

*Sustainable Integrated Water Resources and
Wastewater Management in Pacific Island Countries*

National Integrated Water Resource Management Diagnostic Report

Federated States of Micronesia



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SOPAC



Acronyms

ADB	Asian Development Bank
CIP	Capital Improvement Programs
CPCUC	Chuuk State Public Utilities Corporation
DOI	Department of Interior
DOTU	Department of Transportation and Utility Kosrae
DTC&I	Department of Transportation Communication and Infrastructure
ECO	Economical Affairs
EPA	Environmental Protection Agency (USA)
FEMA	Federal Emergency Management Agency
FSM	Federated States of Micronesia
GPM	Gallons Per Minute
KUA	Kosrae Utilities Authority
MG	Million Gallons
NOAA	National Oceanic and Atmospheric Administration
OMIP	Operation and Maintenance improvement programmes
PUC	Pohnpei Utilities Corporation
UCs	Utilities Corporations
WERI	Western Environmental Regional Institution
YSPSC	Yap State Public Service Corporation

Table of Contents

Acronyms.....	ii
Table of Contents.....	iii
Executive Summary.....	vi
1 Introduction.....	1
1.1 Objectives of this report.....	1
1.2 Scope of this report.....	1
2 General Overview.....	2
2.1 Country Background Information.....	2
2.2 Soils.....	3
2.3 Climate.....	5
2.4 Agriculture.....	5
2.5 Population.....	7
3 Integrated Water Resources Management Situation for FSM.....	9
3.1 Water Resources Management.....	9
3.1.1 Types of freshwater resources.....	9
3.1.2 Types of freshwater uses.....	9
3.1.3 Major issues and concerns.....	10
3.1.4 Measures to manage impacts and concerns (IWRM approaches).....	11
3.2 Island Vulnerability.....	11
3.2.1 Types of disasters with major issues and concerns.....	11
3.3 Awareness.....	12
3.3.1 Type of awareness campaigns, advocacy initiatives currently being undertaken in the area of water resources management.....	12
3.4 Technology.....	13
3.4.1 Types of water supply systems.....	13
3.4.2 Types of wastewater/sanitation systems.....	14
3.4.3 Major issues and concerns.....	14
3.4.4 Measures to manage impacts and concerns (IWRM approaches).....	14
3.5 Financing and institutional arrangements.....	15
3.5.1 Institutional arrangements.....	15
3.5.2 Financing arrangements.....	16
4 Linkages to other areas.....	17
4.1 Land use and agriculture.....	17
4.1.1 Irrigation and rain-fed agriculture.....	17
4.1.2 Agriculture and water quality (deforestation).....	17
4.2 Habitats and ecosystems.....	17
4.3 Health and hygiene.....	19
4.4 Watershed and coastal management.....	20
5 Stakeholder Engagement.....	21
6 Other programmes, projects and activities related to IWRM.....	22
7 Capacity Development Needs for Removing the Barriers.....	23

[8 Introducing an Integrated Approach towards Barrier Removal.....23](#)
[References.....24](#)

LIST OF TABLES & Figures

Table 1: Summary of the main geographic information for the FSM..... 8
Table 2: Existing freshwater resources for each State in the Federated States of Micronesia.
10
Table 3: Key and legend to figure 7..... 20
Table 4: Bodies and organisations used in consultative process..... 22

Figure 1: Location of the FSM in the Pacific Ocean..... 2
Figure 2: Map of the FSM..... 3
Figure 3: Percentage area of private and state ownership by FSM state..... 4
Figure 4: Annual rainfall in the four FSM States: 2000-2004..... 6
Figure 5: Mean annual over-water rainfall in Micronesia..... 6
Figure 6: FSM population from 1920 with projected increases to 2012..... 8
Figure 7: Protected areas on Pohnpei..... 21

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Executive Summary

Water is the basis of life - an ecological resource for the flora and fauna of our planet and a fundamental necessity for all lives. Without effective water resource management it is difficult to imagine productive human activity, be it agriculture or forestry, livestock, farming or fisheries, trade or industry.

The volume of fresh water on earth cannot be augmented. The high rate of population growth, urbanisation, deforestation, economic development and the increasing pollution of surface and ground water, however, constantly reduces the amount of water available per capita. Water continues to be scarce thus becoming a crucial factor for development and the quality of life in many countries including the Federated States of Micronesia (FSM). In individual arid areas it has even become a survival factor.

FSM is a grouping of 607 small islands in the Western Pacific about 2,500 miles southwest of Hawaii, lying just north of the Equator (Figure 1). Generally speaking, FSM comprises what is known as the Eastern and Western Caroline Islands. While the country's total land area amounts to only 270.8 square miles, it occupies more than one million square miles of the Pacific Ocean, and ranges 1,700 miles from East (Kosrae) to West (Yap). Each of the four States centres around one or more "high islands," and all but Kosrae include numerous atolls.

Major water resource management issues for FSM include:

- Vulnerability to climate change.
- Deforestation of watersheds and resultant sedimentation of lagoons and coastal areas.
- Water related disease through poor sanitation and lack of effective wastewater treatment.
- Lack of awareness of water related diseases, hygiene and sanitation.
- Cross subsidising of water supply through electricity production and the long term sustainability of this.
- Lack of capacity in water resource management.
- Loss of biodiversity through deforestation and lagoon degradation.

The FSM specially, the States of Yap, Chuuk and their adjoining outer islands are prone to extremely damaging natural disasters, in the form of typhoon, extended drought, landslides, tidal erosion and extensive floods. Due to climate change, the drought is perceived to be occurring with increasing frequency and intensity. Natural disasters are of special concern to FSM due to its fragmented composition of smaller islands, dependence on subsistence agriculture and tourism, all of which are vulnerable to natural and environmental disasters. The natural disasters usually affect the economy and natural environment, which are long lasting and the rehabilitation costs are high.

The islands of the FSM are particularly vulnerable to global warming and climate change, climate variability and sea level rise. Global climatic change can destroy coral reefs, alter the distribution of zones of upwelling and affect both subsistence and commercial fisheries production. It will affect the vegetation including freshwater resources adversely due to saline water intrusion.

1 Introduction

Water is the basis of life - an ecological resource for the flora and fauna of our earth and a fundamental necessity for all lives. Without good water resource management it is difficult to imagine productive human activity, be it agriculture or forestry, livestock, farming or fisheries, trade or industry.

The volume of fresh water on earth cannot be augmented. The high rate of population growth and the increasing pollution of surface and ground water, however, are constantly reducing the amount of water available per capita. Water is thus becoming a crucial factor for development and the quality of life in many countries. In individual arid areas it has even become a survival factor.

Any national water resources management strategies must necessarily be formulated in the context of the overall natural, socioeconomic, cultural and political environment. The common water resources management and water use efficiency issues throughout the Pacific Island Countries (PICs) can be summarised as follows:

- An increasing demand for water (potable, irrigation and industrial) coupled to a rise in population, increased tourism and/or expanding development.
- Inadequate and inefficient capture, storage and distribution of water resources (small catchments, inadequate rainfall forecasting, poor watershed management, poor infrastructure).
- Pollution and associated reduction in water quality as a result of:
 - Poorly controlled urban and industrial expansion and development
 - Inappropriate domestic waste disposal
 - Inadequate sanitation and drainage infrastructures
 - Inappropriate agricultural practices (erosion of soils, excessive use of agro-chemicals, deforestation).
- Climatic threats to water supplies (e.g. drought, flooding, storm surge, sea level rise).

Integrated Water Resource Management (IWRM) offers a systematic approach to address the sustainable development, allocation and monitoring of water resources for PICs. The key concept of IWRM is that it provides a framework to integrate societal, economic and environmental considerations in water resource management. It recognises that all water use is interdependent and therefore should be managed in an integrated manner.

1.1 Objectives of this report

1. Provide a summary of IWRM needs, issues and current initiatives for the FSM.
2. Collate information related to water and wastewater in the FSM for future use by the National IWRM Focal Point and SOPAC.
3. Provide a reference document on the state of IWRM in the FSM to May 2007.

1.2 Scope of this report

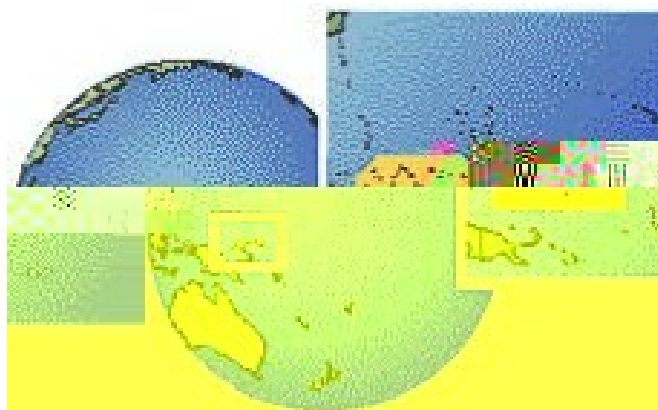
This report covers three aspects of IWRM: water supply; treatment of wastewater and water quality in the fresh water and marine environments. In covering these three elements, issues of land use, human impact on the environment, and ecosystem services are covered.

