is recharging and RWH. However, in a severe drought, RWH is useless. The freshwater lens reservoir is paramount, and demands are at its highest yet yield potential is at its lowest. Such a situation demands that extraction is at a sustainable rate, and this requires knowledge, monitoring, and regulation, at a local/community level.

The enabling environment to achieve a sustainable balance between the social, economic, and environmental needs for water can be defined by policies and legislative frameworks, financing, and implementation. Governance is weak (Table 2). The health indicators for RMI (Table 7) show a comparatively low standard of living, with government and public utilities struggling to provide basic WatSan services. RMI's human development ranking of 117 and per capita GDP are at the lower end among PICs. There are, as a result, significant financing problems. The human right to water means, at minimum, there is sufficient capacity to meet basic needs (drinking, washing, cleaning, cooking, and sanitation). It also means the water is safe (free of pathogens and not dangerous

[48] Water Source 2017Water challenges in the Marshall Islands, Water e-Journal Vol 2 No 2 2017

[49] Republic of the Marshall Islands: Ebeye Water Supply and Sanitation Project

to health) and accessible. Evident failures in all parameters, (i.e., the sufficiency, safety, and accessibility of water) suggest that implementation needs improvement.

The model RMI National Water and Sanitation Policy was passed by Cabinet and signed by the President. It was developed through a robust participative process involving government, NGO, and community stakeholders but financing and implementation have failed to progress. The posit being advanced is that despite support, the policy lacked coherence, resulting in a failure of governance, a lack of finance, and a lack of implementation.

Constraints

Socioeconomic inequalities exist in the Marshall Islands, which is reflected in the lack of investment in WASH infrastructure. SDG Targets 6.1 and 6.2 call for "universal and equitable access to safe and affordable drinking water" and "access to adequate and equitable sanitation and hygiene for all." Sustainable management of water resources is key to ensuring economic health and improving societal wellbeing.

The UN-Water's Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2017 study (WHO, 2017) indicates that a lack of financial resources is a significant constraint to achieving higher investment levels in most developing countries. Marshall Islands has obtained donor funding for infrastructure to address its water supply and sanitation issues in Ebeye and water availability in Majuro. Resources are also needed to operate and maintain these systems on an ongoing basis, which then becomes a political issue involving bargaining and influence. These are the challenges of governance in RMI.

Investment in infrastructure in the Marshall Islands is further complicated because all land is privately owned and cannot be sold, i.e., there is no public land on the Marshall Island; all government infrastructure is on leased land.

The OECD Water Governance Survey provides a valuable overview of where RMI's governance is failing (Table 11). However, the survey also illustrates a recurring problem in attempting to critically and comparatively appraise using global indicators generated through questionnaires and self-reporting, i.e., the information is incomplete. In the case of the Pacific, some are not relevant.

Water governance in RMI, as assessed by the OECD water governance survey, is poor. The RMI National Water and Sanitation Policy was approved by Cabinet in 2014 but was never implemented, and the poor water governance accounts for this. UN-Water has compiled baseline country data to enable reporting on global progress toward SDG6 and, as part of that baseline, has established the degree of IWRM implementation (indicator 6.5.1). These baselines indicate that IWRM implementation sits at the medium to low level in four out of five categories and low in the financing category (Table 10).

It is argued that for WRM in the Marshall Islands to meet these water rights, three elements must be in place: effective and transparent governance, adequate financing, and implementation. Both vertical and horizontal policy coherence is needed in WRM as it is cross-cutting. A standard WRM policy needs to have vertical coherence across government agencies, national and local. Similarly, horizontal policy coherence is required across government agencies–all have a role to play in WRM. They need to coordinate their efforts through an immersed WRM policy. Indeed, their respective policies should be joined through the incorporation of WRM. This approach contrasts with a specific WRM sectoral approach used in the past and which has mostly failed. IWRM goes part the way in accommodating other actors in WRM but is still based on a sectoral approach.

In looking at the political economy of WRM, there is significant support for WRM. Yet, politicians have failed to deliver appropriate access to safe drinking water. As politicians need visibility as part of the electoral process, the incentive is to provide infrastructure and goods with maximum and short-term impact and enable politicians to "claim" credit and derive the electoral benefit (Mani and Mukand, 2007). WatSan policy, financing, and implementation do not meet that criterion. WRM is not a one-off cost; instead, it is a significant recurring cost that does not offer short-term political gain. Decision-makers may morally support the need for WRM, but where financing is difficult and electoral politics are poor, the imperative falls away.

Drivers

Pressures on RMI's water resources and the environment are being generated through human activities such as urban development brought about by population growth through inward migration from the outer islands, lack of land use planning, geo-

morphology, and climate change. These pressures are the result of economic, socioeconomic, cultural, and climate change and variability drivers.

RMI's population is growing with an annual growth of 0.64%. Climate change and variability result in the migration of outer island people to urban centres, which places increased pressure on services with linked impacts on water resources and sanitation. The limited land area also means most food needs to be imported. In addition, there is no public land in RMI, which means infrastructure costs are higher as locations need to be leased. These costs are compounded when dealing with remote outer islands due to materials' high logistical and transportation costs.

The socioeconomic indicators (Table 3) indicate there are many stressors within RMI society. For example, waterborne diseases, stunting, and underweight children are symptomatic of a stressed system related to WASH. In addition, poor water governance indicators suggest that leadership, knowledge, and finance are missing drivers.

The RMI National Strategic Plan 2020-2030 reflects this tension in that while imperatives for WASH are acknowledged and strategies have been developed, these relate to the main population centres of Majuro and Ebeye. The WASH dilemma in outer islands' receives little attention. The implementation of the strategy relies on sectoral plans and therefore fails to drive vertical and horizontal coherence. Top-down plans have no evidence of community engagement and represent the priorities of city-based ministers and government bureaucrats and are therefore likely to differ from the priorities of people living in the outer islands.

WatSan infrastructure is allowed to deteriorate as too little recurrent funding is available for maintenance. There is little political incentive to level a charge for WatSan that reflects the cost of its ongoing supply due to the "common good" nature of water, i.e., usually phrased as “provided by God, so why is there a charge for it?" Politicians see service charges as being a "hip pocket issue" and therefore electorally unpopular. In RMI, public WatSan facilities make significant annual losses, which means they need to be subsidised by the government. Similarly, municipal WatSan schemes struggle financially due to the unwillingness to recover the cost. Well-managed and resourced WatSan utilities would offer increased efficiency and decreased water losses. Moreover, it would develop consumer and political confidence and, with it, a willingness to pay for the services.

Within the PICs, there also needs to be a recognition within society that the government alone cannot take on the full responsibility of providing WatSan services to all, particularly given the remoteness of the outer islands. Therefore, municipalities and communities need to take responsibility. However, they also need assurance that they will receive capacity building and management and financial assistance.

Climate change and variability will continue to stress the status quo and threaten the wellbeing of the people of the Marshall Islands; water security must be the primary driver of reform. ADB's Water Security Scores for the Marshall Islands reveal that there is engagement (Table 12) in ensuring water security but that it is far from capable of providing water security for the people of RMI.

Recommendations

1. The establishment of a cost recovery pricing mechanism for WatSan utilities for Majuro and Ebeye would assist with the provision of safe drinking water and water security for the majority of RMI.

2. Household RWH should continue to be promoted throughout RMI. A public education programme for the maintenance of the household system should be pursued.

3. To deal with adverse climate variability and change, atoll aquifer management needs to be established on an individual aquifer basis. Management, maintenance and capacity building tools should be developed to facilitate this.

4. Water security could be improved with a stronger focus on household water collection.
5. Women traditionally have had a primary role in the growth and health of children and animals. Christian religions in the Pacific have actively promoted women's groups and women's fellowships, and these provide a base for engaging women in WRM in Nauru.

6. Any scheme to promote an increase in household RWH should be inclusive and be nudged through water charges for the freshwater supplied through desalination. Increased use of shallow aquifers for non-consumption water is possible and should be investigated.

Projects Current and Pipeline

Addressing Climate Vulnerability in the Water Sector (ACWA) in the Marshall Islands

Started Feb 2020 – Feb 2007

Green Climate Fund 24.7m

Marshall Islands: Ebeye Water Supply and Sanitation Project

Grant 0438-RMI: Ebeye Water Supply and Sanitation Project

Asian Development Fund USD 5 million

Grant 0439-RMI: Ebeye Water Supply and Sanitation Project

Government of Australia USD 4 million

Grant 0749-RMI: Ebeye Water Supply and Sanitation Project (Additional Financing)

Asian Development Fund USD 3 million

The Project for Improvement of Water Reservoir in Majuro Atoll

Japan International Cooperation Agency (JICA) USD 1,540,000

Managing Coastal Aquifers in Selected Pacific SIDS

Project objective: to improve the understanding, use, management and protection of coastal aquifers in the Republic of Palau, Tuvalu and the Republic of the Marshall Islands towards enhanced water security within the context of a changing climate

Secretariat of the Pacific Community (SPC)

Start Date 01 Jun 2018

End Date 01 Jun 2022

GEF Allocation to project USD 5,261,356

Regional Engagement Strategy on Water Security

SPC Programme NZ Funding Ongoing

Enhancing water- food security and climate resilience in volcanic Island countries of the Pacific"

Project Preparation Grant (PPG): USD 150,000

Full-Sized Project (FSP): USD 6 Million

5 years (2022-2027)

Current Status (2021) PPG PHASE

Photo courtesy of Dave Hebblethwaite, SPC

Federated States of Micronesia

Introduction

The Federated States of Micronesia (FSM) lies north of the equator and consists of four states–from east to west, Kosrae, Pohnpei, Chuuk and Yap. These comprise around 607 islands with a combined land area of 700 km^2, spread over a longitudinal distance of 2,700 km. Each of the States is centred around high volcanic origin islands with numerous atolls, the exception being Kosrae. Palikir, located on Pohnpei Island, is the nation's capital, but Weno, located on Chuuk, is the largest city.

Political Context

FSM gained independence in 1986 under a Compact of Free Association with the United States. It is governed by its 1979 constitution, which establishes the powers for three layers of government: national, state and municipal. The national and four state governments each have three main branches, i.e., the executive, the legislative and the judicial. Traditional leadership, traditions and customs are also recognised in the Constitution. The Executive branch of the national government is headed by the president and vice-president, whereas the state governments are led by governors and lieutenant-governors. A mayor usually runs the municipal government (Table 54). The 14-member unicameral congress is popularly elected with one senator representing each state elected for four years and another 10 elected by districts for two years. Congress elects the president and vice-president, who appoint their cabinet with congressional approval. The executive branches of the government have the primary power and responsibility to execute and implement the law of their jurisdictions.

The national government's powers include foreign affairs; national defence; immigration; citizenship and naturalisation; taxes, duties, and tariffs based on imports; income taxes; regulation of currency, banking, and foreign and interstate commerce; bankruptcy; patents and copyrights; navigation and shipping; the national postal system; the national capital; the national public service; ownership, exploration, and exploitation of natural resources within the marine space beyond twelve miles of island baselines; national elections; and national crimes.

The National Constitution provides virtual autonomy to the states; each has its constitution, code of laws, and corresponding regulations. Their powers include protection and promotion of public health; public education and schools; conservation and development of natural resources; social security and public welfare; traditions, customs, and traditional leadership; state elections; appropriation of public funds; and recognition and establishment of local governments.

Table 54: FSM State's Municipalities

State	Number Municipalities
Kosrae	4
Pohnpei	11
Chuuk	40
Yap	11

Economy

Subsistence farming, fishing and tourism provide FSM's primary economic activity. In 2019 tourism accounted for 6.1% of its gross domestic product. GDP was estimated at USD 389 million and per capita at USD 3,469 in 2019. Debt was around 19% of GDP and was considered high risk, with ODA comprising about 20% of GDP in 2019 (Table 1). FSM is a member of IDA, and its Global MVI Index is 8 (very high vulnerability).

Socioeconomic

FSM's socioeconomic indicators lie in the lower range in the Pacific, its HDI was 0.62, with a global ranking of 139 in 2019 (Table 3). Urbanisation is growing at 0.3% per annum. Female participation in positions of formal power in the public and private sectors are midrange for PICs. There are no women senators.

Population

The estimated population of FSM was 116,713 in December 2021, with an annual growth rate of 1.07%, ranked 102nd globally and

a population density of 166 km^2, ranked 77th globally. The median age is 26.8 years, and the birth rate was 17.9/1,000. Chuuk State has the highest population (Table 55).

Table 55: FSM Estimated Population by State (2020)

Year	FSM	Chuuk	Kosrae	Pohnpei	Yap
2020	103,169	45,973	6,047	39282	11867

Health

Selected WHO global health indicators are used to assess the health and wellbeing of FSM's population (Table 7). FSM's indicators are significantly worse than the global averages. Water-related diseases are high; leptospirosis, hepatitis and amoebiasis are endemic in some States. FSM is one of only three PICs that have not achieved WHO's leprosy elimination goal of < 1/10,000 population. Rotavirus vaccination for children under 1 year is 40%, which is below the global average of 46%.

Water Sanitation and Hygiene (WASH)

Improved drinking water is available to 79% of the population (Table 5). Only 7% of the 70 surface water networks supply treated water. Surface water quality is monitored for trends in faecal coliform levels. A survey of 40 Pohnpei rivers and streams revealed that 68.3% were unsafe for recreational use and none for drinking water.

Improved sanitation facilities are used by 88.3% of the population (Table 8). However, the 2010 census revealed that 55% of the population use outhouses (36%) or open defecation on land or sea (19%). Moreover, the proportion of the population using open defecation has only shown a marginal decrease over the intervening nine years.

There is no policy in schools for WASH or gender-specific toilets. Schools are mandated to have one toilet per 25-50 students. There are no standards for maintaining toilets and handwashing facilities.

Physical Dimension – Climate, Climate Change, Water Availability

Climate

Located on the western side of the Pacific, FSM's climate is strongly influenced by northeast trade winds and surrounding sea surface temperature, providing a tropical climate with slight seasonal variation in temperature (< 1.5° C). The mean annual temperature (1901-2019) averages 27.1°C.

The volcanic islands of Kosrae, Pohnpei, and Chuuk experience high rainfall when the Intertropical Convergence Zone is strongest, i.e., during the wet season from May to November (Table 56). Annual averages for Kosrae is 5,156 mm, Pohnpei is 4,826 mm and Chuuk 3,556 mm. As the location moves westward, so too does the influence of the West Pacific monsoon. These areas experience high climate variability with storms and typhoons. In addition, the El Niño- Southern Oscillation (ENSO) results in heavy rainfall and drought. Yap, the westernmost state, has an average annual rainfall of 3,100 mm and experiences frequent periods of drought.

