

Initial Environmental Examination

49450-023
July 2019

FSM: Renewable Energy Development Project

Prepared by the Ministry of Finance, Federated States of Micronesia for the Asian Development Bank.

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ABBREVIATIONS

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ABBREVIATIONS

ADB	Asian Development Bank
ABS	Areas of Biological Significance
AP	Affected Person
BESS	Battery Energy Storage System
CEMP	Construction Environmental Management Plan
DoF	Department of Finance
EA	Executing Agency
EARF	Environment Assessment and Review Framework
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
ESD	Environmental Significance Declaration
EEZ	Exclusive Economic Zone
FSM	Federated States of Micronesia
FSMEPA	<i>Federated States of Micronesia Environmental Protection Act (1984)</i>
GDP	Gross Domestic Product
GEF	Global Environment Fund
GHG	Green House Gas
GRM	Grievance Redress Mechanism
GWh	Gigawatt Hour
HPO	Heritage Protection Office
HV	High Voltage
IA	Implementing Agency
IEA	Island Environmental Authority
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
KIRMA	Kosrae Island Resource Management Authority
KLUP	Kosrae State Landuse Plan
KUA	Kosrae Utility Authority
LV	Low Voltage
MW	Megawatt
NBSAP	National Biodiversity Strategy and Action Plan
NES	National Environmental Service
PMU	Project Management Unit
PREIF	Pacific Renewable Energy Investment Facility
PV	Photovoltaic
SPS	ADB Safeguard Policy Statement 2009

CURRENCY EQUIVALENTS

FSM uses the United States dollar (US\$) as at November 2018		
AU\$1.00	=	US\$0.72
US\$1.00	=	AU\$1.39

NOTES

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EXECUTIVE SUMMARY

- The project.** The FSM Renewable Energy Development Project: Kosrae (the project) will assist the FSM to meet the objectives of its National Energy Policy to provide cost effective, safe, reliable and sustainable energy. The FSM National Energy Policy sets goals to increase renewable energy generation to 34%, increase electricity efficiency by 50% and reach a rural electrification rate of 90% by 2020. Currently approximately 19% of energy generation in FSM is from renewable sources whilst 67% of households have access to electricity. Nearly 15% of GDP is spent on imported fuel, making energy the costliest sector of the FSM economy.
- The project will undertake feasibility assessments and prepare procurement documents for subprojects in two of the four States of the FSM; Yap and Kosrae. Subprojects are designed to help the FSM meet the goals of its National Energy Policy and each State to meet the targets set in its corresponding State Energy Action Plan.
- Kosrae currently has only approximately 8% renewable energy generation, but, with an electrification rate of 98%, has already exceeded the goal of the National Energy Policy and State Energy Action Plan. The feasibility assessment identified two subprojects to increase the renewable energy generation on Kosrae and to electrify Walung Village, the last remaining population centre on Kosrae that does not have access to electricity. Combined the subprojects are expected to increase the percentage of energy generated from renewable sources on Kosrae to 34% and result in diesel fuel savings of at least 100,000 gallons per year and the avoidance of 1023 tonnes CO₂e per year. This outcome will enable Kosrae to exceed its State targets and also help FSM achieve the goals of the National Energy Policy and commitments under the Paris Accord.
- Implementation arrangements.** The FSM Department of Finance and Administration (DFA) will be the executing agency and the FSM Department of Resources and Development (R&D) will be the implementing agency. A Project Management Unit (PMU) will be set up to manage the project and will be supported by a Project Implementation Consultant (PIC).
- Screening and categorisation.** The project has been classified as Category B for environment following the ADB's Safeguard Policy Statement 2009 (SPS). A category B project requires an environmental assessment commensurate with its level of impact, and this IEE including an EMP has been prepared.
- Potential Impacts.** No critical habitat will be impacted by the project. The main negative environmental impact will be the loss of vegetation associated with the installation of ground mounted solar PV arrays in Tofol and a solar powerhouse and distribution system in Walung Village. The subproject sites in Tofol are degraded and dominated by introduced species. A survey at the Tofol sites did not record any flora species listed on the International Union for Conservation of Nature (IUCN) Red List and the sites do not provide priority habitat for any fauna species listed on the IUCN Red List. One flora species listed on the IUCN Red List was recorded at the Walung subproject site and a further four listed fauna species have potential to utilise the site. The listed flora species will be avoided during detailed design of the subproject and the site is unlikely to provide priority habitat nor have a significant impact on any listed fauna species.
- Environmental Management and Monitoring Plan.** Potential impacts can be managed and reduced to acceptable levels through the implementation of the measures identified in the EMP. The IEE and EMP will be updated as the subprojects are further defined during feasibility assessments. Environmental mitigation measures will be incorporated into the design of the subprojects. The IEE and EMP will be included in technical specifications and bidding documents. The successful construction contractor shall prepare a construction EMP (CEMP) that will be reviewed and approved by the IA or a specialist consultant engaged on their behalf. The IEE and EMP will form a preliminary proposal and environmental impact assessment checklist and EIS (if

required) to obtain a development review permit from the Kosrae Island Resource Management Authority (KIRMA).

8. **Consultation, participation and disclosure.** The project continues work toward developing and implementing the objectives and goals of the National Energy Policy. Consultation for the National Energy Policy was undertaken in 2009 and 2010. Further consultation was undertaken in 2017 and 2018 by Castalia and ITP who were commissioned by the FSM National Government to prepare an Energy Masterplan for FSM.

9. For the project, a range of stakeholders from State and National Government, Government agencies, municipal representatives and residents of Walung Village were consulted. Kosrae Utilities Authority (KUA) has undertaken consultation with landowners and residents in Walung to; inform landowners and residents about the proposed project and how it would proceed, answer questions and negotiate any uncertain terms and conditions with the community and to reach formal agreements with relevant landowners for grants of easement. Feedback from consultation has been considered in the selection and initial design of subprojects as part of the feasibility assessment. KUA are committed to undertaking further stakeholder and community consultation.