2 General Overview

2.1 Country Background Information

The Federated States of Micronesia (FSM) is a grouping of 607 small islands in the Western Pacific about 2,500 miles southwest of Hawaii, lying just north of the Equator (Figure 1). Generally speaking, FSM comprises what is known as the Eastern and Western Caroline Islands. While the country's total land area amounts to only 270.8 square miles, it occupies more than one million square miles of the Pacific Ocean, and ranges 1,700 miles from East (Kosrae) to West (Yap). Each of the four States centres around one or more "high islands," and all but Kosrae include numerous atolls.

Figure 1: Location of the FSM in the Pacific Ocean



Source:

FSM consists of four separate states: Chuuk; Pohnpei; Yap and Kosrae (Figure 2). Chuuk State has a total land area of 49.2 square miles and includes seven major island groups. Pohnpei State has 133.4 square miles of land area, of which 130 is accounted for by Pohnpei island, the largest in FSM. Yap State is made up of 4 large islands, 7 small islands and 134 atolls, with a total land area of 45.6 square miles. Kosrae is essentially one high island of 42.3 square miles.

The islands of the FSM result from volcanic activity millions of years ago resulting in islands and atolls. Some are tips of mountain peaks thrust above the surface and now surrounded by fringing reefs. Others are atolls -- islands that have sunk beneath the surface, leaving a ring of coral barrier reef and tiny island islets encircling a coral and sand lagoon. And, still others are mixtures of atolls and high ridged islands within a lagoon.

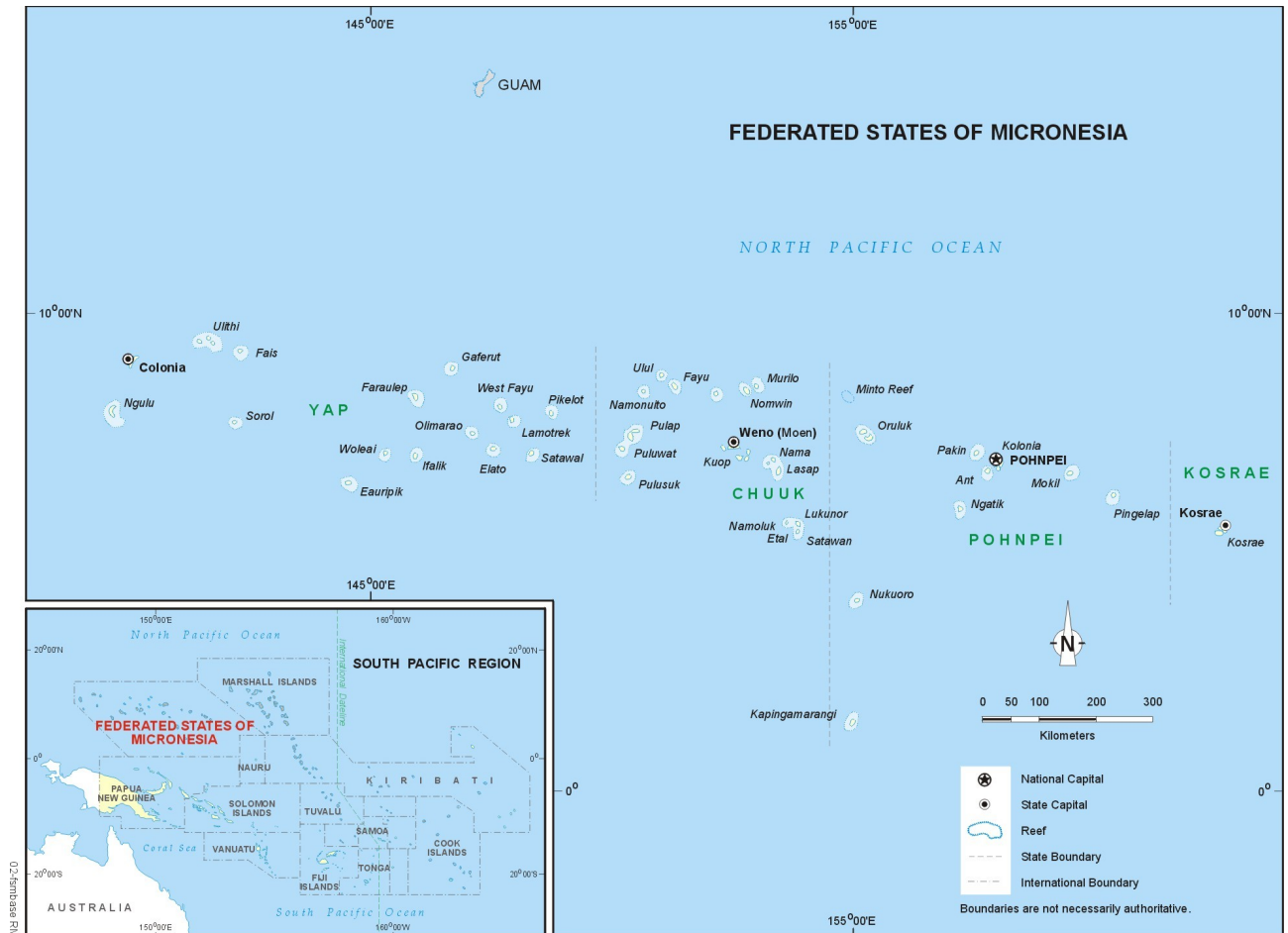
Pohnpei Island is typically volcanic, with a majority of the land area characterised as steep and mountainous. Vegetation is mainly upland forest (56%) mostly in the interior. The coastal areas and lower slopes are characterised by agroforest (33%) and secondary vegetation (5%). Agroforestry has been expanding rapidly in the last decades, replacing forest and secondary vegetation. A barrier reef and a lagoon surround the island, with extensive mangrove forest development around most of the shoreline.

On Yap there are a series of natural habitat zones where rainfall is buffered and sediments and nutrients carried with freshwater runoff are filtered out into biotic communities successively less tolerant of the situation. The climatic conditions present classical problems of how to use tropical soils without exposing them to erosion and nutrient depletion.

Kosrae, is a high island and its climate and agro-ecological zones are similar to those of Pohnpei.

In 2001, about 69 percent of the land in FSM was privately owned. By state, about 98 percent in Yap and Chuuk; about 64 percent in Pohnpei; and 36 percent in Kosrae were privately owned (Figure 3).

Figure 2: Map of the FSM



SOURCE?

In FSM, considerable inequality exists in terms of gross domestic product (GDP) per capita among the four states. The rate of population growth continuing to exceed economic growth, unequal standards of living between outer islands, migration from adjoining outer islands to Pohnpei and Weno/Chuuk pose a serious future concern for basic amenities and infrastructures.

The FSM have developed settlement patterns in keeping with their surroundings. Each inhabited island is divided into municipalities, villages (sections of municipalities), and farmsteads (smallest land holding unit within a village). The manner in which the people have arranged over the landscape varies from dispersed settlement to clustered villages.

2.2 Soils

Soils in FSM vary widely in their potential for major land uses. In most of the islands in the Federated States of Micronesia, at least 30 percent of available land is used for subsistence tree crops, mainly bananas, breadfruit and coconuts.

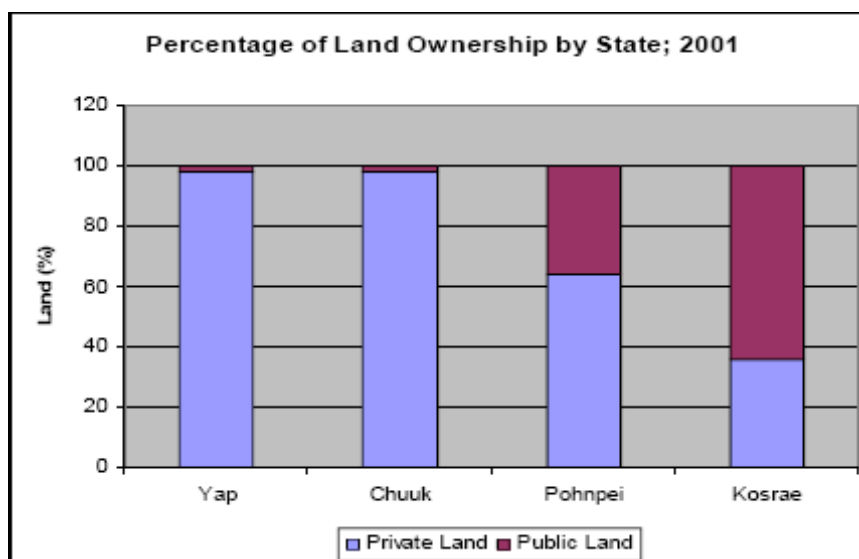
Soils can be classified into two major groups with slight variations between one island and another (Laird 1983a,b). Under the two groups are various sub-groups.