Table 56: FSM State Averages Monthly Rainfall and Rainy Days

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	
Kosrae	mm	307	275	348	376	367	349	334	292	256	259	284	357	3804	67.9
	days	17	16	18	19	20	20	20	19	18	18	18	19	222	11.5
Pohnpei	mm	233	193	238	272	327	318	332	303	286	314	301	286	3403	12.5
	days	17	14	17	18	20	20	21	20	19	20	19	19	224	11.2
Chuuk	mm	206	186	216	242	289	324	326	324	307	271	283	238	3212	13.2
	days	6	14	16	18	20	20	20	20	19	20	19	18	210	81%
Yap	mm	154	125	141	151	235	302	353	352	308	280	242	241	2884	92.5
	days	17	14	15	15	19	20	21	20	19	19	19	18	216	0.826

Climate Change

Since the 1950s, there has been a decadal decline in rainfall: for Yap, 7.9 mm; Chuuk, 48.9 mm; and Pohnpei, 88 mm. IPCC AR 6 predicts with high confidence that temperature and extreme heat will increase. Rainfall is predicted to increase slightly and drought to decline marginally. Sea level will continue to rise, increasing coastal erosion and diminishing atoll aquifers due to wave-driven flooding. Modelling of 105 atolls' freshwater resources under severe drought in Pohnpei, Yap and Chuuk concluded that only six would have freshwater lenses thick enough to provide groundwater (Bailey & Jenson, 2011). Storlazzi et al., (2018) have modelled the impact of sea-level rise and wave-driven flooding on atoll infrastructure and freshwater availability and concluded that atolls will become uninhabitable by 2050. High volcanic islands' surface water availability is predicted to remain largely unaffected save for extremes, which will increase flooding.

Water Availability

High and year-round rainfall provides high volumes of surface water and aquifer replenishment. Surface water accounts for around 60% of FSM's water usage. Typically, water is sourced from small streams running through small catchments and usually requires heavy treatment for turbidity, microorganisms, odour and taste. During the drier months, stream flows diminish, and water access reduces. FSM's small high volcanic islands have steep topography with small catchments that do not readily lend themselves to damming (SPREP 2010).

Groundwater accounts for around 40% of water usage. The hydrogeology of the volcanic islands limits the extraction rate from wells but provides adequate water supplies to small communities on the volcanic islands. On atolls, aquifers are supplemented by rainwater tanks for drinking water. Under normal rainfall patterns, the extraction can be balanced by rainfall recharging, but in droughts, the water quality deteriorates to a point where aquifers become redundant. State governments are responsible for the water supply. Municipal governments maintain community-level water systems.

Structures and Institutions

FSM is made up of four relatively autonomous states. National frameworks are established through legislation, policies, and strategic development plans. However, WRM is up to the states through their legislation and institutions. Not all current national regulations are available online. State legislation is complicated to access, with very little available online, and the existence of legislation needs to be sourced from state institutions.

Customary Law

The General Provisions [Title 1] in the national Constitution require due recognition be given to local customs in the system of law (Section 114), provided they are not in conflict with other laws in Micronesia (Section 202).

Water Policy

The Framework National Water and Sanitation policy (2011) has as vision "To ensure that the people of the Federated States of Micronesia's right to secure access to safe and clean drinking water are met and that the use of the Nation's freshwater resources is planned in a manner that maximises the benefits of this scarce and fragile resource for island communities, now and

in the future." Its primary goals are:

• To create an environment at the national level in which collaboration and partnership in addressing water resource and wastewater management issues between all stakeholders and at all levels is fostered and encouraged; and

• To enhance the mainstreaming of Integrated Water Resource Management and Water Use Efficiency Principles into National and State Development Planning

Federated States of Micronesia Strategic Development Plan 2004-2023 identifies the nine strategic goals to improve Micronesia's environment, including to "Manage and Protect the Nation's Natural Environment/Protect, conserve, and sustainably manage a full and functional representation of the FSM's marine, freshwater, and terrestrial ecosystems."

Key Actors

The key actors involved in WRM in Micronesia were identified (Table 57), and their relative support or opposition was assessed, along with their influence on the implementation of WRM.

Table 57: Key Actors involved in WRM in Micronesia

Organisation	Relevance to WRM
FSM EPA (FEPA)	National level environmental management
State EPA (SEPA)	State-level environmental management
State Health (SH)	Provides health care and health education
Department of Health and Social Affairs (DHSA)	Responsible for health planning, donor coordination, and technical and training assistance. It is also responsible for public health programmes funded by the United States Department of Health and Human Services
Department of Finance and Administration (DFA)	Manages the national government's financial assets, strengthens and maximises tax collection of local revenues, investments and maintains border control
Department of Environment, Climate Change & Emergency Management (DECCEM)	Supports the protection, conservation and management of the nation's environment and achieve sustainable development; and facilitate support to the states on the implementation of the FSM Strategic Development Plan
State Budget Office (SBC)	Responsible for preparing for the approval of the governor and presenting to the legislature a complete financial plan for the Pohnpei State Government annually
State Dept Lands (SDL)	Administers and manages State's terrestrial ecosystem—land, ocean, historic sites, parks, watershed areas, public lands, lands use and zoning, flora and fauna, coastal resource management, and marine natural resources within the state 12 miles zone, including the prevention of environmental degradation of the watershed and coastal resource management program and activities
State Dept of Resources and Development (SDRD)	Responsible for agriculture, marine development and project planning and implementation
State Treasury and Administration (STA)	Responsible for the receipt, custody, accounting, and disbursement of funds; the collection of taxes and revenues; the acquisition, control and disposal of property; the investment and the management of investment of public funds; and advising the governor and other officials on financial matters
State Office of Transportation and Infrastructure (SOTI)	Inspection and maintenance of all government property, including pipelines, drainage systems and other infra-structure
Water and Environmental Research Institute of the Western Pacific (WERI)	Regional Water Resources Research Institute supported by the US Geological Survey
All NGOs Combined (ANGOs)	Conservation Society of Pohnpei, Micronesia Conservation Trust, The Kosrae Conservation & Safety Organization (KCSO), The Kosrae Conservation & Safety Organization, Chuuk Conservation Society, Yap Community Action Program
State Governors (SGS)	Executive Power
State Legislatures (SLs)	The power to legislate
Municipal Mayors and Councils (MMCs)	Local legislation and administration
Water Supply Utilities (WSU)	Chuuk Public Utilities Corporation, Department of Transportation and Infrastructure, Kosrae, Pohnpei Utilities, Central Yap State Public Service Corporation and Northern Yap Gagil Tomil Authority

Overview of WRM – Status, Constraints and Drivers

Status

Progress in achieving IWRM (SDG 6.5.1), as reported by FSM, is at a medium-low level (Table 10). There are no state instruments that explicitly promote/support WRM. Some provisions enable the protection of watersheds in some states. The Framework National Water and Sanitation Policy (2011) advanced through the GEF Pacific IWRM Project was launched with great fanfare and apparent support. However, the multistakeholder committee comprised of representatives of national and state government and NGOs never met. Though there is considerable support for WRM among NGOs and some national and state agencies, this has not resulted in significant resourcing and implementation of WRM.

A lack of a coherent and supported WRM policy within the autonomous states means progress will continue to stagnate. The consequences of this can be seen in the ADB's water security scores for FSM (Table 12). Out of the 14 PICs, FSM ranks 14th.

Despite substantial aid funding, inadequate progress has been made in improving access to safe drinking water for island communities.[8]

Constraints

The socioeconomic indicators for FSM (Table 3) show Micronesians have a comparatively low standard of living, with government and public utilities struggling to provide essential services. As a result, its human development ranking of 136 and per capita GDP is at the lower end among PICs. On the other hand, about 79% and 88% of the population have access to improved water and sanitation, respectively.

The states' virtual autonomy and differences make a national water policy largely irrelevant. Instead, state level WRM policies are needed. In 2018, Pohnpei State aligned the development to its state water policy.

The OECD Water Governance Survey (Table 11) provides a valuable overview of challenges in FSM's governance. However, the survey also illustrates a recurring problem in attempting to critically and comparatively appraise using global indicators generated through questionnaires and self-reporting, i.e., the information is incomplete, and in the case of the Pacific, some are not relevant.

Given the constraints faced in water governance in the states, a sectoral approach is unlikely to work nor be appropriate. However, an integrated approach allied to water security, land management, and climate change offers benefits to politicians, administrators, utilities, NGOs, and appeals to external donors. It would also be easier to reconcile with landowners.

Drivers

Pressures on water resources and the environment are being generated through human activities such as urban development through population growth, farming and forestry, lack of land use planning, which are all compounded by climate change. These pressures result from economic, socioeconomic, technological and cultural drivers.

FSM's population is relatively stable and is currently undergoing a net loss (0.68%). However, the effects of climate change have been driving people from the outer islands to the high islands, which places increased pressure on services and food production with linked impacts on water resources.

Limited land area and a shift from subsistence to a cash-based economy increases pressure on natural resources. The steep high islands have limited land for agriculture and forestry, and these often coincide with freshwater catchments being used to source fresh water. Land tenure also impacts the availability of land for primary production and commercial development and access to fresh water, which varies from state to state (Table 58).

Table 58: FSM State Land Ownership

Categories	Chuuk	Kosrae	Pohnpei	Yap	Total FSM
Total Land Area, Square km	127	108.8	341.9	118	695.8
Total Dry Land Area	101	108.8	174	100	483.8
Public Land	5	70.5	62.7	2.3	140.5
Private Land	95.95	38.3	111.3	97.7	343.25

These drivers exist within a period of sociocultural evolution. The FSM Constitution protects the customs and traditions that govern people, land and natural resources. However, the degree to which traditional leaders can exercise power varies within the four states. Overlying this is the near-autonomous governments of these states. Governance is thus under tension with state administrations promoting development, sometimes at odds with traditional leaders and landowners.

FSM's annual GDP is low even by regional standards, so government services and infrastructure are limited. Providing water and sanitation services is financially always a challenge as there are many pressing demands on the limited public purse.

Small populations and the remoteness of FSM states increase the cost of providing services. Water utilities struggle financially to maintain services and require external donor financing for upgrades or expansion. Water treatment and monitoring are recurring costs, and, in small communities, safe water supplies are rarely available.

Many actors are involved in WRM in FSM as each state is virtually autonomous. Within FSM's small economy, states' competing needs, coordination and appropriate resource allocation are and perhaps always will be problematic. An assessment of WRM power dynamics reveals support among a diverse group of actors for WRM. These are in the lower right quadrant and thus lack the power to significantly influence implementation. Executives and finance controllers who balance competing needs are more likely to support the status quo.

Recommendations

For water quality to be maintained and improved, land use planning needs to address cross-cutting environmental issues that impact surface water. Formal or informal mechanisms need to be developed, trialled, assessed, and implemented to enable this across customary and privately owned land. Such a mechanism must be created with stakeholders, and in many instances, these same stakeholders will need to take the lead in implementing WRM practices.

Water security could be improved with a stronger focus on household water collection. Women traditionally have had a primary role in the growth and health of children and animals. Christian religions in the Pacific have actively promoted women's groups and women's fellowships, and these provide a base for engaging women in WRM in Nauru. Any scheme to promote an increase in household RWH should be inclusive and be nudged through water charges for the freshwater supplied through desalination. Increased use of shallow aquifers for non-consumption water is possible and should be investigated.

Regulating pollution is implicit in managing water sources, groundwater or surface water. A significant source of water contamination is sewage, both human and animal, as evidenced by the consistent presence of unsafe *E.coli* levels in water samples throughout FSM. Open defecation is still prevalent due to the incomplete availability of improved sanitation throughout FSM. Adequate treatment of sewage needs to be addressed with some urgency. Urban sewage systems are being upgraded and extended in Chuuk and Pohnpei, but rural and remote atoll communities need to improve the treatment and disposal of sewage. These improvements are required for effective WRM and communities' health and wellbeing.

However, it appears that setting appropriate regulations does not achieve these objectives. The political economy in states and their rural and remote communities needs to be recognised and solutions need to be developed within these.

Associated with the development of local-level WRM is the need to provide appropriate technology and training in water quality monitoring. This may include the development of a best practice atoll aquifer management tool that empowers communities to:

- develop an understanding of the dynamics of their freshwater lenses
- develop management approaches under various extraction and recharges scenarios
- provide appropriate technology monitoring devices and
- provide training capacity building in the application of the tools

Palau

Introduction

The Republic of Palau is comprised of about 340 islands and lies in the far western Pacific Ocean between 2°-8° north of the equator and 134°-135° east longitude. It has a total landmass of 466 km^2 and a coastline of 1,519 km. The capital, Ngerelmud, is situated on the east side of Babeldaob. Palau has 16 states, 10 of which are on Babeldaob. Koror is the centre of commerce.

Political Context

Palau received full sovereignty under the Compact of Free Association with the USA in 1994 and is a presidential republic. Legislative power is concentrated in the bicameral Palau National Congress. Traditional governance is recognised through the Council of Chiefs, composed of one traditional leader from each state. The council advises the president on matters concerning traditional laws, customs, and their relationship to the constitution and the laws of Palau. In addition, it works closely with elected officials on various local and regional issues.

Economy

GDP in 2019[56] was about USD 316 million, and per capita USD 17,573. Tourism accounts for around 50% of Palau's GDP, whilst ODA contributes 8.7% of GNI (Table 1). Its MVI index is 4 (very high vulnerability).

Socioeconomics

Highly urbanised (81%), Palau's HDI rank was 60 in 2019, reflecting a comparatively strong socioeconomic setting (Table 3). Palau has a matrilineal system, and land and titles are inherited through the female lineage. As a result, women have a powerful role in Palauan society, which is reflected in their comparatively high participation rates in leadership (op.cit.).

Population

National population[57] was estimated as 18,169 in July 2021 with an annual growth of 0.50% and density of 39.6 km^2, of which 78% reside on Koror. Palau's median age was 35.9 years, ranking it 94th globally, and the birth rate is 13.5 per 1,000 (Table 6).

Health

Grants from the US Government and access to its technical agencies support Palau's health services, management, organisation, training, and health professionals' registration requirements. As a result, government health expenditure in 2019 was 6.4% of GDP, and Palau's health and wellbeing indicators are among the best in the Pacific (Table 7).

Water, Sanitation and Hygiene (WASH)

Palau has the highest WASH indicators amongst PICs (Table 8). Koror has improved water and sanitation services (WHO/UNICEF indicators) operated by the Palau Public Utilities Corporation (PPUC). ADB is currently financing upgrades to the system that services 80% of Palau's population. The upgrade will also ensure that sewage treatment and waste disposal meet Palau's environmental and health standards. In addition, hygienic public toilets will be established in Koror. Outer island states also have improved wash indicators.