9. **Grievance redress mechanism.** A grievance redress mechanism (GRM) has been established for the subprojects. The GRM will be implemented through all stages of the project including design, construction and operation. The community will be informed of the GRM through the consultation programme and by prominent display of the GRM process at the subproject sites and in the KUA office prior to the commencement of onsite works. There will be full and free access to the grievance focal point (KUA).

10. **Monitoring and reporting.** Environmental monitoring will be carried out through all phases of the project development to ensure that the environmental mitigation measures are effective and that actual environmental impacts accord with predicted impacts and are compliant with KIRMA regulations and ADB safeguard standards.

11. Reporting will include contractor's monthly reports to KUA, quarterly progress reports prepared and semi-annual safeguards monitoring reports prepared by the IA and submitted to the ADB. ADB will disclose the monitoring reports.

12. **Conclusion.** This IEE has identified potential environmental impacts associated with the proposed subprojects as far as is practicable whilst the subprojects are still subject to feasibility assessment. Measures required to mitigate or minimise impacts have been summarised in the EMP which, together with this IEE, will be updated as the subprojects are further defined during the feasibility assessment. Provided the mitigation measure outlined in this IEE and EMP are appropriately implemented, the subprojects are not be expected to have any widespread, irreversible, significant or long-term environmental impacts.

1. INTRODUCTION

A. Project Background

13. **Location.** The Federated States of Micronesia (FSM) is located in the western Pacific and is approximately 1680 mi (2700 km) from east to west (Figure 1). It includes 607 islands, 74 of which are inhabited, and is comprised of four States; Yap, Chuuk, Pohnpei and Kosrae.

14. Kosrae is a high volcanic island and is the eastern most of the four States. It is the second largest island in the FSM with a land area of 42 sq mi (110 km²) and an Exclusive Economic Zone (EEZ) extending for 200 nm. Kosrae has a population of 6,616 people (2010 census) or approximately 6% of the FSM's population. It is the only State to be comprised of a single island.

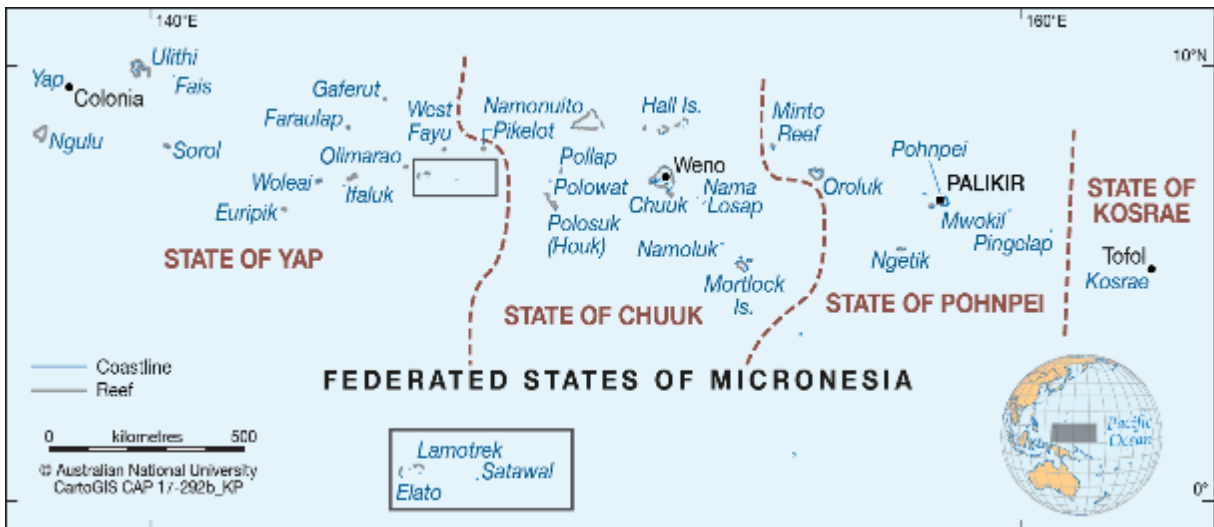


Figure 1: Map showing locations of the Federated States of Micronesia

15. The FSM, like many Pacific Nations, has traditionally relied on imported fossil fuels for electricity generation. However, the impacts of high and often variable cost of imported fuels on economic growth has led to the development of policies aimed at reducing reliance of fossil fuels thereby reducing costs and increasing security of supply. In FSM these policies have been articulated in the 2012 National Energy Policy which sets an objective to provide cost effective, safe, reliable and sustainable energy services as well as goals to increase renewable energy generation to 30%, increase electricity efficiency by 50% and reach a rural electrification rate of 90% by 2020.

16. Despite the National Energy Policy, the FSM currently has approximately 19% renewable energy generation whilst 67% of households have access to electricity¹. Nearly 15% of GDP is spent on imported fuel, making energy the costliest sector of the FSM economy. Kosrae currently has only approximately 8% renewable energy generation, supplied by a 350 kW solar installation, but a high 98% electrification rate¹.

17. The Pacific Renewable Energy Investment Facility (PREIF), approved by the Asian Development Bank (ADB) in May 2017, has been set up to support 11 small pacific island countries, including the FSM, transition electricity generation from diesel to sustainable renewable energy generation sources. The PREIF will benefit economies through (i) improved balance of

¹ Castalia April 2018 Energy Master Plans for the Federated States of Micronesia. http://www.castalia-advisors.com/files/updated_2014/FSM_Energy_Master_Plans_Final_Report_-updated_April_2018.pdf

trade by reducing fossil fuel imports, (ii) improved energy security, (iii) downward pressure on tariffs, and (iv) reduced greenhouse emissions. The ongoing facility will support regional approaches to energy sector reform, private sector development and capacity building and will finance projects with an overall estimated cost of \$750 million.