A. Soils in coastal mangrove swamps, on coastal strands and on bottom-lands:

The soils in this group can be both shallow and very deep and are somewhat poorly drained. They are formed from inorganic deposits and coral sand. This group is used for the production of wood, coconuts and wetland taro and for urban development. The native vegetation is mainly mangrove forest, atoll strand forest and water tolerant grasses. Under this group are the following:

- Shallow and very deep, very poorly drained, level and nearly level soils in coastal mangrove swamps. This type of soil is flooded daily with salt water during high tide. They are formed in a mixture of organic deposits and coral sand. The surface layer is peaty and sandy. The vegetation is mainly mangrove forest and used for mangrove wood production.
- Very deep, somewhat poorly drained, level and nearly level soils and urban land on coastal strands. These soils are very deep and somewhat poorly drained. They are formed in water and wind deposited sand derived dominantly from coral. The soils are sandy throughout. This type of soil is used for coconut production.
- Very deep, poorly drained, level and nearly level soils on bottom lands. They are formed in organic deposits. The soils are mucky and peaty throughout. The vegetation on this type of soil is mainly tall water tolerant grass. This type of soil is used for taro production and it has few limitations for this use.

Figure 3: Percentage area of private and state ownership by FSM state



Source? FSM Economic Affairs, Division of Statistics www.spc.int-prism-fsm

B. Soils on uplands.

The soils in this group are shallow, moderately deep, and very deep and are well drained. They formed in residuum and colluviums derived dominantly from basic igneous rock. This group is used for subsistence farming. Under this group there are the following soil sub-groups:

- Very deep, well drained, sloping to extremely steep soils on uplands. These soils are very deep and well drained. They are also loamy and very stony throughout. The soil in this group is suitable for subsistence tree cropping.
- Rock outcrops, shallow and moderately deep, well drained nearly level to moderately slopy soils on uplands. This consists of areas of exposed volcanic rock on ridge tops and nearly vertical rock cliffs. The soils here are good for subsistence farming, woodland and wildlife habitat.

The soils in Pohnpei generally have a clay-rich texture since they are derived from volcanic bedrock in a warm humid climate. However, on the steeper, upland hill slopes, soils can be quite rocky and in contrast, peat soils may form in the lowland swamps. The cohesion given the soil by their clay minerals tends to decrease their erodibility by overland surface water flow. The fertility of the upland soils is normally greater than in the lowlands.

Soils in areas under agroforestry are characterised by Typic Acrorthoxes in the lowlands and Typic Dystropepts on mountain slopes, with a few small areas of Typic Humitropets. Soils in the upland mountainous areas are generally deep and are limited by steep slopes and

stoniness. These areas are nearly level or gently well drained. Low fertility and wetness are limitations. The bottomland soils are generally poorly drained and are limited by wetness.

2.3 Climate

FSM has a tropical maritime setting and diurnal variations in temperature are greater than between seasons. Most islands have a marked dry trade wind season from November to May and a wet variable season from June to October. Constant high temperatures and high humidity with very high average rainfall characterise the wet tropical maritime. Typical daytime maximal temperatures are near 30°C with a minimum around 24°C. Rainfall varies between island within FSM (see Figures 4 and 5).

On the island of Pohnpei the climate is characterised by high rainfalls and high temperature. The average annual rainfall is 4820 mm and the average annual temperature is 27°C. The rainfall is fairly evenly distributed throughout the year, although the average for January to February is about 30 percent less than the annual monthly average. Rainfall in the higher elevations is estimated to be as high as 750 cm annually in the mountainous interior areas. Here the average monthly temperatures do not vary from the annual average by more than 1 degree, and the difference between the average minimum and the average maximum temperatures is less than 8 degrees throughout the year. Temperatures are slightly lower at the higher elevations. Humidity is very high throughout the year.

In Chuuk, the climate is chiefly influenced from November to June by the north-easterly trade winds. By about April, the trade winds begin to diminish in strength, and by July they give way to the lighter and more variable winds of the doldrums. Between July and November the islands are frequently under the influence of the inter-tropical convergence zone. This is also the season when moist southerly winds and tropical disturbances are most frequent. The humidity at this time is often oppressively high. Rainfall averages about 3650 mm a year. The most stable time of the year is the relatively dry period from January to March when monthly averages are less than 210 mm. February is the driest month with an average of 157 mm. Rainfall varies widely from year to year in amount and in seasonal distribution. Annual totals have been as low as 3000 mm and as high as 4500 mm. Even in the drier season of January to March, monthly rainfall has been as much as 600 mm in some years, however, it has been less than 300 mm. Temperature is relatively uniform throughout the year varying 10°C from the averages for the warmest and coolest months.

In Yap, the mean annual rainfall is 3028 mm. As a high island, Yap provides for the collection of rainfall and the flow of water from uplands to lowlands and then into the sea.

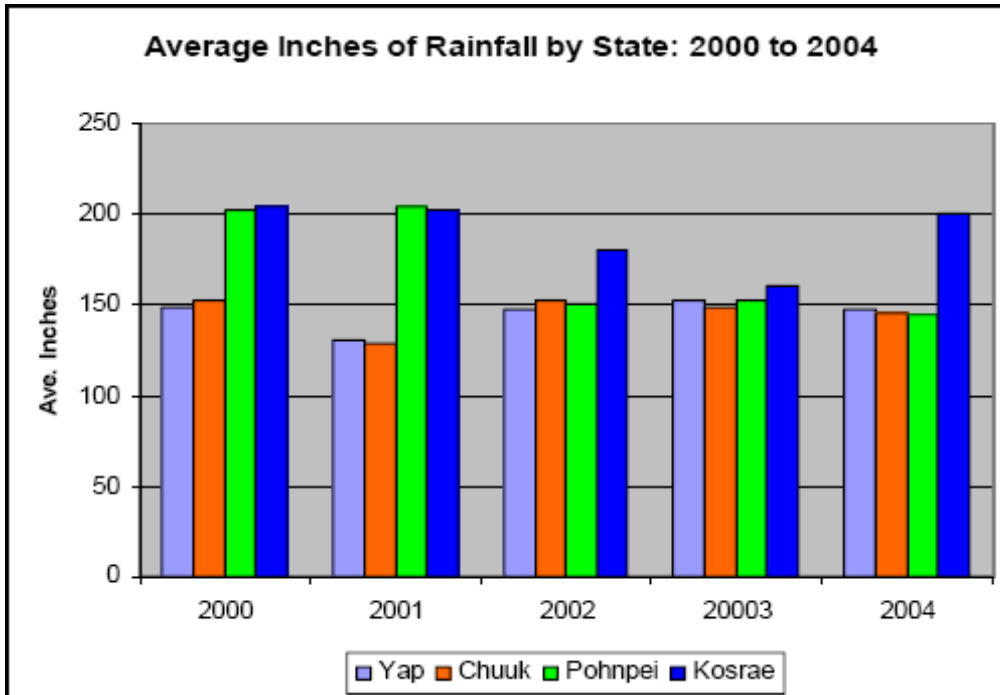
2.4 Agriculture

Agriculture is the most important primary activity in the nation because of its contribution to employment, wage income, export earnings, and subsistence production. Agricultural activities provide over 60% of the food consumed, and employ almost 50% of the labour force on a full-time or seasonal basis.

With one exception, fully commercial agriculture does not exist. On Pohnpei, a commercial pepper farm has been started with extensive cropping of about 100 acres targeted for production over the next five years. Copra remains the ubiquitous cash crop throughout the FSM, but production has decreased substantially due to low prices for copra coupled with increasing sterility of the coconut palms. The copra processing plant on Chuuk manufactures laundry soap and plans to produce a similar variety of products at the Pohnpei plant in the near future.

In Kosrae, citrus is a significant cash crop with limes and tangerines being exported. Periodically, Yap exports bananas, other vegetables, fruits, and betel nut to Guam and Palau.

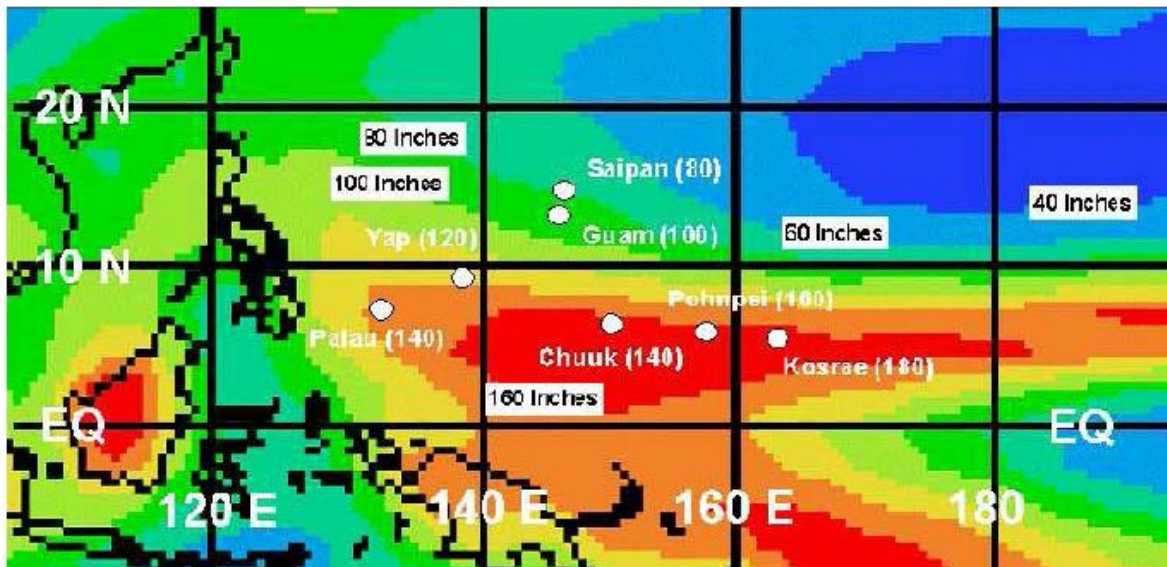
Figure 4: Annual rainfall in the four FSM States: 2000-2004



Source? State website but didn't give an address

Figure 5: Mean annual over-water rainfall in Micronesia

<http://orbit35i.nesdis.noaa.gov/arad/gpcp/>



Source: <http://orbit35i.nesdis.noaa.gov/arad/gpcp/>

Colours indicate rainfall pattern (amounts as labelled: red = 160 inches per year, orange = 140, yellow = 120, light green = 100, dark green = 80, teal = 60, light blue = 40, and within the blue there is a bit less than 40 inches of annual rainfall). Mean annual over-water rainfall at selected islands is indicated.