[56] https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.KD?locations=PW Oct 2021

[57] https://worldpopulationreview.com/countries/palau-population , Oct 2021

Physical Dimensions

Climate

Palau's climate is classified as "Af - tropical rainforest" (Köppen-Geiger system), characterised by high rainfall, temperature and humidity. The average annual temperature is 27.5°C. Rainfall ranges between 3,000-4,000 mm/yr^{-2} averaging 3,638 mm/yr^{-2} (Table 59). However, precipitation is strongly linked to ENSO events, the location of the Intertropical Convergence Zone, and seasonal monsoons (NOAA 2015); these result in highly variable annual rainfall. Droughts occur during strong El Niño events resulting in water shortage and rationing (Polhemus 2017; Rupic et al. 2018).

Table 59: Average monthly rainfall and rainy days for Airai, Palau

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	245	209	170	188	282	360	347	279	279	262	267	272
Rainy days (d)	18	16	16	16	19	20	20	18	18	19	19	19

Climate Change

The projected impacts of climate change on Palau are that air temperature will rise, storms and typhoons will strengthen and sea-level rise will heighten high tide flooding, storm surges, and coastal erosion. In addition, average rainfall will increase and be associated with higher extremes of rainfall and flooding, and drought frequency will decrease. The risks to freshwater are that hotter temperatures will increase water demand and decrease water availability. Saltwater intrusion into island aquifers will increase from storm surges and tidal flooding. Therefore, extraction will need to be carefully calibrated to maintain water quality. Increased storm and typhoon intensity will impact water supply infrastructure and water quality, which will increase the likelihood of water-related illnesses caused by pathogens, such as bacteria, viruses, protozoa, and toxins produced by harmful algae and cyanobacteria, and by chemicals introduced into the environment by human activities (Miles et al. 2020).

Water Availability

Palau averages 3,800 mm of rainfall annually, producing 1.1 billion m^3 of water per year from surface water run-off. The Republic of Palau (2007) estimate that Palau has 1.7 billion cubic metres of internal renewable water. The 10-km long Ngerdorch River is Palau's longest river; and flows out of Lake Ngardok, which has a storage of 56700 m^3 and is Micronesia's largest freshwater lake.

The island of Babeldaob has five major watersheds with an additional 11 minor watersheds. The Ngerikiil River in Airai supplies 11,000 m^3 a day to the Koror/Airai Water Treatment Plant, which also draws a further 3,700 m^3 a day from the Ngerimei watershed that drains into Ngerimei Dam. The plant supplies water to 75% of the population of Palau. The remainder of the islands of Palau relies on groundwater sources and rainfall. Peleliu has the largest freshwater lens, estimated to yield 3785 m^3 of freshwater per day (Barrat, 1986).

Outer island states, meanwhile, rely on either surface or groundwater supplemented by rainwater tanks to provide drinking water (Table 60).

Table 60: Palau's Outer Island States' water sources.

Island States	Aimeliik	Ngaraad	Kayangel	Ngardmau	Hatohobei
Ground Water			Other Uses		Other Uses
Surface Water	Majority Uses	All Uses		All Uses	
Rain Water Tanks	Some (drinking)		Drinking		Drinking

Structures and Institutions

Customary Law

The Constitution recognises traditional law as having parity with statute law, provided it is not in conflict with the latter.

Water Policy for the Republic of Palau

The National Water Policy received a presidential endorsement in 2012. It "sets the overall vision, goals and principles for Palau's water resources management and outlines the policy elements to achieve them. Individual organisations will develop, implement, and support specific plans and actions to support these policy elements." The policy was developed under the GEF Pacific IWRM Palau Project and articulates the roles and responsibilities of various stakeholders. These were classified under six categories, along with the actors involved.

1. Resource Management – PWSC, EQPB, state governments, public land authorities, traditional leaders, private landowners, conservation organisations, community members
2. Infrastructure Management – BPW, PWSC, Association of Water Operators, state governments
3. Monitoring and Testing – PWSC, BPW, EQPB, DEH, Association of Water Operators, conservation organisations
4. Enforcement – EQPB, the national congress, state governments, MOJ/OAG, traditional leaders, community members
5. Use – Governments (national and State), businesses, public
6. Education and Awareness – MOE, BOA, EQPB, DEH, PWSC, conservation organisations, traditional leaders, community groups

Executive Order no. 401 was issued for Establishing Water Use and Conservation Policies in response to the 2017 drought.

Palau WRM Key Actors

The key actors involved in WRM in Palau were identified (Table 61), and their relative support or opposition was assessed, along with their influence on the implementation of WRM.

Table 61: Key Actors involved in WRM in Palau

Stakeholders	Interests and Responsibility
President (Pres)	Chief of state and head of government, has power to legislate.
Palau National Congress (PNC)	Power to legislate.
Bureau of Budget & Planning (BBP)	Formulating the annual national budget; compiling relevant economic and social statistics, geographic information, climate change impact; and project monitoring and evaluation to support policy development and implementation.
Bureau of Public Works (BPW)	Operation of public utilities for the health and wellbeing of the people and the community.
Ministry of Health and Human Services (DEH)	Ensures clean, safe and healthy living environments.
Environmental Quality Protection Board (EQPB)	The provision of safe, healthful, productive, and aesthetically and culturally pleasing surroundings and to attain the widest range of beneficial uses of the environment without degradation, risk of health and safety
Palau Conservation Society (PCS)	Preserving the nation's unique natural environment and perpetuating its conservation ethic for the economic and social benefit of present and future generations of all Palauans and the enjoyment and education of all
Office of the Palau Automated Land and Resource Information System (PALARIS)	The development and maintenance of a centralised land and resource system to inventory and support the management of Palau's natural, economic, and human resources
Bureau of Agriculture (BOA)	To promote, develop, protect, and conserve the Republic's land-based natural resources and assist families in having the skills, resources and opportunity to ensure sustained food production, nutrition, food security, and wise stewardship of ecosystems
Palau National Weather Service (PNWS)	The collection and storage site for national and regional weather data, including rainfall and weather patterns
National Emergency Management Office (NEMO)	The management of natural disasters, including contamination with chemicals, bacteria, other waterborne pathogens, and incidents of drought.

US Govt Natural Resources Conservation Services (NRCS)	Collection and collation of natural resource inventory, including watershed inventories, e.g., Ngerikiil Watershed.
Governors Association (GA)	The State owns water resources, and care for these resources falls under the charge of these leaders.
The Nature Conservancy (TNC)	To conserve the lands and waters on which all life depends
National Environmental Protection Council (NEPC)	To ensure that national government agencies and groups are coordinated, aligned, efficient, and without gaps or redundancies in the application of environmental and sustainable development responses and programs
Office of Environmental Response and Coordination (OERC)	Functions as an autonomous agency under the Office of the President, national environmental planning and secretariat to the National Environment Protection Council
Palau Public Utilities Corporation (PPUC)	Water supply, billing and collection
Rural Water Operators Association (RWOA)	Rural water suppliers
Community Stakeholders (CS)	Vested interest in water resources

Overview of WRM – Status, Constraint and Drivers

Status

The socioeconomic indicators for Palau (Table 3) show Palauans have a comparatively high standard of living, well supported by government services and public utilities. Its human development ranking of 60 and per capita GDP are the highest among PICs. In addition, nearly 100% of the population has access to improved water, sanitation and hygiene.

Palau does not have a specific permanent high-level sectoral water management and coordination committee. However, the Palau Climate Change Policy (2015) nominates as one of its priority interventions to "Undertake a comprehensive water resource inventory and develop an integrated water resource management plan." In addition, the 1st National Environment Symposium "… represented an unprecedented collaborative effort among government, community groups, and traditional leaders to shift our thinking and perspective: To redefine Palau's environment for Palauans today and tomorrow."[58] There were 40 recommendations out of the symposium, including to "Maintain strong partnerships between states, governments, and non-profits. Improve partnerships between management organisations and the private sector." Specific water-related recommendations were:

1. Improve water quality data to support better-informed decision-making.
2. Work with state governments to better understand and embrace water quality regulations, including improving land management efforts at all levels (community to government and developer actions).
3. Proactive effort should be placed into developing master-plans, land use plans, and marine spatial/marine resource use plans. The plans should dictate investment; rather than the other way around.
4. Land use and marine planning must proactively account for climate change and disaster risk management.

Given that 78% of the population is in Koror and therefore proximal to the power, it is no surprise that water supply, sewage and energy have received high priority funding. Infrastructure has been upgraded through ADB loans, and land use planning is being addressed, with state governors showing a willingness to adopt and implement watershed management plans. The PPUC addresses water usage and wastage issues, but this relates to 78% of the population that lives in the Koror-Airai area.

The atoll and outer island communities have evolving issues that are human and climate in origin. They rely on a mix of RWH, groundwater and surface water (Table 60). Climate change and pollution pose issues for both surface and groundwater.

Constraints

The reliance on tourism and the recurring El Niño associated droughts also act as powerful drivers of action for WRM. Palau has enough integrating arrangements, e.g., National Environmental Protection Council (NEPC), to make WRM a high priority for public policy and funding by national and state governments despite the lack of any sector-specific coordination mechanism. Given that 78% of the population is in Koror and therefore proximal to the seat of power, it is no surprise that water supply, sewage

[58] https://www.sprep.org/attachments/palau-nes-symposium-report-2016.pdf Oct 2021

and energy have received high priority funding. Infrastructure has been upgraded through ADB loans and land use planning is being addressed with state governors showing a willingness to adopt and implement watershed management plans. The PPUC addresses water usage and wastage issues, but this relates to 78% of the population that live in the Koror-Airai area.

The urban and outer island communities have evolving issues that are human and climate in origin. For example, small atoll aquifers require careful extraction management to maintain and improve water quality and ensure appropriate land use. Groundwater is increasingly coming under threat from climate change yet offers vital water reserves to cope with climate change threats. Proper improved sanitation is linked to this. These WRM issues are and will continue to be magnified with climate change, despite a high degree of support for WRM. The control of financial resources and policymaking dictates progress in WRM. The political economy of WRM is confused by power conflicts between state and federal governments and customary landowners. These power conflicts dramatically increase the transaction costs of implementing WRM to the extent that it becomes too difficult within the political cycle to make significant progress.

The OECD Water Governance Survey provides a valuable overview of where Palau's governance is failing (Table 11). As assessed by the OECD water governance survey, water governance in Palau is poor. However, the survey also illustrates a recurring problem in attempting to critically and comparatively appraise using global indicators generated through questionnaires and self-reporting, i.e., the information is incomplete. In the case of the Pacific, some are not relevant.

UN-Water has compiled baseline country data to enable reporting on global progress toward SDG6 and, as part of that baseline, has established the degree of IWRM implementation (indicator 6.5.1). Palau did not submit.

Water resource management in Koror-Airai revolves around the adequacy of availability and quality of water from the two major watersheds. Land use planning and regulation are critical to the latter, while the former's more efficient use of existing water supplies is vital. The merging of energy, water and sewage into PPUC, an SOE, should improve the maintenance of reticulation networks, lowering leak loss and pricing to control water usage and encourage greater attention to leaks in domestic plumbing.

Drivers

Given the many actors involved and their competing needs, coordination and appropriate resource allocation are and perhaps always will be problematic–particularly in remote states. However, there is overwhelming support for WRM and heightened influence among diverse actors, suggesting a high likelihood of attention and resourcing for WRM in Palau. A near 100% secondary schooling completion rate and high tertiary education rates mean Palauans have a tremendous absorptive capacity for information and analysis of their situation, which is reflected in their heightened environmental awareness and the comparatively strong influence on WRM. Likewise, NGOs such as the Palau Conservation Society have wide-ranging community and political support and, therefore, can significantly influence WRM and land use planning.

Palau is perhaps the most environmentally attuned PIC and relies on tourism for around 50% of its GDP. Palau ranks 26th for tourists per capita in the world.[59] Community awareness of environmental issues is high. The USP EU GCCA project in Palau assessed climate change vulnerability and adaptation in 13 states and among 259 participants between 2013 and 2016. Of those surveyed, 96% were concerned, including 50% who were extremely concerned. The survey sought to assess community knowledge and attitudes towards climate change, the status of livelihood resources, and the predominant community concerns. The results showed that most people identified problems with governance and socioeconomic resources and the lack of solutions for these. Twelve out of 13 states nominated water resources and security as the most vulnerable livelihood resource. Health and sanitation problems were also highlighted in all states (Emaurois et al., 2012).

Pressures on Palau's water resources and the environment are being generated through human activities such as urban development brought about by population growth through inward migration from the outer islands, lack of land use planning, geomorphology, and climate change. These pressures result from economic, socioeconomic, cultural, and climate change and variability drivers.

Palauan's high environmental awareness influences the political economy of WRM. The country's proactive stance on climate change and reliance on the quality of its environment for 50% of its GDP has resulted in some progress in WRM. However, land use management and its impact on surface and groundwater require greater regulation.

[59] https://www.worlddata.info/oceania/palau/tourism.php

Climate change and variability will continue to stress the status quo and threaten the wellbeing of Palauans; water security must be the primary driver of reform. ADB's Water Security Scores show Palau is capable (Table 12) of ensuring water security; indeed, it has the highest ranking within the PICs.

The socioeconomic indicators for Palau (Table 3) show that Palauans have a comparatively high standard of living well, supported by government services and public utilities. Its human development ranking of 60 is the highest among and per capita GDP are the highest among PICs. In addition, nearly 100% of the population have access to improved water, sanitation and hygiene.

Recommendations

1. Water security from small atoll aquifers is a pan-Pacific issue requiring the development of appropriate management, tools and capacity to monitor and regulate extraction rates and land use to ensure optimised and sustainable water supply.
2. As Palau has a well-educated population, community-based WRM should be tested as a model for other PICs.
3. Water quality will increasingly be an issue under climate change, and capacity needs to be built at household levels to ensure heightened awareness of the consequence of poor water quality.

Nadi Catchment Community Perceptions Survey

Context

The Nadi catchment, which encompasses an area of 542 km^2, was selected for the study because of its critical economic importance to the country and because it was deemed representative of several Pacific Island WRM challenges encapsulated in one catchment (Figure 14). The lower catchment has a town with a population of roughly 65,000 and a major tourism hub, Denarau Island, which is home to several five-star hotels. Tourism is a significant economic driver for the Nadi district, with Nadi International Airport being the gateway to the country. The agriculture sector also plays a vital role in the livelihoods of people living in rural areas. Other industries include mining, water bottling, and forestry. Meanwhile, the 2017 population and housing census showed other occupations: service workers, labourers, mechanics, market vendors, retail employees, civil servants, and pensioners. Nadi catchment was also the national demonstration site for a GEF-funded IWRM project from 2009 to 2013.