18. The FSM Renewable Energy Development Project: Kosrae (the project) is a component of the PREIF aimed to identify subprojects that will assist the FSM to increase renewable energy generation. A feasibility assessment has identified three subprojects in Kosrae State; roof and ground mounted solar generation and the electrification of Walung Village.

19. **Implementation arrangements.** The FSM Department of Finance and Administration (DFA) will be the executing agency and the FSM Department of Resources and Development (R&D) will be the implementing agency.

B. Objectives and Scope of IEE

20. This document provides an initial environmental examination (IEE) of the three subprojects identified in Kosrae as part of the feasibility assessment. The IEE has been prepared with the KUA and following the requirements of the ADB's Safeguard Policy Statement 2009 (SPS)².

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

- Identify and describe the existing environmental conditions—physical, biological and socio-economic—in the subproject areas including the identification of Critical Habitat (as defined in ADB Safeguard Policy Statement 2009 (SPS)) potentially impacted by the project;
- Assess the proposed location, design, construction, and operation activities to identify and evaluate their potential impacts (positive and negative), and determine their significance;
- Propose appropriate mitigation and monitoring measures that are incorporated into an environmental management plan (EMP) that will avoid or minimise adverse impacts so that residual impacts are reduced to acceptable levels;
- Consult with stakeholders on the potential impacts and understand the issues and concerns about the impacts and how they might be affected; and
- Ensure that all statutory requirements for the project such as applicable legislation and regulations, permits required (if any) and policies have been considered.

22. The scope of the IEE includes the footprint of the subprojects as well as the area of influence of the subprojects to ensure that secondary or indirect impacts can be identified and managed.

23. The IEE is based on primary sources of information derived through field studies and consultations during site visits and secondary sources of information available in relevant reports and databases.

² ADB. 2009, Safeguard Policy Statement (Manila, Philippines)

2. LEGAL AND POLICY FRAMEWORK

A. Legal and Policy Framework of FSM and Kosrae

24. **Institutional arrangements for environmental protection.** The FSM is made up of four semi-autonomous States, each with their own government and legislative system, with an overarching national government retaining responsibility for negotiating and entering into multilateral environmental agreements.

25. The States take the lead role in ensuring that development is avoided in vulnerable areas and ensuring that critical natural systems are protected. Each State has made efforts to control development and manage natural resources through the creation of land use plans, coastal zone plans, legislation and regulations. The National Government provides guidance and technical assistance to the States when needed and requested on matters related to planning, economic development, natural resources, fisheries, and the environment.

26. Each State has an Environmental Protection Agency (EPA) and has autonomous responsibility for State Environmental Impact Assessment (EIA) Regulations and other environment-related legislation. Activities undertaken by the national government, or its agencies, are assessed under the National Act. Otherwise, activities are assessed under the state-level Acts and regulations.

27. The state EPAs manage environmental assessment and management of projects. Projects require an EIA to be completed before implementation can begin. An initial statement of potential impacts and mitigation is required to identify potential environmental risks. If no potential risks are raised in the initial assessment, then the project can proceed. If the initial assessment identifies potential issues, then a full assessment is required.

28. The Kosrae Island Resource Management Authority (KIRMA) is responsible for environmental protection on Kosrae. It is made up of three sections; Environmental Protection Agency, Land Resource Management and Heritage Protection Office.

29. **National Energy Policy.** In 2012, the FSM put in place the National Energy Policy, which calls for a 30% reduction in use of fossil fuels, 50% increase in energy efficiency and a rural electrification rate of 90% by 2020. The "National Vision" for energy as outlined in the policy is:

"To improve the life and livelihood of all FSM citizens with affordable, reliable and environmentally sound energy." The "National Objective" is: "to promote the sustainable social and economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable energy services." FSM Energy Policy 2012

30. The National Energy Policy includes a series of State energy plans that describe activities and programs planned to be implemented to enable FSM to achieve the National Energy Policy Goals. This project is aligned to both the State Energy Action Plans and the National Energy Policy.

31. **FSM Energy Sector Masterplan 2019-2039.** The FSM National Government contracted Castalia and ITP to prepare an Energy Sector Masterplan for FSM, with individual plans for each of the States³. The Masterplan covers a 20 year period from 2019 through to 2039. Within this period, plans have been broken into five year periods typical of aid agency funding windows. The State plans set out the technical projects in the electricity sector are required to achieve the National Energy Policy as well as financing and implementation plans.

³ Castalia April 2018 Energy Master Plans for the Federated States of Micronesia. http://www.castalia-advisors.com/files/updated_2014/FSM_Energy_Master_Plans_Final_Report_-updated_April_2018.pdf

32. **Environmental policy.** The environmental policy of the FSM is to use all practicable means, consistent with other considerations of national policy, to improve and coordinate governmental plans, functions, programs, and resources to the end that the inhabitants of the FSM may:

- fulfil the responsibilities for each generation as trustee of the environment for succeeding generations;
- enjoy safe, healthful, productive, and aesthetical and culturally pleasing surroundings;
- attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences;
- preserve important historic, cultural, and natural aspects of our Micronesian heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice; and
- remain responsible members of the global community by complying with the international legal obligations accepted by the Federated States of Micronesia upon ratifying or acceding to international environment agreements.

33. **The Federated States of Micronesia (FSM) National Biodiversity Strategy and Action Plan (NBSAP)** outlines the state of the nation's biological resources and the biological and anthropogenic threats that are affecting their continued existence. The NBSAP vision is:

“The FSM will have more extensive, diverse, and higher quality of marine, freshwater, and terrestrial ecosystems, which meet human needs and aspirations fairly, preserve and utilize traditional knowledge and practices, and fulfil the ecosystem functions necessary for all life on Earth”.