Farmstead livestock production is increasingly important throughout the FSM, particularly poultry, eggs and pork. Goats are becoming increasingly important in some areas, with goat meat production in Pohnpei doubling over recent years. Insignificant numbers of large ruminants continue to be raised, with 120 head of cattle and 70 head of buffalo in Pohnpei. There are also a few head of cattle in Kosrae and buffalo in Chuuk.

Primary industrial processing occurs on Pohnpei, Chuuk and Yap. Ponape Coconut Products Inc. continues to develop a number of coconut oil products including laundry soap, shampoo, body and hair oil, cooking oil, liquid soap and suntan oil. High quality charcoal is also being produced from coconut shell on Pohnpei as a by-product of the coconut oil industry.

Pepper (*piper nigrum*) is being industrially processed and packaged on Pohnpei to supply both the local tourist market and export markets. White pepper is being produced as a cottage industry, and is primarily sold locally to tourists. A small kimchee factory operates on Pohnpei using locally grown cucumber and head cabbage.

Yap processes fibre from coconut husks into brooms, brushes, ropes and mats. Also in Yap, a small abattoir has been established, capable of slaughtering animals for the local market.

2.5 Population

By the most recent count (2000) the total population of FSM stands at about 107,000, an increase of about 24,000 since the 1980 census. The State of Chuuk accounts for roughly half the total, at about 53,500. Pohnpei is next at about 34,500. The State of Yap has about 11,200 people, and Kosrae has a population of about 7,700. Since the Compact of Free Association permits FSM citizens to enter the US freely, to maintain "habitual residence" and to pursue education and employment, upwards of 15,000 Micronesians are currently living in the USA - 7,000 in Guam, 3,000 in CNMI¹, and the rest in Hawaii or on the Mainland. The numbers who actually immigrate to the USA, however, remains relatively low as most FSM citizens eventually return to FSM.

Between 1989 and 1994, the population of FSM increased by 10 percent (Figure 6). Pohnpei and Kosrae shared the increased population by 13 and 4 percent respectively. For Pohnpei, this increase represents the migration of the general population to the nation's capital for economic opportunities. Although the medium age of the population has increased over the last 30 years from 16 to 18 years of age, the structure of the population remains the same.

The FSM has one of the youngest populations among all Pacific Island nations. Almost 64 percent of the nation's population is under 24 years of age. The average population density in 1994 was 389 persons per square mile. But this varies by State. It ranges from a high of 1,088 per square mile in Chuuk to 170 per square mile in Kosrae. The matter of population density is important since it raises the issue of economies of scale for a variety of development efforts, including climate change matters. Average population density on a state-wide or nationwide basis may be misleading since the pattern of population density varies considerably.

¹ Commonwealth of Northern Mariana Islands

Figure 6: FSM population from 1920 with projected increases to 2012

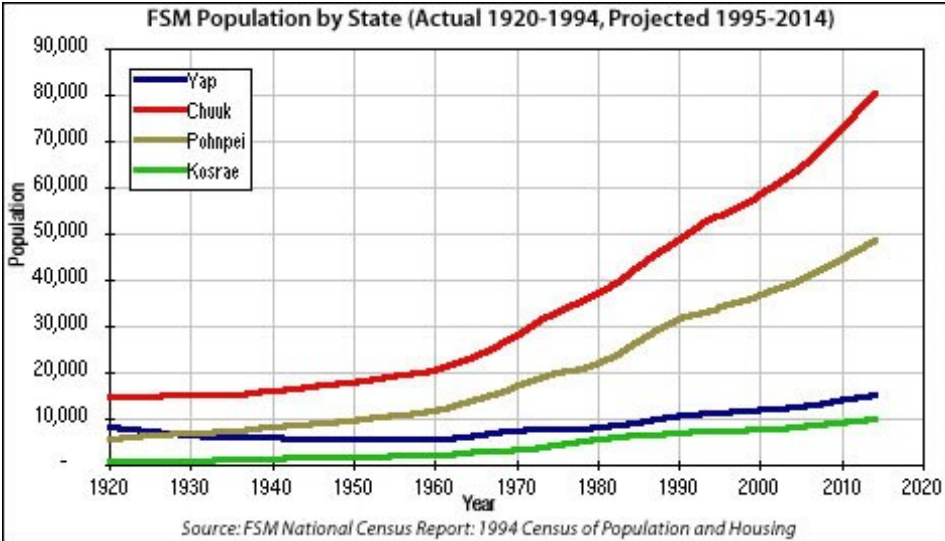


Table 1: Summary of the main geographic information for the FSM

Capital city:	Kolonia on Pohnpei
Population:	Total: 131, 500 (1999) Permanently resident: 107,000
Land Area:	702 sq. kilometres
Coastline:	6,112 kilometres
Highest elevation	790m on Pohnpei
Climate:	Tropical; heavy year-round rainfall, especially in the eastern islands; located on southern edge of the typhoon belt with occasionally severe damage
Mean Temperature:	27°C (January) 26°C (July)
Annual rainfall	4928mm
GDP per Capita:	US\$2,000 (2001 est.)
Currency:	US dollar (US\$)
Languages:	English (official language), Trukese, Pohnpeian, Yapese, Kosrean, Ulithian, Woleaian, Nukuoro, Kapingamarangi.
Government	Constitutional government in free association with the USA

3 Integrated Water Resources Management Situation for FSM

3.1 Water Resources Management

All four of the focal islands have coastal mangrove fringes and intermittent development along their coasts, with much less interior development. The natural vegetative cover is dense on all islands and has not generally been disrupted for intensive agriculture use. Whether planned or fortuitous, this has protected the watersheds, helping to reduce the rapid runoff and maintaining a reasonable recharge opportunity for the aquifers that are important to each state for a portion of its water supply. The direct runoff from intense rainfalls, even on these relatively small surface catchments, also provides one important source of water for all four islands; however, in each case, drought periods also arise when supplementation from ground water sources is important, and even critical.

3.1.1 Types of freshwater resources

About 60% of water resources exist as surface water in the form of small, intermittent streams that drain catchments areas of limited aerial extent. The streams are dry for about 20% of the year. The development of surface water as a water supply is therefore inherently expensive, since it requires the construction of dams to impound the surface runoff for use during dry periods. The topography in the stream basins is not conducive to the construction of economical dams. Furthermore, surface water requires extensive and costly treatment, largely to reduce high turbidity, undesirable taste and odours, and to remove all micro-organisms.

The remaining 40% of the islands' water resources exist as groundwater in small, dispersed zones of sedimentary deposits, weathered volcanic and weathered schist. These formations are not conducive to the development of high yielding wells. Drilling through this formation involves costlier investment. However, the hydrogeology is suitable for multiple, low to medium yielding wells in the range of 20 – 150 gpm range. The quality of the ground water is mostly excellent.

3.1.2 Types of freshwater uses

For FSM as a whole, the main source of fresh water are surface water, groundwater and rainwater. The primary source of fresh water in most of the Island States comprises of both underground, surface water and rainwater; the small islands for each state are fully dependable on rain water and shallow wells due to the low elevation of the islands.

In the FSM's atolls, raised coralline islands, and in those coastal areas composed of coral sand deposits and lagoon sediments, the freshwater lens which "floats" on the underlying denser seawater is tapped through shallow, hand-dug wells to supplement the rainwater catchments and storage tanks which are widely used and commonly the main source of drinking water in the outer islands.

In the early 1990's bottled water was introduced to all the states in the FSM mainly for business development. It cost approximately 60 US cents for a 500 ml bottle. During the mid 90's the private owned businesses adopted the function of converting the city water to distilled water using the reverse osmosis filtration process. The competition among the entire privately owned distilled water industry has seen the reduction of the cost of a 500 ml bottle to 50 cents or even lower to 45 cents US currency. Bottled water remains a popular form of potable water consumption in FSM.

Rainwater harvesting is not a serious issue in the urban areas on the main islands, for all the four states in the FSM. Most rain water harvesting is concentrated in the outer islands and the rural areas. The practical approaches are done for each individual house hold.