There is no shortage of water in Fiji, which has an average rainfall of 250-400 mm/month in the wet season and 80-150 mm/month in the dry season. There is also a pronounced difference in precipitation patterns between the Western Division, including the Nadi catchment where this community study was done, and the Central Division. The mean average rainfall/annum in Laucala Bay, Suva, Central Division, was 3,036 mm from 1942 to 1989. The mean rainfall for Nadi Airport for the same period was 1,849 mm/annum.

The Nadi catchment has plentiful water sources maintained by high annual rainfall (Figure 5). The primary surface water sources for this catchment include the Nadi, Namosi, Nawaka, and Malakua rivers (perennial). Nadi also has a high-yielding aquifer known as the Meigunyah Aquifer. In addition, several communal boreholes draw groundwater from fissures and local moderate productivity aquifers. However, despite the presence of surface and groundwater, these do not provide readily available freshwater sources all year round due to fluctuating groundwater table levels and distance in accessing these sources. As a result, some communities require cartage of water during the dry season.

The "water vulnerability" occurs from the lack of infrastructure management and coordinated approaches across various sectors on resource management. There is also a lack of awareness in communities on the importance of water management. Therefore, the study standpoint has been one of not assuming resources are scarce but investigating underlying causes of poor resource management and issues surrounding people managing their water.

Introduction

A community perceptions survey was conducted to assess what could be learnt from the community through the exchange of reflections and practices regarding their water resources and whether there is a need for management and, if so, by whom. It should also involve dialogue with government and technical personnel who operate in the same catchment. The three objectives of the community perceptions survey conducted in the Nadi catchment were to:

1. Understand community perceptions of their water resources;
2. Identify hotspots where water security was most threatened (spatially and temporally) and
3. Identify community strengths and traditional knowledge in managing water resources.

The assessment was designed to provide insights into the barriers and enablers in the up-scaling and adoption of IWRM practices among community groups.

To achieve these objectives, the research was framed around the following questions:

- How can formal institutions and organisations address community perceptions of their water needs more effectively?
- What are the key findings of the community perceptions survey based on the social learning approach, points of difference, and was there overlap with the conclusions of the political economy analysis of the water sector in Fiji?
- What is the current status of water resource management in the Nadi Basin?
- How can the role of communities in water management be strengthened?

Methodology

The methodology has previously been described above (Data and Information Collection).

Figure 14: Nadi District and its location in Viti Levu, the largest island in the Fiji group

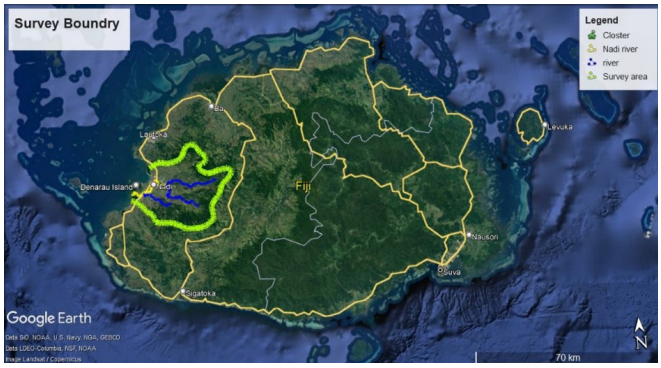
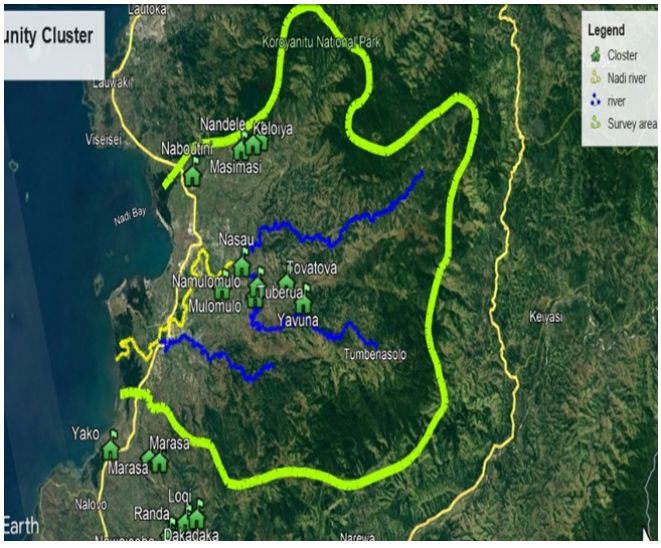


Figure 15: Nadi District Community clusters surveyed from the upper catchment to the lower catchment and their proximity to the main rivers



Results and Discussion:

The 151 interviews conducted from the four clusters (Figure 15) used a semi-structured questionnaire. Forty-five questions in the questionnaire were divided into sections dealing with household information, water sources, water reservoirs, water supply during normal times and times of major climatic events, sanitation, agricultural practices, and water testing.

Community perceptions of water quantity and water quality

There are three primary sources of water in the Nadi district: piped water supplied by WAF, boreholes where water is pumped into communal tanks for domestic use and creeks that are used as a secondary source for bathing and laundry. The third group depends on rainwater harvesting and water cartage every fortnight by WAF. Over half (54%) of households interviewed did not have tanks for rainwater collection and 44% said they have insufficient water throughout the year. The general perception (81%) was that if the water was piped then its quality was good as they believed it was treated. The vast majority (>90%) believed their water source was protected from animal and human activity as the sources were either dams, reservoirs, or bores.

The consumers in the Nadi district were unanimous in their view that the water supply could be improved if infrastructure were improved. WAF owns a reservoir in Nawaicoba that is currently in disuse three years after being built as part of the government's attempts to supply water consistently to drought-prone areas. There is a population of roughly 2,000 people in Nawaicoba and surrounding areas that would benefit from a functioning reservoir. Still, those in elevated areas depend on water sourced from boreholes, and those in lower areas depend on WAF water rationing. Many expressed a need for pumps to increase pressure, particularly those living in elevated areas. There is a school connected to WAF pipes, but the pressure is too low to have any water in the pipes. There is also significant water loss in the reticulation system due to leakage and frequent burst pipes.

There is little awareness in the community on monitoring drinking water quality, with the majority (52%) not knowing whether drinking water had ever been tested and a staggering 86% not knowing how it is tested.

Community perception of assistance by authorities in water provision services

Most communities have piped water from the WAF but experience various difficulties with a regular supply. The hot spots identified through the pre-feasibility assessment were Solove, Solove Heights, Marasa, Tunalia, Niihau and Waireba. These areas suffer dirty water, low pressure, broken pipes, disconnected reticulation, and intermittent water supply, which result in water carting. The communities have suffered for years and are still awaiting authorities to rectify the situation.

Community resilience

A few communities have a piped water system but are predominantly supplied by a communal reservoir supplied by a borehole. These boreholes have pumps that consistently pump water to their storage tanks, which supply the houses. These communities have the advantage of not being connected to the WAF water supply; therefore, they are free of problems that those connected to the WAF system face. They, however, face other obstacles in their water supply. For example, they must replace or repair their water pumps after a certain number of years; furthermore, they face and suffer greatly when drought hits. The boreholes also tend to be at a lower level or dry up entirely. As a result, crops die and livestock have no drinking water.

Some communities face even more dire circumstances regarding their water supply. They are heavily reliant on rainwater supply and well water for their survival. When these sources dry up, they use water from the creeks nearby. Animals use the same creeks for drinking, and bacterial contamination is a very real risk. Appendix 4 shows the survey results presented graphically with respect to their water source, reservoirs, water supply system and the impact of droughts on the communities of the Nadi District.

The results demonstrate that although the communities have access to water in one form or another, there is much room for improvement in the consistency of supply. The residents are a hardy lot and have become accustomed to not having a regular supply like their urban counterparts through their taps. They have devised ways to access water in difficult times like drought events.

The issues faced by Nadi catchment residents are not unique. Water disruptions are a daily occurrence in practically all urban centres in Fiji. The demand has exceeded the supply and is coupled with aging infrastructure. There is not enough water to cater to everyone's needs.

Key Findings

Water issues:

At best, of the total population in the Nadi district, 67% have access to piped water supplied by the WAF. One-third of the district's population relies on water from boreholes, wells, water cartage and rationing by WAF. A significant proportion does not have access to a consistent potable water supply. It is an agricultural area that is often subjected to floods and droughts. Almost all the communities that were visited experienced water problems. These include:

- Poor water quality (high levels of turbidity, potentially linked to faecal contamination)
- Low pressure (from groundwater pumps and piping sources)
- Intermittent water supply
- Broken pipes
- Lack of storage tanks
- No communal reservoir
- Rationed water supply
- No water sources
- Currently using inadequate sources (for example, insufficient volume and/or quality)
- Using untreated water, e.g., well and creeks (exposed to livestock and other contaminants)

Community Perceptions Survey and PEA of Water Sector

How do the community perceptions survey results relate to the political economy analysis of the water sector in Fiji? The Nadi catchment can be considered a microcosm of the country's water security issue. Firstly, the number of actors in the water sector is considerable, but they have different degrees of influence and interest. In rural areas like Nadi District, the key actors are the Ministry of Rural and Maritime Development and Disaster Management (MRMDDM), which the Divisional Commissioners and District Officers represent, the Ministry of Infrastructure, Transport and Meteorology (MITM), who is responsible for rural water supply and WAF whose ambit is to provide water and sanitation services in urban areas as well as rural water schemes. In addition, the Ministry of Waterways and Environment (MWE) and Ministry of Agriculture (MoA) have interests in IWRM; the Ministry of iTaukei Affairs (MTA) represents iTaukei interests in the provinces through the Provincial Offices; the Ministry of Land and Mineral Resources (MLMR) administers surface and groundwater and of course the Ministry of Economy controls the budget.

The community perceptions survey found that the MRMDDM plans to address the water issues in Nadi District in three phases. In the short term, water cartage to communities is being implemented daily. The medium-term plan is to drill more boreholes in collaboration with MLMR. The long-term plan is to establish

a reticulated water supply system through WAF to those communities that are yet to be connected. The last option requires significant funding and is donor dependent. The perceptions survey also found that communities are well aware of influential stakeholders at the community level and their relative importance in assisting with water supplies and reducing drought vulnerability. These include the District Advisory Councillors who look after the interests of the Indo Fijian communities, the *Turaga ni Koro* (village headman) of iTaukei villages, prominent farmers and local community members. The communication channel for addressing water issues from the community to the government level is clear.

The drilling of boreholes is done through the technical expertise of MLMR personnel; however, traditional resource owners complement the technical expertise with their knowledge of the local environment and location of potential boreholes. There is, however, a need to raise public awareness of the need for more holistic management of the catchment and the merits of IWRM. Nadi catchment is renowned for extreme flooding events during cyclonic rainfall. Still, the link between land use practices, resource extraction and these catastrophic floods is not well understood. This is perhaps where a body established by the GEF IWRM project, the Nadi Basin Catchment Committee, might be revived and supported by the appropriate legislation to enable it to develop and implement a strategic plan for this critically important catchment.

Concluding remarks

Water supply is abundant in most of the communities mentioned above; however, its management requires significant improvement to prevent the frequent occurrence of water problems. A considerable amount of water is lost in the reticulation system due to background leakage and frequent burst pipes. As a result, several areas face problems with either too high or too low water pressure. Nadi district has a reservoir in Nawaicoba lying idle since its construction three years ago. A functional reservoir would help alleviate water insecurity in the district. Regular maintenance by WAF of its pipes would also help to ease water supply issues.

The hot spots identified in this survey are Solove, Solove Heights, Marasa, Tunalia, Niihau and Waireba. These areas need reservoirs and pumps to cater to residents who endure dirty water, low pressure, periods of no water during droughts and water cartage every fortnight. Authorities must urgently address these issues to ensure that residents are not deprived of their right to a regular supply of clean water.

The tenacity of the residents, particularly those living in hot spots, must be commended. They have learned to tap alternative water sources during natural disasters and to manage their water consumption to suit the supply. However, it could be better managed if infrastructure were installed or made operational so that water is made available through their taps all year round.

Photo courtesy of Randolph Thaman

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Appendices

Appendix 1: Approach and Analytical Framework

There are several ways to conduct a political economy analysis. Because of the diversity of land and resource tenure and systems of ownership across the various countries in the Pacific, we adapted positive aspects of the World Bank, USAID and DFAT PEA approaches (see Appendix 2) framed by the *Developmental Leadership Program (DLP) framework and approach to thinking and working politically (TWP) in development* (Dasandi et al., 2016).

The strength of the TWP approach in this undertaking is that it has three (3) clear phases: (i) Thinking politically, (ii) Working politically, and (iii) Ensuring interventions are 'politically smart and locally led' (ibid, 3). Laws and Marquette (2018: 2) listed the core principles of TWP as:

- Strong political analysis, insight and understanding
- A detailed appreciation of, and response to, the local context
- Flexibility and adaptability in program design and implementation.

For our literature research/review we undertook key informant interviews, and a perceptions survey to clearly understand and explain the critical factors in WRM. We analysed the political context, the water resources sector organisations, and the role of individuals and agencies in the success of WRM programs. The DLP's TWP Framework that informed our PEA for water resources management in PICs is shown in Figure 16.

Using the TWP approach, we firstly carried out research to better understand the political context of aid interventions in the water resources sector across the Pacific. We also provided general political contextual information of countries located within the three regional groupings of Melanesia, Polynesia, and Micronesia and specific countries. The country-specific contexts are a bit detailed because these are necessary for the analysis and recommendations made in the report.

We also identified agency, specific stakeholders/actors (local government, civil society, private sector, etc.), and leadership within the political systems of respective countries and incentives to shape WRM programs. Other contextual structures and influences such as religion, ethnicity, culture, informal institutions and the rural-urban divide were considered.

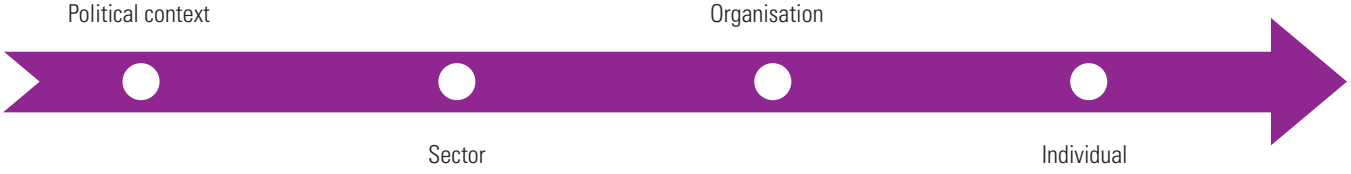
Secondly, we looked at operational issues and how political factors might contribute to positive development outcomes and service delivery in the water resources sector. Our primary interest was to understand how characteristics of water resources in specific PICs and across sub-regions more generally influenced program implementation and impact.