34. The FSM NBSAP addresses a broad and comprehensive range of issues organized into 11 themes and calling for some 198 actions. It places responsibility for the implementation and monitoring of the NBSAP with the States. This resulted in the finalisation of the Kosrae BSAP.

35. **The Kosrae State Biodiversity Strategy and Action Plan 2004** is about striving for successful action to conserve Kosrae state biodiversity and must address the full range of causes of its current loss through conservation programs, protection of biodiversity, sustainable use of natural resources, restoration of endangered species, and build-up of individual human capacity for conserving biodiversity through awareness programs.

36. **The Kosrae Shoreline Management Plan 2013** has a number of recommended strategies to implement as a means of increasing the resilience of Kosrae's communities and associated infrastructure to the impacts of coastal-related hazards and exacerbating effects of climate change.

37. The document recommends a number of strategies that incorporate climate change considerations to projects to further long-term risk reduction and adaptation.

38. **The Kosrae Land Use Plan (KLUP)**, developed in 1993 and revised in 2003, is a type of strategic environmental assessment, which means that it explicitly considers environmental issues as part of an over-arching government policy. The KLUP provides guidance for decisions in relation to development within Kosrae and the issue of development and conditions.

39. The KLUP aims to:

- assist with the orderly physical development of the resources of Kosrae;
- protect ecologically important or unique natural resources and habitat areas;
- assist with the review and permitting of development projects; and

- provide guidelines for the sustainable use of natural resources in development projects.

40. The recommendations and restrictions identified in the KLUP in relation to active use districts, special consideration districts, and areas of particular concern are taken into account by KIRMA in determining whether and where particular types of development are appropriate.

41. **Legal framework.** The principle environmental Act of the FSM is the *Federated States of Micronesia Environmental Protection Act (1984)* (FSMEPA) which, together with its subsidiary instruments, seeks to provide the legislative basis for the protection of the environment, including cultural, historic and natural aspects of Micronesian heritage, throughout FSM. The FSMEPA acknowledges that close co-operation between the National and State Governments is required to support this objective.

42. Kosrae has enacted legislation and prepared a range of resource and management plans to give effect to its responsibilities in relation to the management, protection and conservation of the environment and natural resources. Principally these responsibilities are implemented by KIRMA, a semi-autonomous government agency mandated to:

“protect the environment, human health, welfare and safety and to abate, control and prevent pollution or contamination of air, land and water by balancing the needs of economic and social development with those of environmental quality and adopting regulations and pursuing policies which, to the maximum extent possible, ensure that economic and social development is environmentally sustainable.” (Kosrae State Code, Section 19.101).

43. Under Title 19 of the Kosrae State Code and the Regulations for Development Projects, KIRMA has responsibilities and powers to administer a development permit system. Figure 2 shows the EIA process.

44. The first step in the EIA process is for the project proponent to meet with the Program Office, KIRMA’s Permitting Unit, to determine whether a development review permit is required. Development review permits are required for the following activities:

- Projects involving earthmoving activities;
- Projects located within a “coastal development risk area”. Note: this area is illustrated in the “Coastal Development Risk Area Map”, which is provided as Schedule 1 to the Regulation;
- Projects which cost over \$5,000;
- Projects which are incompatible with surrounding land uses;
- Projects involving the disposal or removal of dredged materials, including all sand-mining operations;
- The use, handling and disposal of toxic or hazardous chemicals, pesticides, petroleum, oil and lubrication; and
- Projects involving the commercial harvest of aquatic, marine or timber resources (Regulation 3.1).

45. Whilst there are exemptions for modifications to residential buildings the scope of the project includes elements that would meet the definition of a number of activities listed above. Therefore, it is likely an application will be necessary.

46. Along with an application for a development review permit the proponent is required submit an initial EIA checklist. The checklist is used to screen activities based on the likelihood they will have a significant impact on the environment.