In the FSM, irrigation for agriculture is not practical in all the four states; the agriculture department in each state use the surface water and ground water to feed crops.

Among the four states, Pohnpei has the only hydropower plant with a capacity of 1.7 mega watts. It is located in Pohnpei at Nett (Nanapil) and is used to supplement the Island's power.

Table 2: Existing freshwater resources for each State in the Federated States of Micronesia.

Water System Name	Location	Source of Water	Type of Treatment
Kolonia	Pohnpei	Nanpil River and Wells	Sedimentation, Filtration and Chlorination
Palikir	Pohnpei	Wells	None
Wapar	Pohnpei	Well	None
Weno	Chuuk	Pou River & 32 wells	None
Colonia	Yap	Gitam Reservoir & Wells	Coagulation Sedimentation, Filtration and Chlorination
Gagil-Tomil	Yap	Wells	Chlorination
Southern	Yap	Wells	Chlorination
Malem	Kosrae	Malem River	None
Utwe	Kosrae	Pulistik River	None
Tafuyat	Kosrae	Tafuyat	None
Yekula	Kosrae	Yekula River	None
Mutunte	Kosrae	Mutunte River	None
Walung	Kosrae	Walung River	None

3.1.3 Major issues and concerns

The major concerns and issues are impacts of climate change; deforestation of the watersheds; and sanitary controls on the watershed activities – both human and animal.

The deforestation of the islands watersheds is one of the major issues in the FSM. In the early 1980's deforestation of the interior of Pohnpei and resultant pollution of the watershed resulted in the creation of a 5100 ha forest reserve. When survey teams tried to mark out the boundaries of the reserves, they were threatened by angry villagers. The government quickly backed down and land clearance, largely to plant kava (a valuable social drug crop), continued.

Water quality and resultant health concerns have been a major issue in FSM. For example in April 2000, an outbreak of cholera that began on Pohnpei, affected approximately 3,500 persons and caused 20 deaths. This was the result of poor waste water control.

In most parts of FSM, the underground water sources have potentially high iron content. In a study for FSM² relating to a high quantity of water extraction from an aquifer but the

² Study conducted during the Trust Territory of the Pacific Islands (TTPI) identified potential aquifer source for Pohnpei but the quality of water affected by high iron content. There has been consideration for the re-initiation of an iron removal plant to enable tapping this resource. In the meantime, authorities continue to face high iron content issues in the existing well field.

disturbance of high iron content is an issue among the people and the EPA office that have the full responsibility on water quality assurances.

The FSM IWRM council requires more incentive to integrate on water resource management and its components. Since, the small island countries are slowly developing, a concrete or solid legislation requires effective efforts to initiate the protection of the underground and surface water areas.

3.1.4 Measures to manage impacts and concerns (IWRM approaches)

The National Sustainable Council (NSC), Nature Conservation Society of Pohnpei, FSM Department of Health, States Environmental Agencies, FSM Weather Service, Watershed and Coastal Management and Land Use Planning and Zoning Commission are the main offices that have played a role in managing the impacts and concerns within their mandates.

The National Sustainable Council has launched several activities relating to public education and watershed protection is recently active in each state. Since the Utilities are responsible for the supply of water in the FSM, each State utility have different approaches to adapt the concerns and the impact of the issue and concern.

3.2 Island Vulnerability

3.2.1 Types of disasters with major issues and concerns

The greatest natural hazard in Micronesia is from typhoons, which are likeliest to occur during the rainy season from June to December. Tsunamis are also a significant natural hazard in the region. Low-lying islands in the chain face potential loss of land area, or in extreme cases complete submersion, as a result of anticipated rises in sea level caused by anthropogenic global warming.

The Federated States of Micronesia specially, the States of Yap, Chuuk and their adjoining outer islands are prone to extremely damaging natural disasters, in the form of typhoon, extended drought, landslides, tidal erosion and extensive floods. Due to climate change, the drought is perceived to be occurring with increasing frequency and intensity. Natural disasters are of special concerns to FSM due to its fragmented composition of smaller islands and dependence on subsistence agriculture and tourism, which are vulnerable to natural and environmental disasters. The natural disasters usually affect the economy and natural environment, which are long lasting and the rehabilitation costs are high.

There are offices for disaster preparedness in all the States. During a natural disaster the US Federal Emergency Management Agency (FEMA) and Red Cross provide supports for disaster preparedness. The inadequacy of supplies and logistic and effective manpower usually restrict the country to work on disaster preparedness ahead of time. The cultural barriers, superstition and lack of communication further contribute to a reduced ability to prepare for and respond to the frequent disasters.

The State Disaster Office should initiate early warning systems to take necessary precautions and to make people aware of the natural disaster. Sound management and engineering need to be adopted to assist in disaster mitigation. This should include the regulation of building codes and water quality standards.

The islands of the FSM are particularly vulnerable to global warming and climate change, climate variability and sea level rise. The people are living very close to the seashore, agricultural land and infrastructure are not very far from the seashore, and any rise in sea level will have significant effects on their economy and living conditions. The low-lying coral islands are always threatened. Inundation of coral islands results in a loss of human lives, a loss of subsistence agriculture for food and houses and infrastructure, which are not recoverable and always involve a costly rehabilitation. Global climatic change can destroy coral reefs, alter the distribution of zones of upwelling and affect both subsistence and commercial fisheries production. It may affect the vegetation and saline intrusion may adversely affect freshwater resources.

The FSM States need to monitor the climate change and any affects of changes, record the information and to take appropriate measures for protection.

3.3 Awareness

3.3.1 *Type of awareness campaigns, advocacy initiatives currently being undertaken in the area of water resources management*

There are no national level public education policies with respect to water supply and sanitation issues. Health Departments in each of the states has Health Education staff and programmes that from time to time touch on water quality and water handling issues. This is particularly the case during epidemics and reports of cases of water contamination. Nevertheless, public education for a range of health issues has been carried out by staff of the National Department of Health Education and Social Affairs.

Radio stations in each of the states broadcast items concerned with water supply and sanitation issues and utility matters. The Utility Corporations themselves can organise broadcasts and community awareness programmes as can other departments such as Health or Public Affairs.

However, there are no continuous or coordinated programs in any of the states. Public participation in the water supply sector has historically been very low. Under the US administration piped water supplies were limited but free. Under the FSM administration water was supplied free of cost until mid 1990s with the creation of Public Utilities that introduced a fee for service. However, this is variously applied, as connections are yet un-metered or meters are broken, particularly in Chuuk and Kosrae. Utilities also have, from time to time carried out education and communication activities, most often in connection with the electricity supply. All utilities expressed great interest in developing a better, more comprehensive, educational and participatory programme.

The FSM States have adopted policies for public awareness for; public health, protection of water resources, pollution of water resources, conservation and controlled use of drinking water. The policies need to be broadened and enforced in an effective manner. The concerned authority should develop enhanced policies so that people can follow them.

The local governments need the cooperation and support of the communities and politicians to enforce the policies. Community participation is a key approach towards environmental protection, protection of surface water catchments, groundwater and waste management. Awareness and motivation of the people are very important for the improvement and development of the water resources, treatment and distribution of water.

The communities are required to organise properly in order to participate in the improvement of their own water supply as well as operations and maintenance. Various diseases are caused due to supply of contaminated water in the FSM. In particular during the extended drought, there have been incidences of cholera outbreak, which leads to loss of human lives. We learnt from other countries that public awareness, community participation and political motivation support the community for a sustainable water supply. Involvement of women is particularly important for water resources management. Women are the prime users of water and who take care of the children, food preparation and household activities. Gender balancing and equity at policy levels will enhance health and hygiene aspects as well as management issues. FSM has yet to have enough qualified personnel to handle the wide range of responsibilities associated with the management and development of water and environmental sanitation sectors.

The incidence of economic inequality varies widely among the four states and the lowest income households are on the outer islands where there is a chronic lack of opportunity for basic needs and formal sector employment caused by sluggish economic growth. There are also significant gender inequalities as shown by lower female literacy and lower educational enrolment ratios.

3.4 Technology

3.4.1 *Types of water supply systems*

Only Kosrae and Pohnpei have perennial stream flow; the large deltas of rivers with short stream length and steep channel gradient attest to the very high rainfall which occurs in the mountainous interiors of these islands. Kosrae State is served with piped systems mainly from stream intakes via gravity distribution. The central water supply system comprises about five miles of distribution mains drawing on a diverted river, a rapid sand filter, and a 40,000-gallon storage tank.

In Pohnpei State, the capital centre of FSM has a water supply system that consists of a river source (the Nanpil Dam) supplemented by six drilled groundwater wells (bores) and three storage tanks consist of one tank capacity of one million gallons and two tanks with capacity of 0.5 million gallons each. The main source of filtration is a slow sand filtration and chlorination process. This feeds 60 miles of distribution mains of the central water supply distribution system. Along with the supplementary of the water for the entire 60 miles of distribution lines, additional groundwater holes were drilled to ascertain supply levels for future demands. A particular aquifer located at Nett in Pohnpei had a high capacity of water but with a high iron content. The installation of an iron removal plant was then initiated during the early 1980's to enable the distribution of a potable water supply to the people of Pohnpei and to operate, when required as a supplement to the existing system. All the connected households are on 24-hour water service. Rural areas have a few community systems such as that in Kitti where a filtration and chlorination process precedes the distribution network.