Thirdly, we analysed the features of the implementing organisations to determine whether they can support or hinder politically informed programming. The sorts of coalitions that exist or can be built between different stakeholders to ensure the successful implementation of reforms in the WRM sector is of particular interest. These are the sorts of questions pursued in the research and analysis.

Finally, we were also interested in understanding individuals' role in thinking and working politically in program success, highlighting local political factors critical for communities and individuals to accept and lead interventions and reforms proposed by program design strategy and activities.

The outcome of this PEA provides an understanding of the political context. It identifies possible reforms in the water resources

Figure 16: Factors to consider for 'thinking and working politically'



(Source: Dasandi, Marquette and Robinson, 2016)

sector in Melanesia, Polynesia and Micronesia within a broader institutional context and maps out risks and assumptions. These can then be used in the future to check the feasibility of the design and implementation of WRM programme strategies and activities. The PEA serves as a pointer to what is feasible or possible and guides interventions in the WRM sector. Community-level data from our discussions/engagements with people and communities of the Nadi catchment area in Fiji contributes to this analysis/understanding.

Data & information collection methods

We focussed on PICs, conscious of similarities and differences that may exist in Melanesian, Polynesian and Micronesian countries. Interviews and discussions with stakeholders were minimal and restricted by Covid-19 pandemic restrictions on movements and time constraints. The perceptions survey carried out in the Nadi catchment communities was similarly impacted. A significant component of this PEA was desktop-based.

Desktop review of the literature

We reviewed national socioeconomic statuses and developed comparative indicators, policy documents, laws, and reports on WRM in PICs previously undertaken, other important public documents and publications on Pacific societies, emphasising the Melanesia, Polynesia and Micronesia demarcation and the water resource sector. For Papua New Guinea, Solomon Islands, Vanuatu, Fiji, Tonga, Samoa, Tuvalu and Kiribati, these were primarily based on "Climate Impacts on Pacific Water Security and Water Resource Management: A stocktake of institutional settings and challenges in eight Pacific Island countries" (Dore, D. 2021). When carrying out the desk review, we focussed on the following:

- The political, economic, socioeconomic context of the PICs.
- The bigger picture of PICs and the sub-regions by looking at relevant reports and legislation on the economy, water resources, political institutions, informal cultural values, and institutions.
- Water resources-related literature –This included a closer look at the structures and processes in place, historical data and economic aspects of the sector. In addition, we looked at the literature on land and natural resource use/exploitation, with a specific focus on WRM efforts that have been tried at the regional and sub-regional levels.

Water resources-related literature also included materials on customary land tenure systems, land rights, etc., as most land in PICs are in the customary domain. Efforts to engage with or reforms in the water resources sector will inevitably deal with customary land and customary landholders such as tribes, clans or individuals.

Stakeholder consultations and engagement

Apart from the desktop literature review on the political economy of water resources, we undertook the collection of data and information from key informants. We consulted with the most important/relevant stakeholders, regional organisations, water management experts, and non-government organisations with interest and knowledge in the water resources sector. Most of the regional expert stakeholders and individuals were in Suva, but national experts were also contacted using online platforms due to movement restrictions posed by Covid-19.

Community perception survey

The third component of the PEA was to carry out a community perceptions survey. The case study sought to document community perceptions by bringing together community and technical expertise in understanding the biophysical and sociopolitical system critical to WatSan and integrated water resource management in the Nadi Basin. The survey work had to be delayed several weeks due to the Covid-19 pandemic lockdown. Field data was recorded using an agriculture value chain application using mobile technology called Traceable Farms. The application is customised to ease the use of technology for farmers for data gathering, profiling, and pandemic and disaster assessment.

Field staff collected biophysical data to identify water vulnerable villages and settlements at a district level. In addition, social parameters to determine water vulnerability and perceptions of critical water issues/needs (Table 62) were also gathered at the village/settlement level (Table 63).

Table 62: Village/settlement level water vulnerability and perceptions of critical water issues/needs survey parameters.

Parameter	Water Vulnerability
1) Water source (household use)	The percent of dependence on different water sources, including surface water, groundwater and government support.
2) Dry season length	Average dry season according to local perspectives.
3) Cartage of water during drought % population	Portion of community that depends on carted water from the Water Authority of Fiji.
4) Type of farmers	Commercial, semi-commercial, and subsistence farmers will have differing drought resilience and adaptive capacity levels.
5) Land-use	Different dependencies on water related to land use, including cash crops, sugarcane, pastoral farming etc.
6) Percent of rain-fed agriculture	Differing levels of dependency on reliable and consistent rainfall.
7) Irrigation of crops	Differing levels of dependency on reliable and consistent rainfall.
8) Stakeholder appraisal	District officers, Water Authority of Fiji, Ministry of Agriculture, District Advisory Councilors, Turaga-Ni-Koros, lead farmers and other local community members who clearly understand the local social and political contexts, which also influence levels of drought vulnerability.
9) Critical water issues/needs	Views of communities at a village/settlement level on water issues they face.

Table 63: Nadi, Fiji Communities Surveyed

Nadi District			
Cluster	**Village/ Settlement**	**Total**	**Popn**
Cluster 1	Dakadaka	4	113
	Randa		131
	Nawaicoba settlement		896
	Loqi settlement		71
	Cluster 2		
Cluster 2	Naboutini	4	789
	Masimasi		247
	Keloiya		479
	Nandele		378
Cluster 3	Nasau [Settlement/ Meigunyah/Nasau Rd]	5	1038
	Mulomulo		1024
	Tuberua		242
	Namulomulo		254
	Tovatova		171
Cluster 4	Marasa	3	32
	Arolevu		173
	Yako [Settlement/Village/ Naihau/Waireba		955
Outlier	Yavuna	2	235
	Tubenasolo		215

The community perceptions survey used the following techniques:

(i) Key person interviews,

(ii) Rapid Appraisals Focus Groups discussions, and

(iii) Online interviews.

Our Analytical Framework

When analysing the data and information collected using the methods and questions outlined below, we adopted the DLP's analytical framework. Under this framework, developmental leadership is the collective political process via which diverse actors work productively together to improve development outcomes (DLP, 2018). This framework's three interest levels are individual, collective, and societal. These three levels of analyses are reflected in the data collection methods that we used:

- At the individual level, we sought to understand what might motivate or discourage leaders from driving developmental outcomes in the water resource sector and how they gained the power and legitimacy to act.
- At the collective level, we sought to understand how leaders might have overcome collective action problems, recognised their shared interests and formed collectives or networks with the power and legitimacy to act in water resources management.
- At the societal level, we sought to understand the relationships between leaders and followers and the broader set of societal norms, ideals, institutions, and associations that may block or drive change.

The first component of our analytical framework is **thinking politically**, whereby our analysis unpacks an understanding of formal and informal institutional contexts in the water resources sector where AWP wants to see change and development: the roles of leaders, ideas, norms, values and opportunities for AWP to situate itself as a "political agent" (per Hudson and Leftwich 2014). This is critical to design and implement strategies and determines how best to intervene in the water resources sector in specific countries of the Pacific (Laws and Marquette, 2018: 3).

The second component of our analytical framework is **working politically** as per our TWP framework. The analysis should allow AWP to tailor and adapt its development assistance in the water resources sector to regional, sub-regional and national conditions. Since any development project will have to engage with political processes, strategies to develop or change the way water resources are managed in any Pacific Island country would be influenced by local political structures that are usually fluid and contested (ibid: 3). As very well summarised by DLP (2018: 24), "… politicians, bureaucrats, civil society, donors and so on need to be able to understand better the local context ('thinking politically') to support the processes that enable local actors to bring about sustainable developmental change ('working politically')".

Combining both TWP and DLP frameworks with our general understanding of the local contexts in the Pacific Island countries, we acknowledge the need to be conscious of the existence and influences of three prominent domains when recommending causes of action. These three domains (see Sanga, 2008) influence individual, collective and societal levels: state, '*kastom*' and church. Our analysis of data and information considered the TWP factors (i.e., political context, sector, organisation and individual) at the regional, sub-regional and national levels. Indeed, most of the analysis was done at the national level focussing on the societal, collective and individual levels since the WRM strategy and intervention would be effecting change at the national level. Our political economy analysis framework (Table 64) combines relevant aspects of the analytical frameworks used by DFAT, the World Bank and USAID but emphasises the TWP factors and influences of the state, *kastom/vanua*, and *lotu*/church in water resources management at the regional (collective), sub-regional societal), and national (community) levels.

It is essential to point out that this PEA is a generic analysis based mainly on a literature review, key persons/stakeholder interviews and a case study of the Nadi Water catchment area. More specific PEAs should be undertaken for each country where interventions are proposed. As can be seen in our analytical framework, we analysed data and information at interrelated levels: (i) regional and sub-regional level, (ii) the water resources sector and organisational level, and (iii) society, community and individual level.

At the regional and sub-regional levels, we analysed the political context. This included the foundational, structural, regional and sub-regional values at the present condition of WRM and water delivery at those levels.

At the water sector and organisation level, we analysed issues at the national context. We sought to understand stakeholder interests, national water authority bodies, the present condition of WRM and delivery, actors and institutions, and formal and informal institutions influencing that sector.

At the societal, community and individual levels, we sought to understand and provide advice on the complex dynamic interactions where WRM takes place. From the collected data, we try to describe leadership at the local level and how relationships and societal values on land and resources may influence WRM outcomes. It is also essential to be conscious of influential actors, formal and informal institutions that may drive or oppose WRM reform at the community level.

Table 64: Our Analytical Framework – Emphasising TWP & DLP (but also adopting aspects of USAID, World Bank and DFAT PEA Frameworks)

Political context: regional, sub-regional & collective level (structural factors, foundational factors, regional/sub-regional values)	What are the overriding Pacific values at the regional and sub-regional levels?
	What are the regional and sub-regional entities/bodies/institutions engaging in water resource management?
	How do they function, and in whose interest?
	What are the key constraints and difficulties?
	Are gender equity, disability, and social inclusion (GEDSI) issues accommodated in WRM at regional and sub-regional levels?
	How can AWP's water resources management strategy be aligned to support or enhance current efforts at the regional and sub-regional levels?
Water Sector & organisation level: national contexts (stakeholder interests, national authorities, rules of the game, 'here & now', actors & institutions in WRM, formal & informal institutions)	Who are the main actors and stakeholders in WRM in specific Pacific island countries?
	What are the overriding rules of the game (laws, policies, etc.)?
	What formal and informal institutions promote or inhibit water resources management in this sector?
	What roles do the state, kastom (vanua) and the church (religion) play in managing and delivering water services to communities?
	How are gender equity, disability, and social inclusion (GEDSI) issues accommodated in the water resources sector?
	Is there momentum for change?
Societal, Community & Individual level (dynamic interactions, leadership & actors, community values & relationships, land/resource tenure, formal & informal institutions)	What formal and informal institutions (state, church and kastom) influence water resources management at the (rural) community level?
	Who are the key players driving or opposing reform at the community level?
	What are the risks and opportunities for engagement?
	How do decision-making processes work in local communities?
	Are there coalitions for change at the community level?
	How are gender equity, disability, and social inclusion (GEDSI) issues accommodated in local communities?
	How can donors support or enhance change/reform to improve WRM and service delivery at the local community level?

Analysis at different levels: In line with the processes of Political Economy Analysis, we combined data from phases 1 and 2 to conduct our analysis at various levels. We used the literature reviewed and information from key informants to research the (i) political context of the Pacific Island countries and the three sub-regions, (ii) the water resources sector; (iii) the organisation and management of water resources in PICs; and (iv) community and individuals. It is important to point out that gendered and inclusive dimensions was incorporated (see Table 64 above).

TOR Research Questions

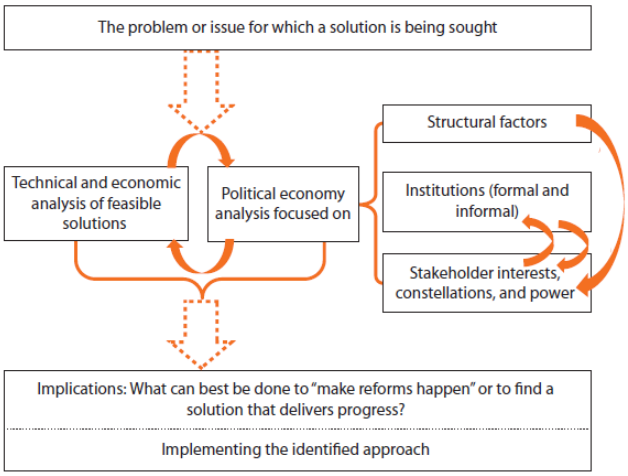
		METHOD 1	METHOD 2	METHOD 3
		Desktop Review of the political economy of PICs (Melanesia, Micronesia & Polynesia)	Interviews – key informants / organisations	Community Focus groups / Tok Stori /Talanoa/ communities
		Home based/Suva (13 Pacific Island countries)	Various (Suva and other places)	Nadi Catchment communities & individuals
RQ1	What are the main constraints to effective WRM in the Pacific, and what does effective WRM look like?			
1a	Are the challenges in WRM operational/technical or developmental in nature?			
1b	Are we able to articulate the specific challenges, or root causes, of ineffective WRM?			
1c	How can these be classified, and what are the linkages?			
1d	What are the differences in WRM at sub-regional levels?			
RQ2	What are the underlying structures, as well as relevant formal and informal institutions (rules of the game), that shape power relations and economic and political outcomes?			
2a	What are the macro-level structures across the Pacific Islands that frame and provide important context for WRM?			
2b	WRM-specific formal institutions, including for wastewater management and WASH (e.g., sub-sector laws and policies; budgeting regulations for public sector spending; water rights legislation; regulations governing private sector participation; tariff regimes; procurement laws)			
2c	WRM-specific informal institutions (e.g., customary water rights)			
2d	Who are the relevant organizations and individuals involved in WRM? What are their motivations and incentives for their support (or not)? What are the relationships between these people and organizations and how does power shape these relationships?			
RQ3	Who are the key actors in the WRM context (regional, sub-regional, national, community), and how can their influence, interests and incentives be understood?			
3a	Understand key actors' level of influence over and interest in WRM.			
3b	How do key actors' interests overlap, and where are there potential synergies and where is there conflict?			
3c	Which actors present as an entry point for AWP's programming objectives?			