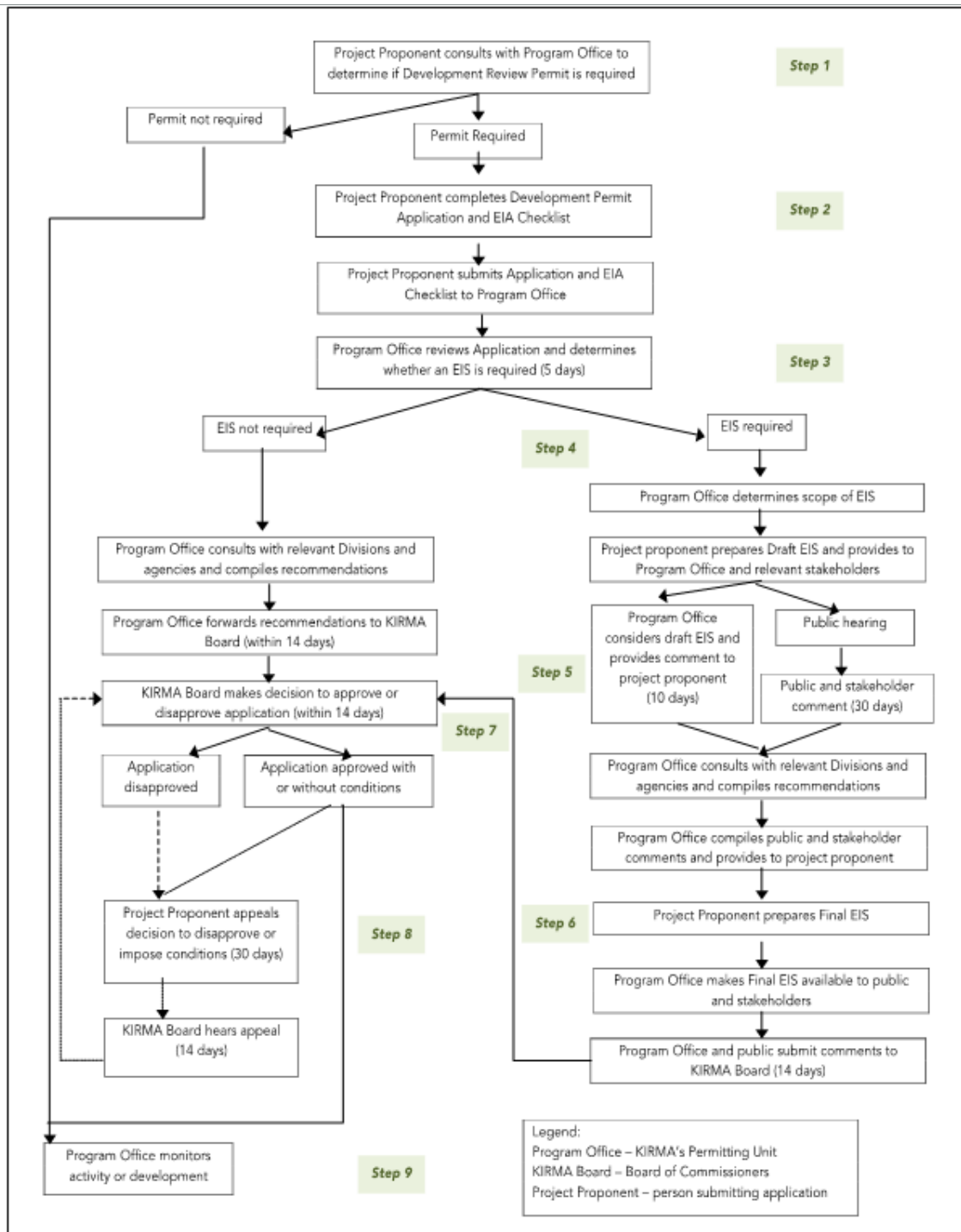


Figure 2: EIA Process on Kosrae (Source: KIRMA)

47. Where a potential project may have significant impact on the environment, these regulations require an Environmental Impact Assessment (EIA). This assesses the physical, ecological, aesthetic, cultural, economic, social, or health effects or impacts of a proposed activity on the environment, whether the effects are direct, indirect or cumulative. The EIA describes the potential effects or impacts on the environment in sufficient detail so as to allow the assessors, KIRMA and the Board of Commissioners, to make a comparison of the alternatives that can be taken to avoid, minimize, rectify, reduce or eliminate, or compensate for the impact of the proposed

activity. The Board of Commissioners will then make a decision to issue or reject a development review permit, subject to conditions that will avoid, minimize or eliminate the effects or impacts of the proposed activity on the environment.

48. The process is detailed in full in KIRMA's guidance document: *Environmental impact assessment in the State of Kosrae, FSM* (KIRMA, 2014).

49. **Other relevant legislation.** The *Trust Territory Endangered Species Act (1975)* provides for the protection of endangered fish, shellfish and game. It declares the indigenous plants and animals of the FSM to be of aesthetic, ecological, historical, recreational, scientific and economic value. It further states that the policy of FSM is to foster the well-being of these plants and animals including the prevention of the extinction of any species.

50. *Federated States of Micronesia Climate Change Act 2013* builds upon FSMs Nationwide Integrated Disaster and Climate Change Policy by introducing legal obligations for departments and agencies of the FSM government. This act and the policy will provide an overarching framework for further detailed legislation on climate change.

51. *Trust Territory Air Pollution Control Standards and Regulations (1980)*. This Regulation sets air quality standards by preventing or controlling the emissions of air contaminants at their source. The Regulations incorporate USEPA National Emission Standards for Hazardous Air Pollutants.

52. *Trust Territory Solid Waste Regulations (1979)*. These Regulations establish minimum standards for the design, construction, installation, operation and maintenance of solid waste storage, collection and disposal systems. "Solid waste" is defined as "garbage, refuse, and other discarded solid waste materials" not including substances in water sources, but including liquid waste such as waste oil, pesticides, paints, solvents and hazardous waste. A "disposal system" includes the entire process of storage, collection, transportation, processing and disposal of solid waste by any person or authority.

53. *FSM EPA Earthmoving Regulations (1988)*. These Regulations provide that "no person shall release funds, equipment or materials or building permit to those engaged in earthmoving activities requiring a permit until a permit is issued by the Secretary of Human resources. Earthmoving is defined to include activities of a continuous nature such as dredging or quarrying which disturb or alter the surface of the land, including reefs and lagoons. Earthmoving also applies to the subdivision of land, and the moving, depositing or storing of soil, rock, coral or earth.

54. *FSM Code Title 26 Historical Sites and Antiquities*. The purpose of this code is to protect and preserve the diverse cultural heritage of the peoples of Micronesia and to assist in the identification and maintenance of those areas, sites, and objects of historical significance with the FSM.

55. **International agreements and convention.** FSM have a number of ratified environmental related international and regional agreements (Table 1).

56. *FSM Intended Nationally Determined Contribution (Paris Accord)*. FSM has committed to unconditionally reducing Greenhouse Gas (GHG) emissions by 28% in 2025 from year 2000 levels. In practical terms, the year 2000 GHG emissions for FSM were 150,000 tCO₂e. Thus by 2025 emissions need to be below 108,000 tCO₂e. Of the year 2000 emissions, electricity generation accounted for 42% of the total emissions (64,000 tCO₂e).