Only in the capital centre of Weno (Moen) and on parts of Tonoas (Dublon) in Chuuk State are there centralised water supply systems. Most of the State's population relies on individual roof catchments and storage tanks for their water. This water supply is supplemented by fresh to brackish groundwater from springs and shallow hand-dug wells.

In Yap State, the Gitam Dam supplies more than 30 million gallons to the capital centre of Colonia but demand exceeds the capacity of the filtration and chlorination plant. The majority of the population relies on individual rainwater catchments. In addition, there are two deep well systems, one serving the northern part of Yap Island, while on the western side of Yap (Map and Rumung municipalities) spring water is collected and fed to the village by gravity feed.

Small rain water catchments and shallow dug wells are used extensively throughout the rural areas and outer islands of the FSM. They are not capable to meet demand during drought, and require standardisation and appropriate design to suit the environment and community demands. On the outer islands, there are no piped water systems and the residents rely exclusively on individual household systems. The full dimension of the problem can be seen from the fact that about 40% of the population of the FSM reside on the Outer Islands and are totally dependent on simple household water systems to meet their needs.

The main problems faced in operating surface water systems arise from the bacteriological contamination of the water sources and supply problems during extended dry periods. In the dry season, maximum demand coincides with minimum supply and water shortages are experienced. Special technical review and careful judgment are required to standardise these surface water systems to fit community demand in terms of quality, quantity and which are environmentally friendly.

These piped water systems are of two basic types. Systems, which utilise streams water sources consist of a small intake across the stream, a raw water main to the treatment plant (for those systems which incorporate treatment) and a transmission and distribution network. Water treatment is by rapid sand filtration, followed by chlorination. Only five systems out of about 70 have treatment facilities, and most systems supply untreated water.

The severe drought of 1983 gave stimulus to a groundwater development program, which resulted in the drilling of several dozen wells in all of the states of the FSM. A total of about 90 boreholes have so far been drilled in the main islands. The under ground formations are

not conducive to the development of high yielding wells and drilling through this formation involved costly investment. However, the hydrogeology is suitable for multiple, low to medium yielding wells in the range of 20 – 150 gpm. The quality of groundwater is mostly excellent. Groundwater exploitation systems usually consist of a production borehole fitted with a submersible pump, and a transmission and distribution network. A chlorine injection procedure is sometimes incorporated into the system at the wellhead.

Groundwater on small atolls occurs as a thin lens, which floats on the underlying seawater. In the FSM, the relatively high rainfall and low rates of surface runoff on the atolls, results in good recharge rates. However, most of the atolls are less than 0.3 square miles in area. Furthermore, they tend to be elongated in shape and are therefore too narrow to produce the conditions that will give rise to a freshwater lens of significant thickness. The hydro geological data obtained from the well drilling programme and an investigation carried out in the mid 1990s reveals that fresh water development is potential in some of the coral islands. But the success lies in the application of appropriate technology and indigenous method.

3.4.2 *Types of wastewater/sanitation systems*

The four main urban centres of FSM have a sewer system. Outside the urban centres the population rely on different forms of septic tank systems. Many of the septic tanks are substandard; an Environmental Protection Authority EPA study on Pohnpei has shown over 2000 homes with either no sanitary facilities or substandard facilities. Pohnpei has one sewage treatment plant located in Kolonia with over 500 homes connected via the sewer network. This is a trickling bed filter system with the treated discharge going into Sokehs Harbour (Kingston 2004).

3.4.3 *Major issues and concerns*

In many of the islands, there are no appropriate actions or policy to protect and safeguard watershed and groundwater resources, which poses a threat due to the rapid population growth on the main islands, changes in economic strategies and a growing demand of freshwater. Contamination of indiscriminately discharged human and livestock wastes is a common threat too to the freshwater resources in FSM.

There are persistent problems due to land access in most of the FSM States, and in Chuuk in particular. There are limited access for proper management and development of the water resources. Unfortunately except for a few exceptions, there are limited numbers of organisations within the municipality or state levels available having adequate capacity to provide specific expertise in the areas of technical, planning and design and management support for water sector development in FSM.

There are also possible constraints due to low groundwater recharge resulting in saltwater intrusion during the drought. The proper operations and maintenance program require to be developed for routine maintenance of the water supply systems. Many systems are supplying sufficient volume of water without proper treatment. Sound technical and appropriate design is vital for these systems in the FSM.

Pohnpei has a problem with high levels of water related diseases, e.g. diarrhoea, gastroenteritis, intestinal worms, cholera and amoebiasis. This occurs mainly outside the urban areas and needs dealing with through health and sanitation education.

3.4.4 *Measures to manage impacts and concerns (IWRM approaches)*

The above constraints need to be addressed and the present level of the management of water systems requires immediate improvement in order to achieve technical capability and sustainable water supply for everybody.

Sound engineering and long-term management strategies for water catchments and storage areas, including the treatment and distribution of limited water supplies, are of particular economic and environmental importance.

3.5 Financing and institutional arrangements

3.5.1 Institutional arrangements

The national government of FSM is headed by the President, elected for a four-year term by members of the national congress. The national congress is a unicameral institution comprising of ten Senators. Each Senator represents a district and is elected by voters in each of the four states. All state representatives are elected by popular vote.

The state government is headed by the Governor who is directly elected by the people of the state also for a four-year term. Both national and state governments have their independent departments to handle various activities, which include water supply and environmental sanitation. The specific institutions that directly undertake water supply and sanitation services in the states are:

- Pohnpei Utilities Corporation (PUC): for the state of Pohnpei
- Chuuk State Public Utilities Corporation (CSPUC): for the state of Chuuk
- Yap State Public Services Corporation (YSPSC): for the state of Yap
- Department of Transportation and Utility of Kosrae (DOTU): for the State of Kosrae

All these Corporations undertake additional responsibilities of generation and distribution of power, except the DOTU of Kosrae. The power sector in Kosrae is directly handled by Kosrae Utilities Authority (KUA). The state legislatures are considering legislation to transfer the responsibilities of water supply and sewerage services to the KUA.

In addition to the Utilities Corporations (UCs) there are some other specific institutions connected to water and sanitation at national and state government levels. Various training programmes for different levels of personnel were provided, which were mostly on the operation and maintenance of the system. These training programmes were mostly conducted off-site generally outside FSM. These training programmes therefore, probably could not help the operation and maintenance personnel to effectively address the particular problems of their respective areas. In addition, some training on software for improving the current accounting system had been recently conducted for some of the UCs. No effective training in the field of public education and participation has so far been conducted at the UCs level.

The national and the state governments are aware of the consequence of termination of US funding under the Compact arrangements particularly in the areas of utilities. All the UCs are charging customers reasonable rates towards electricity consumption and therefore may sustain the generation of power including cost of diesel oil which is presently being borne by the Government from the Compact grant.

Since part of the cost of water supply and sanitation is also being borne by the UCs from generation of revenue against electricity, they are not confident about the sustainability of these systems once the grant is stopped. The state governments therefore realise that water can no longer be a free commodity and a reasonable tariff on its consumption should be imposed based on its affordability to the consumers.

UCs in Pohnpei and Yap have already introduced such policy but not the other states. The government has identified the principal future sources of their revenue generation for the country as fisheries and tourism industries.

Supply of safe water and adequate sanitation provisions are prerequisite for promotion of these industries. The government has accordingly included these utilities as top priority in their national policies.

The national and state governments have also identified the need for institutional strengthening to make the UCs self sustaining. Various operation and maintenance improvement programmes (OMIP) and training of personnel have been implemented with the help of the US Government's Department of Interior (DOI) in the past which have shown

positive improvements to some of the UCs (PUC for example), in their functioning. The FSM Government's policy in prioritising the sector is further confirmed by its action in approaching the Asian Development Bank (ADB) for assistance in improvements of the sector.

The government of FSM does not have any direct role in setting policy frameworks for the sector. The national government, through its Department of Finance and Administration, and Department of Transportation Communication and Infrastructure (DTCI) coordinate the mobilisation of funding for water supply and sanitation projects. Further, specific funding allocations may be appropriated by the Congress under the Capital Improvement Program (CIP) for projects such as water extensions or the construction of community water systems. Usually these projects would be in response to requests from the communities to the Congress members. The government's recognition for human resources development for effective management of this technical sector justify its policy effort due to the improvement of overall health of its people by providing safe water and adequate sanitation facilities. The donors also recognise water and sewerage as priority sectors to develop and are making efforts to develop institutional frameworks under which water and sewerage services can be commercialised and improved for self sustainability of the sector. With these in view the ADB has funded, and is considering more funding loan assistance for the government of FSM.

3.5.2 *Financing arrangements*

FSM runs on financial support of the UCs by State Government under the Compact of Free Association. In the water supply and sanitation sector the capital investments are provided by DOI under periodic OMIPs, while the operation and maintenance expenditure are partly borne by the states from their revenue. In most of the cases there is no separate revenue for water supply and the UCs are to bear the expenditure from the revenue earned from the sale of electricity. The net deficit is funded by the Compact grant.