		METHOD 1	METHOD 2	METHOD 3
		Desktop Review of the political economy of PICs (Melanesia, Micronesia & Polynesia)	Interviews – key informants / organisations	Community Focus groups / Tok Stori /Talanoa/ communities
		Home based/Suva (13 Pacific Island countries)	Various (Suva and other places)	Nadi Catchment communities & individuals
RQ4	Based on the above analysis and case study findings, what is/are the trend(s) for WRM?			
4a	Are there specific challenges that should be prioritized, and why, and how will this resolve, or address development constraints identified in the analysis and case study?			
RQ5	How can community perceptions of their water needs be addressed more effectively by formal institutions and organizations in PICs?			
5a	What previous work has been done in Pacific Islands in engaging communities in WRM?			
5b	What were key lessons learnt?			
5c	In the social learning approach, what are the key steps in understanding community perceptions and who are the main actors?			
5d	What are the key findings of community perceptions survey based on the social learning approach, points of difference and overlap with the findings from the Political Economy Analysis?			

Appendix 2: Overview of Selected 'Political Economy Analysis' Frameworks

The World Bank's Problem-Driven PEA is useful in answering specific questions on issues around water resources management (WRM). Fritz et al. (2014) explain that a PEA should always start by diagnosing a specific or unresolved problem. They argue that "… a problem-driven approach was more likely to lead to specific findings and actionable recommendations than would approaches that have a broad emphasis on 'understanding the context' or a focus on testing existing theories" (Fritz, et al, 2014: 5). A flowchart showing the processes involved in the problem-driven approach to PEA is shown in Figure 1.

Figure 1: The World Bank's Problem Driven Political Economy Analysis

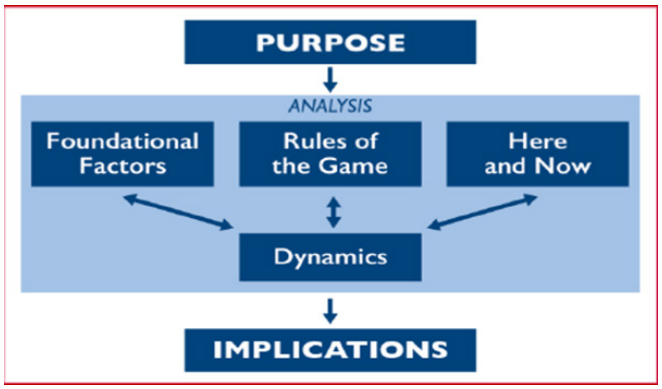


(Source: Fritz et al., 2014)

The problem driven approach to PEA involves three processes. First, is to identify the development challenge, in this case, the challenge of water resources management and why technical efforts in this area have not gained traction. Second, is to determine the political economy drivers by observing: (i) structural factors that influence stakeholder positions; (ii) existing institutions, including those that are changing and those that explain dysfunction; and (iii) stakeholder interests and contexts. Third is to find ways forward and suggest how change might happen, including possible entry points and how engagement may be approached (Fritz, et al. 2014: 5-7). The problem-driven approach to PEA prescribes a framework that aims to clearly understand the problem, analyse the situation and institutions surrounding the development problem and recommend practical actions to effect change. This framework is useful for our understanding of the interplay between structural factors, institutions and stakeholders; opportunities and obstacles to drivers for change; and implications of reforms (Pavlovic, 2015).

The USAID's Applied PEA focusses on understanding both 'how' and 'why' things happen in aid-dependent countries (Cammack, 2016). The Applied PEA framework has three components: (i) purpose, (ii) analysis, and (iii) implication. The first component (i.e., purpose) clearly defines the reasons for conducting a PEA, the main questions to address and at what levels. The second component looks at the data/information generated from the questions outlined in component one to understand three main pillars and cross-cutting considerations (Menochal, et al., 2018). A flowchart showing the components of the Applied PEA is shown in Figure 2.

Figure 2: Components of USAID's Applied Political Economy Analysis



(Source: Menochal, et al., 2018)

The main pillars in the analysis are: (i) foundational factors (national, subnational, international structures that shape character and legitimacy, political system, socioeconomic structures, etc.); (ii) rules of the game (formal constitutional and legal frameworks and informal norms, cultures and traditions); and (iii) the here and now (current event and circumstances that influence the behaviours and outlook of actors and stakeholders and how they may or may not respond to change). The final aspect of the analysis component is to try and understand the **dynamics and interactions** between the three pillars of analysis (i.e., foundational factors, rules of the game, and the here and now) (Menochal, et al., 2018:

4-6). The third and last component of USAID's Applied PEA is to consider the **implications** of the analysis on the donor's engagement in the development area of concern.

The analysis should indicate to the donor insights into opportunities and threats in the development area that they intend to engage in or change. The USAID's Applied PEA Framework is useful to analyse the foundational factors (political context), informal sector (actors, rules of the game, etc.), and specific issues (Swift, 2015) in the WRM and natural resource management sector.

DFAT's Approach to Political Economic Analysis. Similar to the World Bank's problem-driven and USAID's applied PEA approaches, the Australian Government's Department of Foreign Affairs and Trade (DFAT) also provides guidelines to its staff engaging in development work, especially on how to carry out PEA. DFAT's framework emphasises the importance of observing the complex interactions between: (i) structures; (ii) institutions, and (iii) stakeholders/actors to understand the political, economic and social processes encouraging or blocking change (DFAT, 2016). These three important components of a given sector/setting and their interactions to facilitate or discourage progressive change in that sector/area of interest is what the DFAT's framework emphasizes as shown in Table 1.

Table 1: DFAT's Political Economy Analysis Framework

Structures	What are the key 'embedded' political structures?
	How do they function, and in whose interests?
	What are the key constraints and intractable problems?
	What are the relevant political dimensions of Australia's involvement?
Institutions	How well aligned are formal and informal institutions?
	What are the overriding 'rules of the game'?
	What ar the incentives that shape the behaviour of key players?
Actors	Who are the key players driving and opposing reform?
	Is there momentum for reform?
	Are there coalitions for change?
Dynamic Interaction	Why is the situation as it is?
	How do decision-making processes actually work?
	What are the risks and the opportunities for engagement?
	What are the gaps in our knowledge?
	What are the critical areas to be tracked?

(Source: DFAT, 2016)

Structures focus on the features of the society or sector that do not change quickly such as population, natural resource endowment, global influences, history, sociocultural factors, technology, etc. These are like foundational factors (USAID) and structural factors (WB). **Institutions** are local laws, conventions and traditions that shape human behaviour and must not be confused with organisations. It is important to note that informal institutions also fall under this category and are just as important as formal ones. Again, these are like the 'rules of the game' (USAID) and 'existing institutions' under the World Bank's problem-driven framework. Finally, you have the **actors** that are either individuals, organisations or coalitions from various sections of society with their own interests, motivations and networks (ibid: 3). The critical aspect of this framework is to try and understand the dynamic interaction between the structure, institutions and actors to determine the opportunities or threats to change and progress in sector or society.

Appendix 3: Water Resources Management Related Legislation and Policy in PICs

Papua New Guinea

National Water, Sanitation and Hygiene (WaSH) Policy 2015-2030: This policy provides the framework for financing the expansion and maintenance of water, sanitation and hygiene services, particularly in the poorly served peri-urban and rural areas of PNG.

Public Health Act (1973): Established water quality standards and assigned the NDoH the responsibility of monitoring and regulation.

Water Resources Act (1982): Provides the Government regulatory powers over water use, drainage, diversion and damming of waterways without impacting the customary rights of residents to water use. Waste disposal on land, swamps, and waterways is also regulated by this legislation and can provide the basis for compensation to native landowners if mine companies discharge wastes into rivers.

National Water and Sewerage Act (1986): Gives the PNG Water Board, now known as PNG Water, the responsibility to provide water and sanitation services to urban areas while promoting it in rural areas.

NCD Water Supply and Sewerage Act (1996): Gives the responsibility for Port Moresby's water and sewerage services to National Capital District Commission (NCDC).

National Health Administration Act (1997): Gives power to provincial governments to enact rural water supply and environmental health laws.

Organic Law on Provincial Governments and Local Level Governments (LLGs) (1998): LLGs can enact laws on the provision of water supply.

Environment Act (2000): A key piece of legislation that governs water resources management in PNG. It covers water abstraction for use and the disposal of effluent in water bodies.

PNG Development Strategic Plan 2010-2030: This established the development target of 70% access to safe water and sanitation services.

National Health Plan 2011-2020: Specified the department's role in promoting WASH in rural areas.

Solomon Islands

River Waters Ordinance 1969: provides measures for watershed control in relation to rivers only and regulates the use of designated river water through permit applications.

Environment Act 1998: provides for the protection, preservation and conservation of the environment, including the prevention and control of pollution to water.

Public Health Ordinance 1970: authorises inspections to be conducted for the regulation of water pollution.

Solomon Islands Water Authority Act 1992: provides for the establishment of Solomon Islands Water Authority for provision of proper management and development of urban water and wastewater services throughout the country.

Environmental Health Act and Provincial Ordinance: provides for the control and management of water and sanitation services in the rural areas of the country.

Lands and Titles Act: provides for the allocation and control of registered land.

Forestry Act: provides for proper development and management of forestry sector in the country.

Mines and Minerals Act: provides for the promotion and management of mineral development in Solomon Islands.

Draft Water Resources Act (2006): for provision of water resources management in Solomon Islands.

Vanuatu

Water Resources Management Act [CAP 281]: establishes the ownership of water resources with the Minister of Land and Natural Resources on behalf of the State but assigns water access rights for customary use with custom landowners. The Act requires the Director of Water Resources to declare water protection zones and issue waterworks / water use permits for the non-customary use of water resources. The Act enables the Director to set standards and penalize compliance failures. This Act empowers the Director to transfer schemes to Rural Water Committees that meet certain standards (i.e., undertaken DWSSP, at least 40% women representation, registered with the provinces). The Act establishes National and Provincial Water Resources Advisory Committees (NWRAC & PWRACs) to strengthen coordination with other sectors.

Vanuatu National Water Strategy (2008-18): Prioritizes the regulation function and capacities of DoWR (supported by the NWRAC); the community management of water schemes (with greater support of the provinces); improved knowledge management of water resources; strengthened water quality standards, monitoring and water safety planning for risk management; the preparation of provincial master plans for water resource development and management.

Water Supply Act [CAP 24]: establishes the responsibilities for urban water supply schemes up to the water meter (but not service failures) with the government (or its concessionaire) and beyond the meter with the customers. The Act empowers the Minister of Lands and Natural Resources (with the approval of the Council of Ministers) to let water supply concession contracts to the private sector. The Act requires concessionaires to have drinking water safety plans audited by the Department of Water Resources. The Act empowers the Minister in consultation with the Director from the Ministry of Health to issue water quality standards and penalize compliance failures.

Vanuatu National Drinking Water Quality Standards (2016): Establishes a biological standard for urban water supplies of a free chlorine residual of ≥0.2 mg/L or < 0 e. Coli CFU/ 100 ml as well as standard set of physical / chemical parameters. Establishes a biological standard for rural water supplies of < 0 e. Coli CFU/ 100 ml requiring water safety plans and an assessment against source risk profiles as well as a basic set of physical / chemical parameters.

Public Health Act [CAP 234]: establishes the responsibility of provincial councils to ensure and municipal councils to enforce sufficient access to safe water for all. The Act requires owners and/or occupiers of premises that design and construct water supply systems to comply with public health standards. The Act provides for water quality sampling by environmental health officers and the imposition of penalties or closure of polluted water outlets / sources. The Act also assigns the responsibility for maintaining the safety of water for drinking to the occupier of premises. A Law Commission review suggests a greater role for Area Councils in developing public health rules to strengthen water and sanitation service delivery compliance.

Food Control Act [CAP 228]: empowers local authorities to regulate the preparation, storage, sale and use of food (& water) to ensure public health and safety. This includes the safety of water for consumption as well as preparation hygiene and sterilizing food processing equipment.

Decentralization Act [CAP 230]: establishes local government councils as a body corporate (i.e., with perpetual succession and power to sue and be sued and own assets) in local government regions defined by the Minister of Internal Affairs. The Act empowers provincial councils to pass (and notify sub-committees to draft) by-laws for water supply and public health services to be gazetted into law by the Minister of Internal Affairs after a complaint redressal period. The Act empowers provincial councils to issue licenses, contracts and set rates for water and sanitation service delivery. Provincial councils are required to approve their annual budget and may incur debt from donors.

Municipalities Act [CAP 126]: establishes municipal councils as a body corporate (i.e., with perpetual succession and power to sue and be sued and own assets) in regions defined by the Minister of Internal Affairs. Municipal councils exercise control over and care for all roads (including the right of way for public pipes, sewers, drains and cables) and public open spaces within a municipal area. If necessary, the municipality may carry sewers,

drains and pipes through and across any land after notifying the owner. The municipal council is responsible to control, manage and administer the municipality to safeguard public health. Municipalities are empowered to pass by-laws to protect the safety or maintain the health or suppress nuisances for the inhabitants within the municipality.

Environmental Conservation Act [CAP 283]: provides for the conservation, sustainable development and management of the land, air and waters of Vanuatu. Water as defined in the Act refers to all surface water (flowing or situated), groundwater (including geothermal) and estuarine / coastal seawater and therefore does not pertain to water contained in works. All projects, proposals and activities that cause or are likely to cause significant environmental, social and/or custom impacts are required to undergo an Environmental Impact Assessment (EIA). The Act requires the Minister of Environment to issue wastewater standards and regulations governing water pollution.

Physical Planning Act [CAP 193]: enables any municipal or local government council to declare any area within its jurisdiction a Physical Planning Area requiring the preparation and gazetting of a physical (zoning) plan for that area by the Minister for Internal Affairs. No person shall carry out development in a Physical Planning Area without the approval of the council.

Municipal Building Permits: limits the construction of any works subject to an environmental impact assessment (Department of Environment) and compliance with zoning requirements (Municipal Town Planning & Building Division), rights to develop the land enshrined in the land title or lease (Department of Land, Survey & Registry), building safety (Public Works Department), fire safety (Fire Department), approval for a water connection (DoWR or its concessionaire) and inspection (Municipal Town Planning & Building Division).

Building Act [No. 36 of 2013]: Empowers the Minister of Infrastructure and Public Works Utilities to prescribe a Building Code for the construction of buildings in any municipality or Physical Planning Area or any building owned or partly owned by the State. This requires that no person may construct a building without first obtaining a building permit from the relevant authority. No building or any part of a building may be occupied or reoccupied unless the authority has issued a fitness to occupy certificate (based on an inspection against the terms of the building permit).