Table 1: International Conventions and Treaties

Year	Convention or Treaty
6 September 1995	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
20 June 1994	Convention on biological diversity
18 November 1993	United Nations Framework Convention on Climate Change
16 June 1993	Agreement establishing the South Pacific Regional Environment Programme (SPREP)
26 January 1996	Convention to ban the importation into Forum island countries of hazardous and radioactive wastes and to control the transboundary movement and management of hazardous wastes within the South Pacific Region (Waigani Convention)
21 June 1999	Kyoto Protocol to the United Nations Framework Convention on Climate Change
21 January 2014	Doha Amendment to the Kyoto Protocol to the United Nations Framework Convention on Climate Change

B. ADB Safeguard Policy Statement

57. The goal of the ADB's SPS⁴ is to promote the sustainability of project outcomes by protecting the environment and people from any potential adverse impacts of the project.

58. The SPS has the objectives to (i) avoid adverse impacts of projects on the environment and affected people; (ii) where possible; minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. To help achieve the desired outcomes, ADB adopts eleven policy principles for guiding the assessment of projects that trigger environmental risks and impacts.

59. The SPS contains three safeguard requirements (SR); SR1: environment, SR2: involuntary resettlement and SR3: indigenous peoples. Each of the safeguard requirements comprises an objective, scope and triggers, and a set of policy principles that must be met. Each of the safeguard requirements follows a due diligence process of screening, categorization, scoping, consultation, impact assessment, management, and monitoring and reporting. Documentation of the due diligence is subject to disclosure as per the requirements of the *Public Communications Policy 2011*.

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

61. ADB categorizes projects into categories A, B, C, and FI according to the significance of likely impacts. As per SR1, the project has been screened as Category B. Category B projects are assessed to have some adverse impacts, but of lesser degree and/or significance than category A, the impacts are site-specific and can be managed or mitigated to satisfactory levels. Category B projects require an initial environmental examination (IEE), the assessment concludes whether or not there will likely be significant environmental impacts warranting an EIA. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. Accordingly, this assessment also constitutes an IEE and meets the requirements of the SPS.

⁴ ADB Policy Statement 2009, <https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>

3. PROJECT DESCRIPTION

A. Rationale

62. The FSM National Energy Policy which sets an objective to provide cost effective, safe, reliable and sustainable energy services as well as goals to increase renewable energy production to 30%, increase electricity efficiency by 50% and reach a rural electrification rate of 90% by 2020.

63. FSM has also committed to reducing greenhouse gas (GHG) emissions by 28% from the 2000 emissions level by the year 2025 under the Paris Accord. In absolute terms, this relates to an emissions target of below 108,000 tCO₂e. As of the year 2000, 42% of FSMs emissions were from electricity generation.

64. Kosrae has set State targets that are in line with the National Energy Policy, with the same targets for renewable energy contribution, and for 95% of the population to be electrified by 2020. This latter target has already been achieved as of 2018. Walung Village is the only remaining significant population on Kosrae without access to electricity.

59. The subprojects proposed as part of this Project are modelled to increase Kosrae's solar energy generation by 1700 MWh and increase the renewable energy contribution to approximately 34% as well as to electrify Walung Village. This equates to diesel fuel savings of at least 100,000 gallons and the avoidance of 1,023 tonnes CO₂e per year. This outcome will enable Kosrae to exceed its State targets and also help FSM achieve the goals of the National Energy Policy and commitments under the Paris Accord.

B. Proposed Works and Activities

65. Two subprojects have been identified on Kosrae as outlined in Table 2.

Table 2: Kosrae subprojects proposed composition

Subproject
Subproject 1 Tofol Solar
1a – ground mounted solar
1b – bleachers solar
1c – gymnasium solar
1 d – carpark solar
Subproject 2 Walung Village electrification

66. **Subproject 1 – Tofol solar PV.** Solar PV arrays will be installed at four locations in Tofol as shown in Figure 3. The total capacity of solar installed will be approximately 1.27 MWp. All sites are in close proximity to KUA power station allowing straight forward electrical connection via new 13.8 kW line.