The UCs in the States have very recently assumed the responsibility of water supply and sewerage services and are in the process of development. In Kosrae these services have yet to be taken over by the appropriate authority. Due to paucity of resources and dependency on external assistance, development of the infrastructure to meet the desired needs as well as maintenance programmes are generally not included in the States budgetary provisions. Therefore, the service levels in terms of quality and quantity have declined. Many of the services could not be rendered by the UCs due to the unavailability of resources to acquire critical spare parts and carrying out adequate maintenance programmes.

The UCs activities were previously funded by the respective state governments. The tariff structuring and charging of service cost to the consumers were not uniform. In Kosrae no revenue is realised for water supply from the consumers. Such differences arose out of socio-political considerations, having little or no linkage with service pricing and service costing.

The utilities formed for supplying water and power will also have to increase their revenue base by increasing tariffs on water supply and sewerage or imposing the same wherever not levied so far at a concession/minimal rate. However, such tariff structuring will need to keep in view the affordability aspect and cross subsidisation amongst the different groups of consumers. The UCs will have to therefore generate sufficient resources to meet their funding needs and accordingly fiscal reform will have to be initiated for the purpose. Such lack of financial independence has not only affected service quality, but also acted as a hindrance for growth. The UCs have thus either been unable to provide the services or rendering the same by sacrificing the ongoing maintenance program. The effect of such diversion of funds will lead to serious effect on service capability in the future.

4 Linkages to other areas

4.1 Land use and agriculture

Out of a total FSM population of 107,000, an estimated 80% depend on subsistence or semi-subsistence livelihoods. Agriculture is not a major contributor to export receipts but provides livelihood and employment to much of the population. Recent policies have tended to favour commercial development of agriculture, failing to adequately account for subsistence and semi-subsistence farming systems and their inherent characteristics.

Traditional subsistence foods have been overwhelmingly replaced by imported foods, and are regarded as inferior (“starch foods”), and not fully recognised for their economic or nutritional value. Support services have not targeted traditional agriculture. Commercial agriculture has had some successes—especially in niche export markets, e.g., kava (*sakau*), betel nut, cooked breadfruit, and bottled processed noni.

Most agricultural production in the FSM is subsistence in nature, producing food for family use, ceremonial purposes, social obligations, and income generation. The 2000 Census indicated that nearly 17% of families were dependent on subsistence agriculture for their main source of employment, compared with 10% in the previous census. A recent survey on Pohnpei showed the value of average agricultural production per household at US\$4700 in 2003, equivalent to 74% of median household income in 2000.

The major species of livestock are free-range chicken and pigs which are kept for home consumption. Pigs have an important ceremonial value, especially in funerals. There are few regular piggeries, and prices are high because of expensive imported pig feed. Poultry are run free-range, and are used for both meat and egg production. There are a few commercial layer poultry operations, but imported feed makes production costs high. Egg imports in 2002 amounted to US\$444,400, suggesting additional opportunities for local production, based on locally grown feeds.

There are export markets in Guam, the Marshalls, and Saipan for root crops, bananas, betel nut and kava, and in many countries for copra. In addition, there are immediate prospects for import substitution of selected fruit and vegetables in local markets. Agriculture exports amounted to about US\$1.4 million in 2002, equivalent to an average annual increase of 6.5% from 1999-2002. Exports of betel nut, kava, and copra grew annually by 18%, 7%, and 5% respectively in the same period. All three crops are grown by traditional, semi-subsistence farmers. Exports of banana, citrus fruits and root crops declined over the same period by an average of 17%. The majority of agriculture exports are sourced from Yap which accounted for 51% and 65% of total agriculture exports for 1999 and 2002 respectively - while Pohnpei accounted for 31% and 26%, respectively. Conversely, exports from Chuuk and Kosrae are negligible.

4.1.1 Irrigation and rain-fed agriculture

Irrigation is not widespread on FSM. High rainfall means that agriculture is almost exclusively rain-fed.

4.1.2 Agriculture and water quality (deforestation)

Land degradation is a serious issue on most islands. On Pohnpei, encroachment by squatters growing kava into the upper watershed has reduced the area of primary forest significantly – from 15,000 ha in 1975 to 5,200 ha in 1995 to 4,200 ha in 2002. Siltation of the fringing reefs as a result of deforestation and subsequent erosion is causing significant damage to traditional marine food supplies.

4.2 Habitats and ecosystems

The biodiversity and natural heritage of the FSM is both globally significant and the foundation for the country’s long term economic self-sufficiency. The islands of FSM contain over 1,000 plant species, at least 200 that are found nowhere else on Earth. Its reefs, which

provide coastal protection and the source of livelihood for a majority of the local population, are home to nearly 1,000 species of fish and more than 350 species of hard coral. Maintaining the habitats and ecosystems that nurture this diversity is crucial for improving Micronesians' quality of life and sustaining the country's rich traditions. FSM's long-term prospects for economic self-sufficiency rely on three sectors highly dependent on the continued vitality of the natural environment: fishing, agriculture, and tourism. Local cultures and values have strong ties to terrestrial and aquatic resources. Unfortunately, FSM's extraordinary natural resources face mounting threats. In the face of these threats, there is a growing recognition among policy makers and the general public of the links between the health of the nation's natural heritage and biodiversity, sustainable economic future and traditional values and culture. Environmental sustainability is considered as one of the core principles of the FSM National government economic plan and framework for its renegotiation with the USA for the renewal of the financial provisions of the nation's Compact of Free Association.

The FSM clearly still has a relatively rich biodiversity inheritance, including ethnobiological traditions. Nevertheless, this fragile biological inheritance is seriously threatened due to both natural and anthropogenic events. Significant declines in the biodiversity of the FSM are clearly evident. The start of the decline is hard to determine as the written record is not extensive, however, it probably began with the first arrival of man. The rate of biodiversity decline has considerably increased since the arrival of the first European explorers, culminating in the highest increases in biodiversity decline during the last century. Unfortunately, this trend is continuing.

The decline of the FSM's biodiversity is clearly linked to increased centralisation and urbanisation of the population, very high population growth rates, and more effective and efficient technology, commercialisation including increased exportation of natural resources, reliance on imported commodities and the general westernisation of the nation. In addition the nation faces mounting constraints that are inhibiting efforts to conserve the nation's biodiversity.

The list below is not exhaustive, but highlights the major threats and constraints identified by the stakeholders who were consulted during the preparation of this report.

Conversion and degradation of habitat and ecosystems:

- Inappropriate Farming Practices (e.g. extensive burning, wildfires).
- Agricultural degradation, soil degradation, deforestation and development.
- Inappropriate and indiscriminate use of fertilisers and pesticides.
- Degradation of freshwater resources, watersheds/catchments and associated ecosystems.
- Degradation and deforestation of coastal and mangrove forests from inappropriate and greatly increased marine and coastal development.
- Ship groundings.
- Increasing populations and urbanisation.
- Increased and poorly planned infrastructure development (e.g. roads).

Overexploitation and unsustainable harvesting methods and practices:

- Destruction of coral reefs and associated ecological communities (e.g. coral extraction, reef anchors).
- Overexploitation of marine organisms (e.g. reef fish, sea cucumbers, giant clams) including unregulated exportation and utilisation for social functions.
- Overexploitation and inappropriate development of coastal and marine ecosystems (including mangrove forests).

- Overexploitation of forest resources.
- Destructive and unsustainable fishing methods e.g. dynamite, chlorine, fish poisoning plant (*Derris elliptica*), small mesh gillnets.
- Marine sand mining, dredging operations, causeway and sea wall construction.
- Overexploitation of fish aggregation spawning sites.
- Illegal bio-prospecting of genetic resources.
- Loss of traditional ethnobiological knowledge.
- Illegal offshore and inshore fishing.

Waste management:

- Terrestrial and aquatic pollution (e.g. oil spills, coastal waste dumpsites).
- Solid waste collection and disposal.
- Hazardous waste usage and disposal.
- Sewage collection, treatment and disposal.
- Disposal of heavy equipment (e.g. cars).

Invasive organisms and pests:

- Introduction of pests and diseases.
- Direct negative impacts on native species and terrestrial and aquatic habitats by alien invasive species e.g. mile-a-minute plant (*Mikania micrantha*), cane toad (*Bufo marinus*), rats and feral animals (e.g. pigs, wild cats).

Climate:

- Increased frequency and intensity of tropical storms (typhoons).
- Global climate changes and sea level rise.
- El Nino – Southern Oscillation phenomena.
- Increased fluctuations in precipitation patterns (e.g. flooding and drought).

4.3 Health and hygiene

FSM joined along with the other nations and countries with the crisis of water health concern. There are numerous physical studies and reports that have indicated the seriousness of health concerns in relation to watershed and wastewater management. The State(s) EPA has the responsibility of monitoring the environmental pollution and human activities toward any sort of contamination and detrimental activities toward the environment.