Vanuatu National Building Code (2000): Specifies compliance with AS 3500 Plumbing and Drainage Code and AS 2179/80 Metal Rainwater Goods Standard (Specification, Selection & Installation). The code includes plumbing and rainwater specifications for any buildings (DF5 & DF7), public buildings (NF5 & NF7) including fire mains (NE 1.2).

Utilities Regulatory Authority Act [No. 11 of 2007]: Establishes the Utilities Regulatory Authority (URA) to promote consumers' long-term interest in access to safe, reliable and affordable electricity and water services throughout Vanuatu. URA approves tariffs for electricity and water services for State-owned public water enterprises and private providers under concessions contracts. URA is mandated to assist in resolving consumer complaints and advises the government on policy and legislative matters related to electricity and water.

Customer Complaints and Dispute Resolution Rules (2015): provide a clear and transparent understanding of the consumers' and utilities' respective rights and obligations. The process defined in the rules establishes the powers and obligations of the URA to ensure a fair, impartial, transparent and consistent resolution of consumer complaints.

Charitable Associations Incorporation Act [CAP 140]: provides for the incorporation of a committee having not less than six members as a body corporate that may sue and be sued, own assets and liabilities including land to be registered with the Department of Lands. The Registrar of may impose conditions for the appropriate functioning is required to gazette every incorporation under the Act.

Companies Act [CAP 191]: provides for the establishment of not-for-profit companies that promote social causes and prohibit the payment of any dividend to its members. Such companies may be registered as a company with limited liability enjoying all the privileges but subject to exceptions in the obligations of limited companies (i.e., the freedom not to use the term "limited" in the name) specified by the Registrar of Companies (Commissioner of Vanuatu Financial Services Commission).

Cooperative Societies Act [CAP 152]: provides for the incorporation of a society comprising at least seven members with the Registrar of Cooperative & Business Development Services as a body corporate having perpetual succession, the power to hold property, to enter into contracts, to sue and be sued and distribute benefits among members. Cooperatives are required to enshrine one vote per shareholder even if some shareholders possess more shares than others.

Custom Land Management Act [No. 33 of 2013]: provides for the determination of custom owners and the resolution of disputes over ownership of custom land by customary institutions. Formalises the recognition of customary institutions termed '*nakamals*' and 'custom area land tribunals' to determine the rules of custom, which form the basis of ownership and use of land in Vanuatu.

Land Reform Act [CAP 123]: vests all state land and all public roads at the day of Independence with the Government of Vanuatu.
Land Acquisition Act [CAP 215]: provides for the acquisition of land and easements in the public interest including systems for determining appropriate compensation, appeal and resolution.

Land Lease Act [CAP 163]: provides for the registration of the rights and responsibilities of a lessee (Individual or body corporate) to land, water and air and the development of those resources.

Business License Act [CAP 249]: requires anyone undertaking "Water Works, Distribution and Supply Companies and Providers" for the "collection purification distribution, supply and sale of water to household, industrial and commercial users" to obtain a license from the Minister or Local Council.

Vanuatu Qualifications Authority Act [No. 1 of 2014]: establishes the Vanuatu Qualifications Authority to strengthen post-school skills training (i.e., plumbing), regulate the issuing of qualifications and ensure the maintenance of quality standards in associated trades.

Education Act [No. 9 of 2014]: Requires any registered government and non-government schools to comply with reasonable standards of health and safety.

Minimum Quality Standards for Primary Schools: requires each school to have a water source and/or storage unit providing at least 2 litres of potable water for every teacher and student.

National Disaster Act [CAP 267]: Establishes the National Disaster Management Office (NDMO) to implement the strategies and policies of the National Disaster Management Committee. Requires the Director to activate the National Disaster Operations Centre and coordinate government departments in the event of the declaration of a state of Emergency by the President on the advice of the Council of Ministers.

Meteorology and Geological Hazards and Climate Change Bill: Assigns the coordination of climate change activities to the National Advisory Council on Climate Change (NACCC), which is formally recognized by the Vanuatu Council of Ministers to implement Multilateral Environmental Agreements for the Government. The Climate Change Unit in the Vanuatu Department of Meteorological Services (VMS) functions as the Secretariat of the NACCC.

Fiji

Rivers and Streams Act (Cap 136): Under this Act, all navigable waterways and the soil underneath belong to the State but are open to public use. The Minister of Lands can issue a lease to a section of the riverbed as long as there is no major infringement of public rights of usage. The Act, however, states, "Proprietors of land or towns and villages or inhabitants adjacent to rivers or streams shall not only have the fullest enjoyment of the same as part of the public but they may be granted by the Director of Lands, special rights to lead off, for purposes of irrigation, industry, agriculture or domestic use or other uses beneficial to their property, such portion of water as may be agreed on…". The Act and water rights issue will need to be addressed if water use allocation will be vested in a Board as stipulated in the Land and Water Resources Management Bill.

Water Supply Act (Cap 144): This relates to piped water supply for domestic use and public use, meters, fittings, works, and bills.

Drainage Act (Cap 143): The law relates to the drainage of land areas, installation of weirs, and dams in waterways to mitigate flooding.

Irrigation Act (Cap 148): This is related to the construction, improvement and maintenance of irrigation works for agriculture.

Environment Management Act (2005): The Act is the umbrella legislation for environmental governance in Fiji. It promotes the sustainable use of natural resources and recognises the importance of conserving ecosystems and their services and protecting human health and life. In addition, it serves to control and manage developments and control waste and pollution.

Land and Water Resources Management Bill (2016): This Bill replaces the Land Conservation and Improvement Act, which the Land Conservation Board administered.

The plans under this Bill are for watershed management, floodplain management, river and stream management and water use allocation. The Bill will then have to align itself to the Rivers and Streams Act, which grants permanent or temporary water rights to proprietors of land adjacent to the river to extract river water for purposes of irrigation or other uses pertinent to the wellbeing of the landowners. Due regard, however, is given to the needs of those communities downstream of the extraction. The principle of water being a public good is central to the Rivers and Streams Act.

Public Health Act (1936 rev 2020): The Central Board of Health administers this Act, which also bestows sweeping powers on the Permanent Secretary of Health. The Act has regulations on health and sanitation with particular reference to facilities where there is manufacture, storage, sale and consumption of food.

Fijian Affairs Act (Cap 120): The Act sets out the regulations pertaining to the administration and affairs of iTaukei communities and supplements the Native Land Trust Board Act. The Great Council of Chiefs (GCC) was an institution under the Fijian Affairs Act but was disbanded by the government in 2012 and replaced by the Ministry of iTaukei Affairs. The governance arrangements under the Act allow the appointment of *rokos*, Fijian magistrates and other officers for the "proper conduct and administration of Fijian affairs".

Rural Water & Sanitation Policy (2012 rev 2016): The policy aims to ensure the sustainable, affordable and safe quality of potable water in rural areas. It also aims to provide sanitation facilities using affordable and environmentally safe technologies.

Climate Change Policy (2013): After first introducing global climate projections, the policy discusses the potential impacts of climate change on different sectors. In summarising the potential impacts for each sector, it also describes key mitigation opportunities.

Tonga

Water Resources Act 2020: This Act allows for the establishment of a National Water Resources Committee that reports to the MLNR and is responsible for monitoring water use on each island. The Committee is also responsible for projections of future demand by domestic, commercial, agricultural and industrial users while considering climate change. In addition, it is responsible for monitoring new water protection zones and the construction and sealing of new boreholes and wells. It is also mandated to have contingency plans in place in natural disasters that impact water quantity and quality and reduce vulnerability. With the passage of this legislation, there is now a ministry mandated to oversee the country's water resources and to ensure it is included in the national planning processes.

Niue

Water Resources Act 1996: "to make provision for the investigation, use, control, protection and management of water." The vesting of groundwater in the Crown is noted–"The right to the use, flow, pipe, store, sale and control to all groundwater is vested in the Crown."

Water Act 2012; "to make provision for the investigation, extraction, use, control, protection and management of water and related matters." This act supersedes the Water Resources Act of 1996.

Meteorological Services Act 2013: "to make comprehensive provision in relation to the provision of meteorological and climate-related services in Niue, and for all related purposes."

Environment Act 2015: "to provide for the preservation and protection of the environment of Niue and, for that purpose:

(a) authorise the making of environmental standards to regulate activities that affect the environment of Niue; and

(b) ensure that all government departments and public authorities consider environmental matters when making decisions that have or may have an effect on the environment of Niue."

Village Councils Act 2016: "to provide for the establishment, membership, functions, and operation of Village Councils." Part 3 of the Act describes the general functions of the Village Councils and enables "the provision of services relating to health, sanitation, prevention and suppression of infection diseases, and disposal of the dead, including:

(i) services for the purposes of establishing and maintaining village cleanliness;

(ii) the prevention of pollution of water sources and land resources.

Water Regulations 2017: "to regulate the construction, alteration, or maintenance of bores, extraction and water pollution licensing."

Bore (Well) head Protection Regulations 2019: Relates to protection zones at the bore (well) head.

Environment Consent and EIA Regulations 2019: All major projects must have an EIA Report to obtain Environment Consent.

Niue Building Code Act 2021: Relates to design of septic tanks and permits.

Cooks Islands

Land Use Act 1969: The principal act dealing with physical planning for land use.

Environment Act 2003: To provide for the protection, conservation, and management of the environment in a sustainable manner.

Public Health Act 2004: To amend and consolidate the law relating to public health. Including provision for water quality standards and sewage treatment.

Public Health Sewage (Code) Regulations 2008: Relates to designing and constructing sewage systems and discharge standards.

Infrastructure Act 2019: Contains a transitional provision for Te Mato Vai.

To Tatou Vai Authority Bill 2021: Establishes the Tatou Vai Authority as a self-funding not-for-profit statutory corporation to manage the Te Mato Vai water network. It also establishes 10 catchment committees for each valley comprised of local landowners to regulate their land use to preserve water quality.

Samoa

Ministry of Works Act (2002): Controls construction quality of domestic and commercial septic systems design and installation

Water Resource Management Act (2008) and Regulations: Protects water quality and watershed resources through monitoring and management strategies.

Water Resources Management Regulation (2013): Identifies reserve bands from water sources for protection of water quality

Water Abstraction Licensing Regulation (2013): Manages water abstraction by all users, including water suppliers, water trucks and bottling companies.

Samoa Water Authority 2003 and Samoa Water Authority (Sewerage and Wastewater) Regulation 2009: To develop, operate and maintain the central Apia sewer system and control and monitor trade wastes associated with the system.

Nauru

Environmental Management and Climate Change Act 2020 No. 34 of 2020: Makes provision for the management and protection of the environment, climate change, the promotion of sustainable development to facilitate compliance with the Republic's international and regional environment-related obligations and for related purposes.

Nauru Utilities Corporation Bill 2011: Establishes the Nauru Utilities Corporation replacing the Nauru Utilities Authority.

Custom and Adopted Laws Act 1971: "to make better provision relating to the institutions, customs and usages of Nauruans, and to adopted laws."

Lands Act 1976: "to make new provision for the leasing of land for the purposes of the phosphate industry and other public purposes, and for the removal of trees, crops, soil and sand and the payment of compensation and other moneys." This does not allow for compulsory acquisition.

Nauru Rehabilitation Corporation Act 1997: "to establish a Corporation charged with responsibility for coordinating, promoting, carrying out, managing, and participating in, rehabilitation works in Nauru and other matters connected therewith or material thereto."

Nauru Lands Committee Act 1956: "to determine questions as to the ownership of, or rights in respect of land, where the issue involves Nauruans and Pacific Islanders."

Litter Prohibition Act 1983: To make provision for the abatement of litter.

Sanitary Inspectors' Ordinance 1921: (As in force from 29 December 1967) Empowers authorised officers to enter a house, premises, or land to assess their sanitary condition and direct remedial action if deemed unclean or unsanitary.

National Disaster Risk Management Act 2016: To establish under the law the National Emergency Services, the national disaster risk committee, the National Disaster Risk Management Council, and other related purposes.

Tuvalu

Water Supply Act (CAP 32.32): In relation to WRM, the Act states: "The Authority shall have power to make and construct such cuts, channels, feeders, catch-drains, reservoirs, aqueducts, tunnels, pipes, pipe tracks, conduits, filters, trenches, mounds, engines, works and machinery as he may think necessary, proper or convenient for conducting adequate supplies of water, together with such reservoirs and other works as the Authority shall think necessary for securing regularity in the said supplies of water, and to clean, uphold and repair the said works and machinery in all times ensuing, and for any and every such purpose to enter upon, take and use any lands required to be entered, taken or used for such purpose"

Water Supply Act - Water Supply (Delivery of Bulk Supplies) Regulations: this regulation was under section 19 of the Water Supply Act stating that the "Authority shall charge persons desiring to be supplied with water from Government storage cisterns at the rate of $5 for every 1,000 gallons, or part thereof, delivered"

Conservation Areas Act (CAP 13.15): "'Conservation area' means that area declared under section 3 of this Act and may include marine areas within the territorial sea, any terrestrial area including swamps, islets, reef flats, channels, sand banks and coral reef."

Environmental Protection Act (CAP 30.25): The Act provides for the protection of environment in Tuvalu from waste and pollution. It safeguards the environment from waste and pollution that come from development in, on, over land (including water) and sea.

Public Health Act (CAP 28.36): (h) securing the cleanliness and freedom from pollution of tanks, vats, cisterns and other receptacles for storing water used or likely to be used by man for drinking or domestic purposes, and for the purification of water intended to be used in commodities offered for sale; (i) regulating or prohibiting the use of any rain, stream, well or other water supply and for the prevention of the pollution thereof.

Falekaupule Act (CAP 4.08): "the area of authority of every Falekaupule for the purposes of this Act and any by-laws made under it shall include the internal waters, lagoons and lakes of every island or atoll comprised within that area, and the territorial waters, being the first 12 miles of the territorial sea, adjacent to every such island or atoll."

Kiribati

The Environment Act of 1999: "An act to provide for the protection improvement and conservation of the environment of the Republic of Kiribati and for connected purposes" is amended by the Environment (Amendment) Act 2007 and is supported by the Environmental (General) Regulations of 2009 (which repeals previous regulations to the act).

The Public Utilities Ordinance of 1977 which vests responsibility for the protection and security of water resources in the Public Utilities Board and includes regulations for the protection of water reserves.

The Public Health Ordinance of 1926; Public Health Regulations of 1926, both of which provide for public health measures including sanitation, solid waste collection and drainage.

The Foreshore and Land Reclamation Ordinance of 1969: regulates extraction of material such as sand, gravel, reef mud and rock.