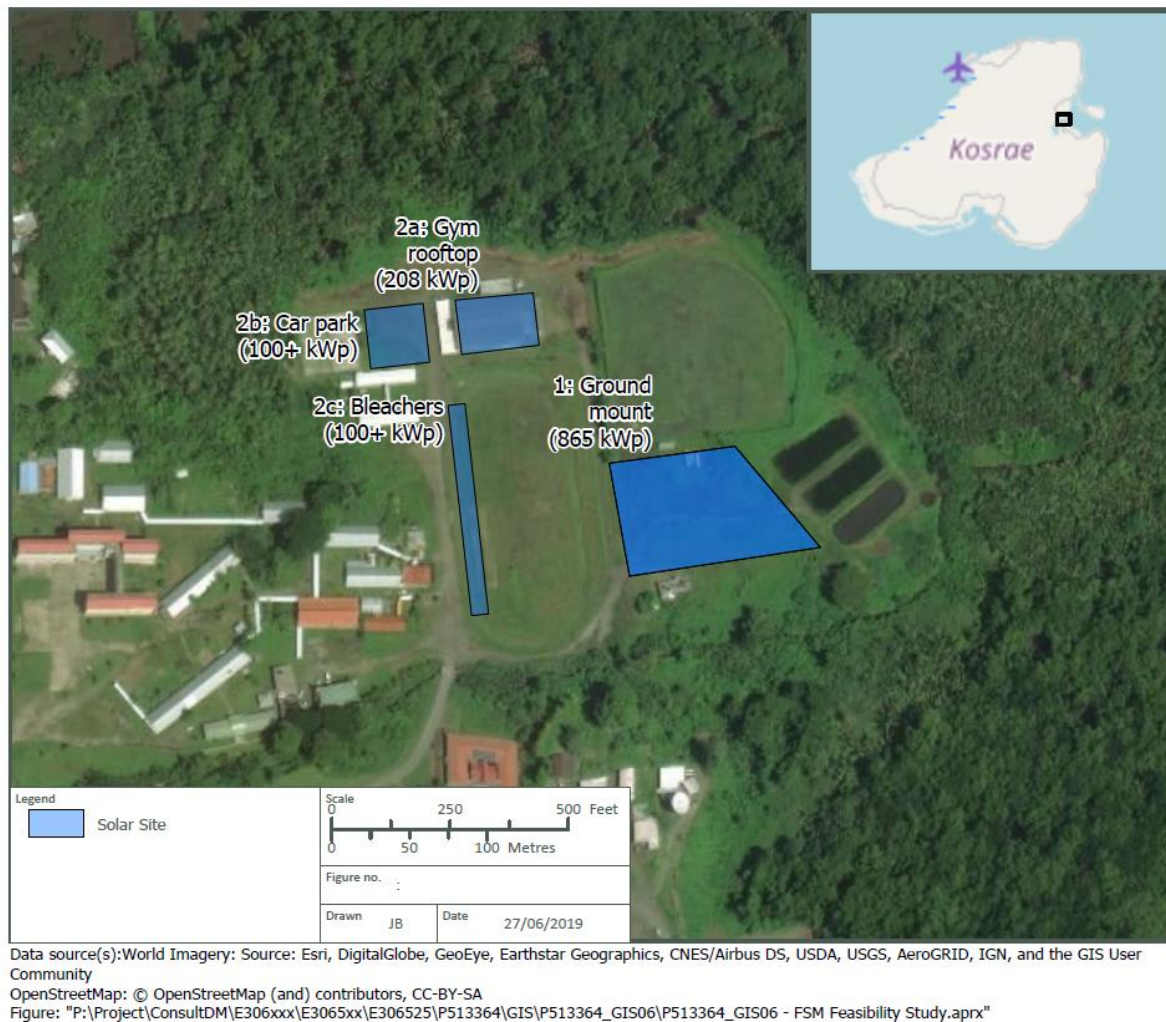


Figure 3: Map showing locations of subprojects 1a to d.

- **Subproject 1a – ground mounted solar.** An approximately 865 kWp ground-mounted solar photo voltaic (PV) array on land between the baseball field, radio station, athletics track and sewerage treatment ponds. The Kosrae radio station and communication tower are located adjacent to the site but will not be disturbed.
- **Subproject 1b – bleachers solar.** An approximately 100 kWp solar PV array would be installed on the western side of the Kosrae athletics track. The solar PV array would be installed on a bleacher style ground mount system that raise the array high enough of the ground that the area beneath the array will provide shade for spectators at events held at the athletics track.
- **Subproject 1c – gymnasium solar.** An approximately 208 kWp solar PV array would be installed on the roof of the existing gymnasium building.
- **Subproject 1d – carpark solar.** An approximately 100 kW solar PV array would be installed on the area currently used for car parking between the gymnasium and tennis courts. The array mounting system will be raised such that cars can park beneath and are provided shade.

67. Subprojects 1a,b,c and d are all located on land /facilities owned by the Government of Kosrae.

68. **Subproject 2 – Walung mini-grid.** The Walung subproject will install a solar, battery, diesel hybrid mini-grid at Walung Village (). The mini grid will electrify the village to standard similar to the rest of the Kosrae (**Error! Reference source not found.**). The mini-grid will include a 60 kW solar PV array installed on the roof of the existing school, a new power house and distribution system.