Major concerns are water related diseases, especially cholera (epidemic in Pohnpei in 2000), leptospirosis, hepatitis and amoebiasis which are all endemic. Disease statistics can be obtained from FSM Health Services, but usually only listed as 'enterogastritis' and non-specific as to the actual disease.

With the expansion of potable water around the FSM islands, the incidence of water related diseases is decreasing, however all rural community water systems are untreated and the outer islands (using mostly water catchments for drinking purposes) remain at risk.

Many of the popular waterfalls and rivers used by tourists do not meet State(s) EPA quality standards for recreational use and are a threat to the health of swimmers. This is due to pollution from improperly located pig pens and toilets that discharge directly or indirectly into the rivers. Tourists continue to swim in our rivers and waterfalls. The incidence of water-related diseases from such activities by tourists is unknown. It is difficult to eliminate

the pollution sources as the benefits from tourism at the community level are not felt directly.

4.4 Watershed and coastal management

In the FSM as a whole there is not much seriousness on the watershed and coastal protected area as seen in the existing legislation. According to the source people, Pohnpei is the only state that has legislation on watershed and coastal protected area. The Kosrae government working with the national government are working toward the areas to be amended but nothing has been finalised yet. National and the Chuuk and Yap state entities are working out the issues to be formulated into legislation. The private owned land in both states gives rise to difficulties in ensuring or empowering the importance of the watershed and coastal management.

Pohnpei alone has the vision on the importance of the roles to step forward to endure the activities of the protected areas and is active in government and with the local people. Figure 7 shows the protected areas on Pohnpei.

The primary threats to protected areas are listed below.

- Rapidly increasing populations and more consumptive lifestyles.
- Inadequate scientific baseline biological information on the status of biodiversity.
- Insufficient aquatic and terrestrial conservation areas and management plans.
- Insufficient biodiversity legislation and lack of enforcement.
- Insufficient skilled/trained human resources.
- Insufficient coastal planning and zoning.
- Inadequate awareness of links between conservation and sustainable economic development.
- Insufficient funding for conservation activities.

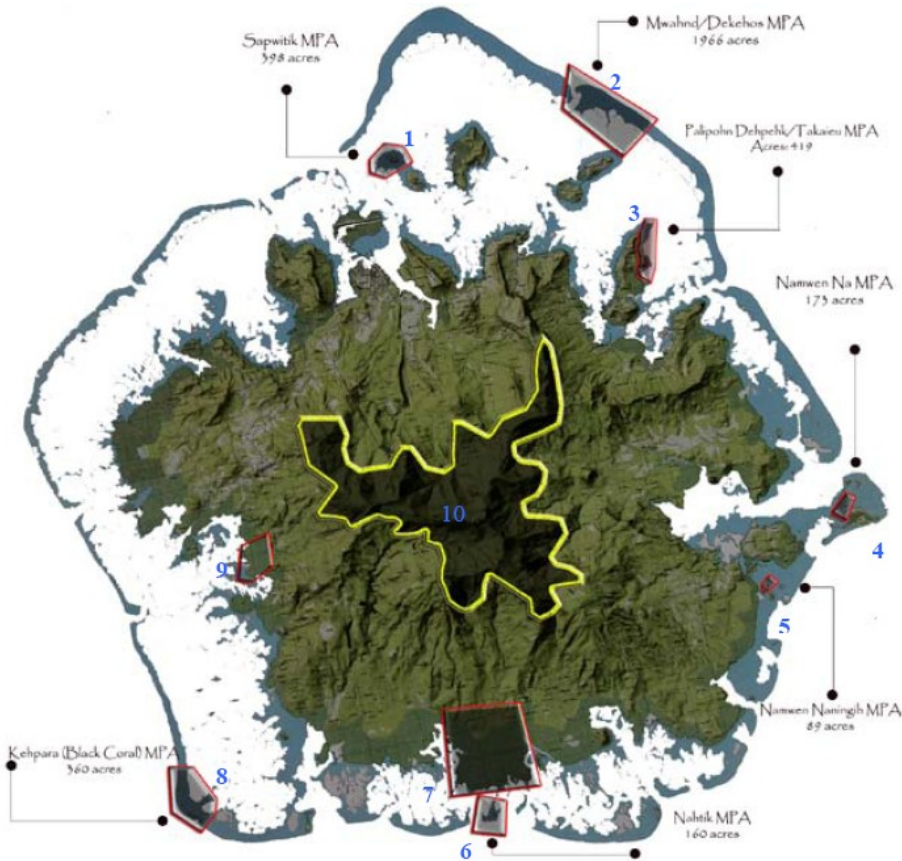
A watershed management and public education and elementary education curriculum programme is on going with the Pohnpei Nature Conservation Society. Each state has its own programme on watershed and costal management. Assistance is required in the four states to ensure a successful result is achieved.

Table 3: Key and legend to figure 7 

LEGEND

No.	Name	Acres	No.	Name	Acres
1	Sapwihtik	398	6	Nahtik	160
2	Mwahnd	1966	7	Enpein	
3	Takaieu	419	8	Kehpara	360
4	Namwen Na	173	9	Pwudoj	
5	Namwen Naningih	89	10	Protected watershed area	

Figure 7: Protected areas on Pohnpei



Source:

5 Stakeholder Engagement

In writing the FSM diagnostic report mid May 2007 a consultative process was initiated to invite responsible offices and people to incorporate their skills and expertise to provide the necessary documents guided by a questionnaire.

The FSM advisory group comprises of different offices in the FSM National Government and State Government which most of the acquired knowledge and information is derived from.

- | | |
|--------------------|------------------------|
| Tajmilur Raham | FSM DTCTI |
| Donna Shceuring | PNI EPA |
| Etiny Hadley | PNI EPA |
| Reseio Marcus | PNI CSP |
| Likiasi P Wesley | Kosrae EPA |
| Abraham Simpson | Kosrae EPA |
| Joseph Konno Chuuk | EPA/ Governor Advisory |
| Moses Predtrick | FSM Health |
| Leerenson Airens | PUC |
| Alex Nanpei | PUC |
| Esmond Moses | PUC |

Leeroy Heits	WERI
Sharam Khosrowpanah	WERI
Mark Lander	WERI
Cindy Henry Ehmes	FSM, Economic Affairs
Marcelo Peterson	Town Mayor, Kolonia
Asher Edward	Land Grand
Wincener David	PNI Health
Francisco Mendiola	College of Micronesia

Table 4: Bodies and organisations used in consultative process

Organisation	Relevance to IWRM	Role in Consultative Process
State EPA	State level environmental management	Provide data for state level
FSM EPA	National level environmental management	Provide data for all states
State Health	State level health management	Contribute the state(s) statutes on health
FSM Health	National level management	Main source for all state(s) current health issues
FSM Economic Affairs	National level economic affairs	Contributes to all state level related affairs
CSP	Management at state level of watershed, coastal and forest issues	Contributes to state protected areas.
College of Micronesia	Land grant program for water etc.	Contributes to land grant programmes
FSM DTCI	National level on infrastructure development	Main source of all national activities in relation to infrastructure
WERI	Oversees nation on federal programmes in relation to IWRM	Contributes and advises on issues related to IWRM and consulting

6 Other programmes, projects and activities related to IWRM

There are several programmes and entities currently in existence in the FSM that are undertaking efforts in the control of some specific function of IWRM. Included under these categories are:

- National Sustainable Council
- Nature Conservation Society of Pohnpei
- FSM Department of Health
- States Environmental Agencies
- FSM Weather Service
- Watershed and Coastal Management
- Land Use Planning and Zoning Commission

- Utility Corporations

Throughout the FSM islands or States, there are several ongoing and completed projects related to water activities. For the past years, the FSM National Government had undertaken a loan from Asian Development Bank (ADB) for improvement of water infrastructure throughout the FSM States or Islands.

There are also some water projects funded by the US Department of Interior on a 50-50 matched basis disseminated through the State(s). These are for water improvement programs and rehabilitation. Recently, under the new Compact fund, water and wastewater were highlighted as one of the top priority in the FSM as whole.

The UCs in all the states have the mandate for the operation and maintenance of water, wastewater and power. Since the completion of the ADB project, one of the States in the FSM took an initiation to enter into Loan through the protocols of the FSM to different donors as rural utility services for water related activities. The Pohnpei Utilities Corporation has entered into a loan of US\$3,911,000 to extend the waterline from Uh to Kinak, with the components of constructing a half a million storage tanks and groundwater wells.

The Western Environment Regional Institute (WERI) of the Western Pacific under the US Federal programs have funded and implemented some water resources project in the FSM State(s). (See <http://www.weriguam.org/fsm/research.htm>).

The nation gives recognition to the need for IWRM to better coordinate the needs and function require in achieving a meaningful and effective result

7 Capacity Development Needs for Removing the Barriers

Reinforcement of the national approach on the removal of barriers/obstacles currently in-place to achieve the national objectives and the need for a specialist to review these objectives and advice/guide the action required in achieving these objectives.

8 Introducing an Integrated Approach towards Barrier Removal

Under the regional understanding on specific action required under the Regional Action Plan, there is a need for an efficient Secretariat to be formed and to monitor, assist and consolidate progress reports in achieving its objectives. Donor agencies and donor countries are required to assist with financial resources.

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