The Marine Zones (Declaration) Act of 1983: provides for protection and conservation of the marine environment, where these are not otherwise covered by national or international law.

The Local Government Act, 1984: empowers local government bodies to issue by-laws relating to environmental protection.

Republic of Marshall Islands

Coast Conservation Act 1988: Coastal zone management, land-use planning, EIA, authorisation/permit, institution, basic legislation

Public Water Supply Regulations: Water supply, authorisation/permit, inspection, potable water, water quality standards

Marine Water Quality Regulations: Marine pollution, pollution control, environmental standards, water quality standards, classification/declassification, environmental planning, oil pollution, freshwater quality/freshwater pollution, effluent wastewater/discharge

RMI Water and Sanitation Sector Strategy (including water policy)

Local Government ordinances

Planning and Zoning Act 1987: Land-use planning, zoning, expropriation, basic legislation, basin/catchment/watershed, water conservation zone

State-Owned Enterprises Act, 2015 (PL 2015-45): Agricultural development, institution, business/industry/corporations, water supply, sewerage

Environmental Planning and Policy Coordination (OEPPC) Act, 2003: Institution, environmental planning, climate change, biodiversity

National Environmental Protection Act 1984. Primary legislation, institution, EIA, special fund, offences/penalties, soil conservation/soil improvement, freshwater quality/freshwater pollution, potable water

Environment Protection Act (Title 35). Fishery management and conservation, marine fisheries, land-use planning, soil conservation/soil improvement, environmental planning

Toilet Facilities and Sewage Disposal Regulations. Pollution control, Waste disposal, Waste domestic sources, Effluent wastewater/discharge, Sewerage

Protected Areas Network (PAN) Act 2015 (PL 2015-48). Ecosystem preservation, environmental planning, basic legislation, protected area, institution, legal proceedings/administrative proceedings, policy/planning, vommunity management, offences/penalties

Environmental Protection Authority Earth Moving Regulations. Soil conservation/soil improvement, soil rehabilitation, erosion, policy/planning, authorisation/permit

Public Health, Safety and Welfare Act [7 MIRC Ch.1] Part 2 Para 109. Standards for latrines and toilets; disposal of human excreta generally. Para 113 Standards for and inspection of schools re health and sanitation.

Federated States of Micronesia

Federal Legislation

FSM Environmental Protection Act Code Title 25: Subtitle I: Sets out Micronesia's public policy on the environment, such as to "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences."

FSM Environmental Protection Act Code Title 25: Subtitle 2: Establishes the FSM Environmental Protection Office with the powers "to protect the environment, human health, welfare, and

safety and to abate, control, and prohibit pollution or contamination of air, land, and water in accordance with this subtitle and with the regulations adopted and promulgated pursuant to this subtitle."

Marine and Freshwater Quality Standards Regulations 1986: Identifies the uses for which waters of FSM shall be maintained and protected (water quality).

Climate Change Act (2013): Introduces legal obligations for specific national government departments and agencies. These must prepare plans and policies on climate change (consistent with the National Wide Integrated Policy), and the Office of Environment and Emergency Management is responsible for overall implementation. Annual progress reporting of policy implementation is also required.

Code Title 21: Health & Sanitation, Ch 13: Sanitation (as of 2001) s1601: Requires latrines or toilets to conform to public health regulation standards and prohibits depositing faeces within 500 yards of a dwelling.

State Legislation

Chuuk State

The Chuuk Constitution requires the Legislature to "provide by law for the development and enforcement of standards of environmental quality, and the establishment of an independent state agency vested with responsibility for environmental matters."

2-94 CSL 2-94-01: To implement Section 1, Article IV of the State Constitution by providing for the protection and enhancement of environmental quality of the air, land, and water of Chuuk State; to provide for the establishment of Chuuk State Environmental Protection Agency; to provide for cooperation between the Agency and other entities in protecting the environment, and for other purposes

4-97 CSL 4-97-01: To authorise the Governor to enter into a financing agreement to borrow a sum not exceed $3,233,000 from the FSM to be secured by future Compact funds and Chuuk State's share of FSM tax revenues; to on-lend the loan to the state public utility for the purpose of establishing and administering the Water Supply and Sanitation Project; to establish the Chuuk State Water Project Revolving Fund; to appropriate the proceeds of the loan; to appropriate the sum of $885,000 from the general fund to finance the local cost-sharing portion of the project; and for other purposes

CSL 3-97-05: To repeal CSL No. 192-12 and establish a Chuuk Public Utility Corporation (CPUC), providing for its powers, duties, and functions, and providing for its composition, members, terms of office, and other purposes, including water supply and sewerage system.

Kosrae State

The Kosrae Constitution requires the State to "by law protect the State's environment, ecology, and natural resources from impairment in the public interest."

Kosrae State Code, Title 17: Chapter 4: Establishes the Kosrae EPA

Kosrae Code Section 11.201: Land use and subsidiary regulations

Kosrae Code, Section 13.514: Water quality

Pohnpei State

In the Pohnpei Constitution, the State Governor must establish and administer "comprehensive plans for conserving natural resources and protecting the environment".

Solid Waste Regulation (30 March 1995): Disposal of solid waste.

Drinking-Water Regulations (effective 3 April 1995): Water quality.

Toilet Facilities & Sewage Disposal Regulations (effective 3 April 1995): Toilet specifications and sewage disposal requirements.

Marine and Fresh Water Quality Standard Regulations (effective 3 April 1995): Water quality

Yap State

The Yap Constitution states that the "State Government may provide for the protection, conservation and sustainable development of agricultural, marine, mineral, forest, water, land and other natural resources."

Earth Moving & Sedimentation Control Regulations: Managing coastal and freshwater sedimentation.

Palau

The Palau National Code (PNC) has a mixture of laws passed by Congress, old Trust Territory Codes, plus some US laws (i.e., Clean Water Act), which have been applied to Palau.

The Constitution of Palau gives state governments oversight of fresh and marine water resources out to 12 miles at sea within their boundaries, including the right to change the classification of waters.

Ngerderar Watershed Conservation Area Management Plan 2011, adopted by Aimeliik State.

Environmental Quality Protection Act Title 24 is the legislative framework for the Environmental Quality Protection Board, which is responsible for managing water resources by promulgating and enforcing ad hoc regulations for the United States Safe Drinking Water Act and promulgating and enforcing nuclear and other hazardous wastes regulations; and administration (and development) of a permit system for the discharge and use of air, land or water to maintain water quality to protect the health, welfare and property, and to prevent pollutants from being discharged into Palau's waters untreated.

The Marine and Freshwater Quality Standards Regulations (Chapter 2401)-11 of EQPB Regulations, as amended) is based on the Clean Water Act's US legislation and applies to all marine and freshwater bodies. Water Supply Systems Regulations promulgated by EQPB protect public water supplies against contamination. These set drinking water standards, a Microbiological Quality Monitoring System, and water supply standards during emergencies.

Wastewater Treatment and Disposal Regulations (Chapter 2401-13) enable EQPB to establish minimum planning, designing, construction, and effectiveness standards to ensure that waste treatment systems and the discharge of wastewater protect groundwater and surface water and public health.

Preserves and Protected Areas Act (Title 24, Division 3 PNC) provides for the establishment of national protected areas.

Protected Areas Network (PAN) Act (Title 24, Chapter 34 PNC) provides a framework for representative protected area planning and management. The intent is to recognise the connectedness of terrestrial and marine areas, including the "ridge to reef' approach. Virtually all protected areas are protected under State legislation.

Utilities Consolidation Act (2013) merges Palau's water and sewer utilities under the umbrella of the Palau Public Utilities Corporation and for other related purposes.

Solid Waste Management Regulations (Chapter 2401-13) prevent pollution of drinking and other waters of Palau and contribute to the conservation of natural resources and the environment.

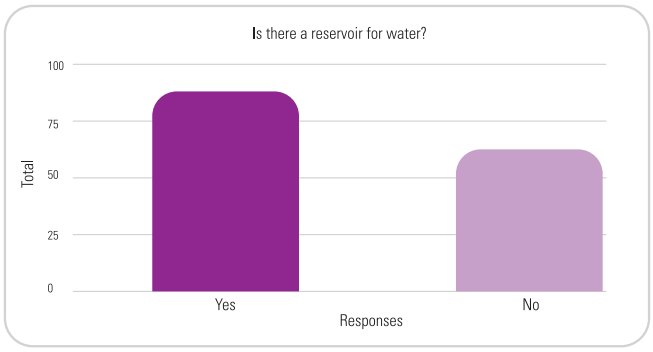
Public Health, Safety and Welfare Act (Title 34 PNC). Covers, subject to presidential approval, develop and apply regulations (al) necessary to promote public health and safety concerning privy vaults, cesspools, and other means of human excreta disposal.

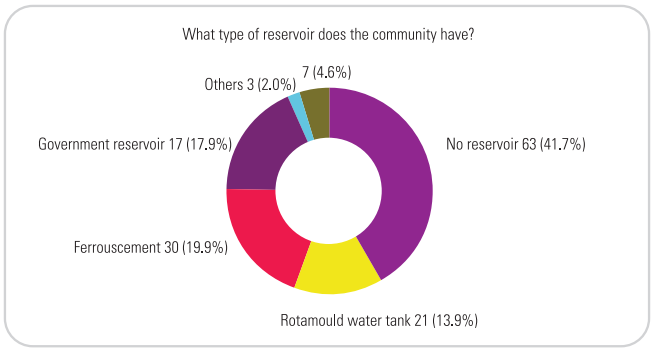
Marine and Fresh Water Quality Regulations Chapter 2401-11 To prescribe regulations necessary for implementing, achieving, and maintaining the specified water quality, to protect the health, welfare, and property, and to assure that no pollutants are discharged into these waters without being given the degree of treatment or control necessary to prevent pollution.

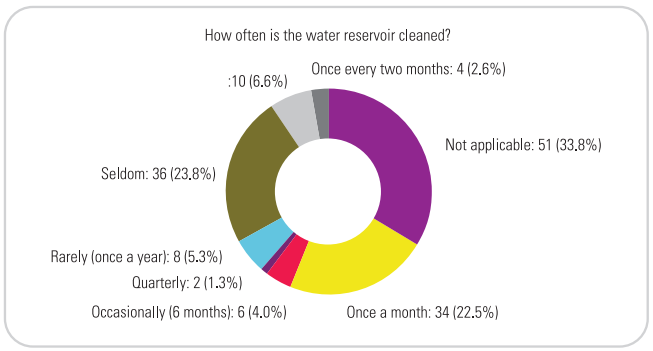
Responsibility for waste management and pollution control vests with EQPB, the DAMR (Division of Agriculture and Mineral Resources) and the DEH (Division of Environmental Health).

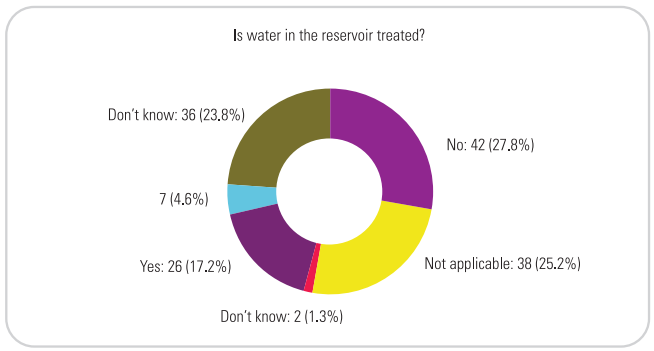
Appendix 4: Nadi District WRM Community Perception Survey Results

1. Reservoir

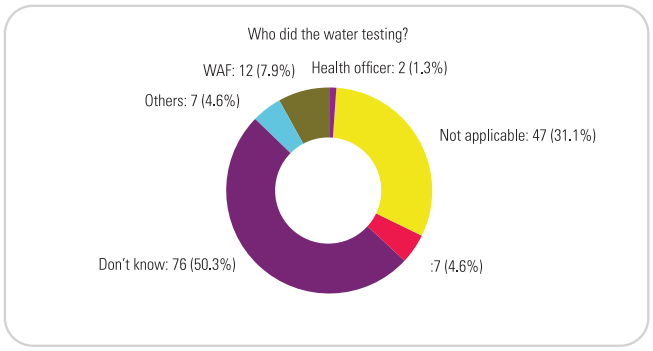


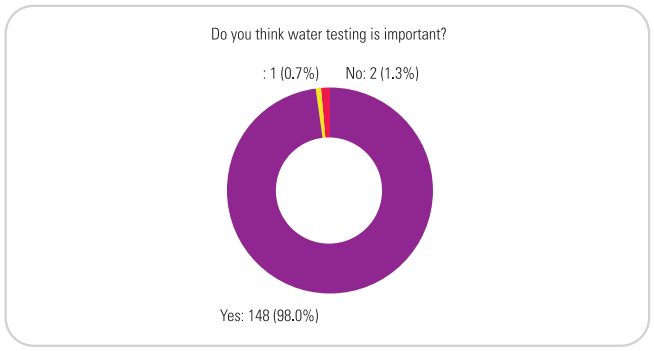




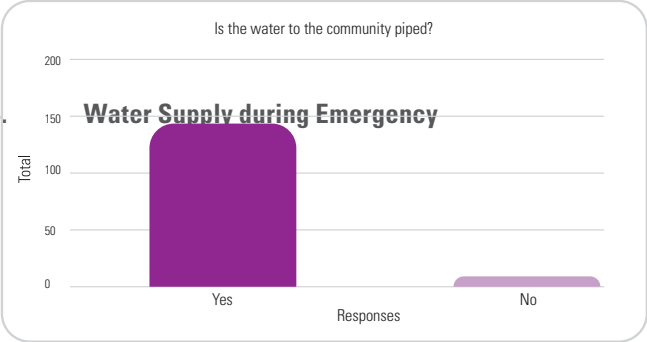


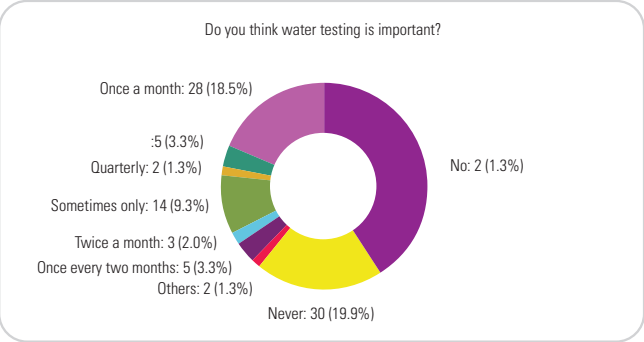
2. Water-quality Testing





3. Water Supply System





4. Water Supply during Emergency