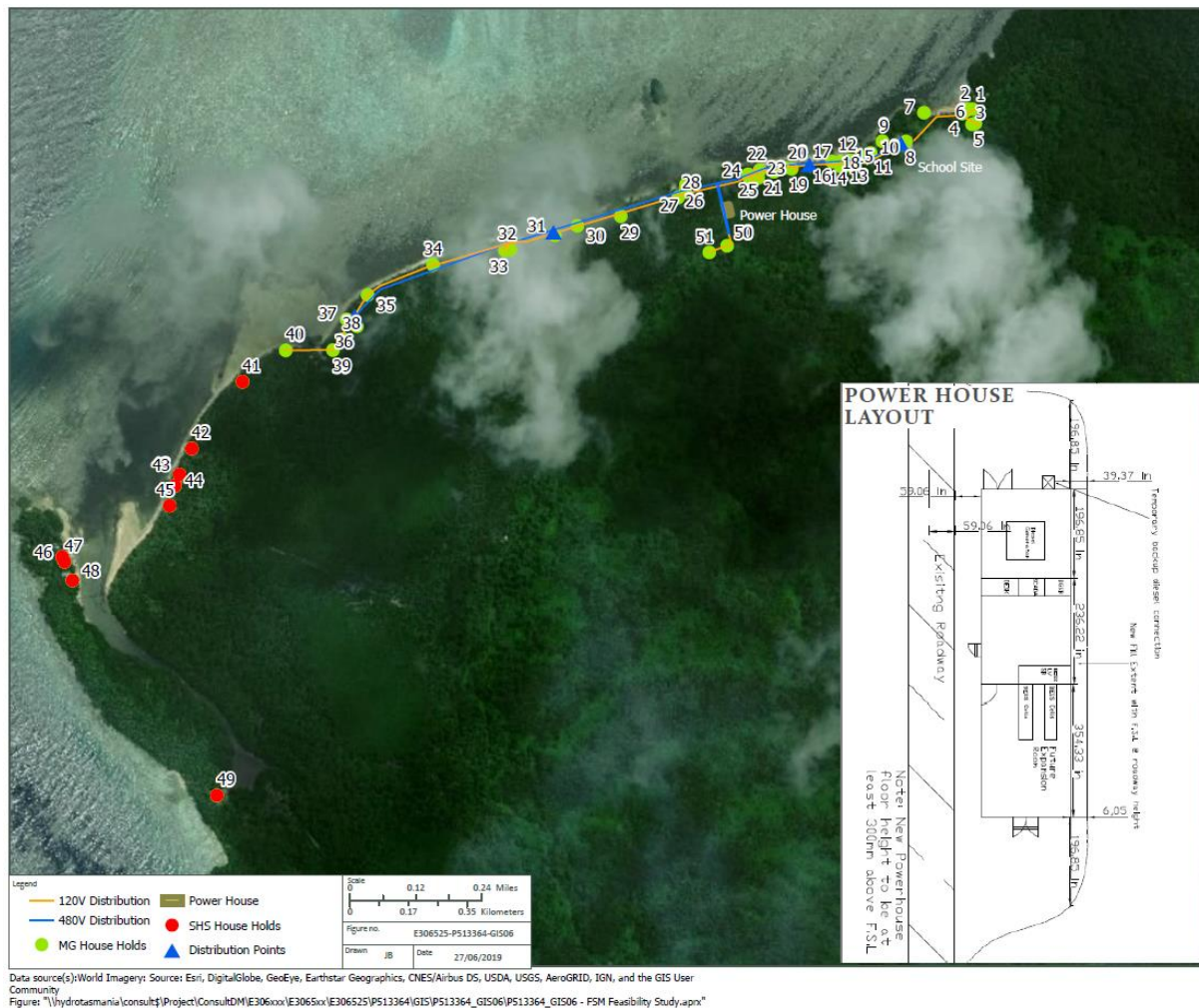


Figure 4: Map showing locations of subproject 2.

69. The new powerhouse will be located adjacent to the existing road (within the road easement) connecting Walung to Utwe. The powerhouse will be approximately 65 ft. by 16 ft. and will house:

- a 30 kW/160 kWh battery energy storage system (BESS) and battery inverter
- a 30-kW diesel generator and associated up to 500-gallon fuel storage tank
- electrical switchgear and distribution board to allow electricity from the solar, BESS or generator to be routed to the distribution system
- control and communications system

70. The distribution system will transmit electricity from the solar PV array to the solar powerhouse and from the solar powerhouse to 41 centrally located residences and institutions. The distribution system will be designed as a radial low voltage (120V) network with an intermediate (480V) backbone. The distribution system is expected to be buried in existing road easements and/or will utilise the same trenches as the existing water reticulation system. Each house will be connected to the mini grid and wired.

71. A further nine houses will have solar home systems installed as they are outlying houses for which connection to the mini-grid is not economically feasible. Solar home systems will consist of a solar PV panels, battery, and solar and battery invertors. The systems will be simple standalone, self-contained ground mounted system, with inverters and battery enclosures to be mounted directly to the framing and shaded by the modules above. The systems will be connected to each house and the house wired.

72. **Project components.** A description of the anticipated key components of the subprojects are provided below.

73. Solar PV arrays:

- Fixed-tilt solar PV arrays are recommended as they are a low-maintenance technology with a strong track record in island electrical grids. Solar PV modules will be modern, high quality panels with a temperature / loss co-efficient suitable for the climate of FSM.
- Solar PV module mounting: For subprojects 1 a and c, solar PV modules will be installed on a pre-manufactured solar PV array mounting system constructed of stainless steel, anodised aluminium and/or galvanised steel mounted either directly to the roof structure (subproject 1c) or on concrete blocks (subproject 1a). Subproject 1b will require a customised mounting structure.
- Solar PV Inverters: Solar PV string will be installed within the solar PV array to convert direct current (DC) electricity produced by PV panels to alternating current (AC) for injection into the electrical grid.

74. BESS (Walung subproject only): A 30 kW/160 kWh BESS and battery inverter will be installed in the powerhouse.

75. Diesel generator (Walung subproject only). A 30-kW diesel generator will be installed in the solar powerhouse with control system, fuel tank and oil storage.

76. Solar Powerhouse (Walung subproject only). A solar powerhouse will be constructed (likely of concrete block) and will comply with FSM Building Codes.

77. The distribution network (Walung subproject only) proposed is an underground three phase low voltage/intermediate 120/480V network expanding radially east and west from the central powerhouse location.

78. **Associated infrastructure.** A perimeter security fence will be established around the ground mounted solar PV arrays (Tofol subproject) and solar powerhouse (Walung subproject option 2).

79. **Existing infrastructure.** Local infrastructure including roads and the Kosrae Port will be used for both subprojects. The Kosrae Port and local roads were inspected during the site visits and found to be suitable for use during the construction of the subprojects.

80. Walung can be accessed year-round by boat (subject to suitable tides) or by an unpaved road that currently impassable. The road is being repaired and it is anticipated that it will be suitable for the transport of materials and equipment to Walung required for subproject 2. Nonetheless, there is no road access to the school building, and it is expected that solar panels

and mounting systems will be required to be manually transported from the road end in Walung to the school site.

81. **Project construction (subproject 1a, b and d).** Construction of the Tofol ground mounted solar subprojects will generally include:

- Clearing of existing vegetation and removal of rubbish and scrap metal if remaining on site (subproject 1a only).
- Spreading of fill material, compaction and levelling.
- Installation of site drainage, erosion and runoff controls.
- Installation of security fencing around perimeter of sites.
- Trenching and installation of underground cables and conduit.
- Installation of solar PV mounting system.
- Installation of solar PV panels on mounting system.
- Landscaping of site including planting low growing vegetation (e.g. grasses) beneath the solar PV modules to help stabilise the site.
- Connection to new underground transmission line to Kosrae Power Station

82. **Project construction (subproject 1c).** construction of the rooftop solar subproject will generally include:

- Inspection and upgrade of the existing roof structure as required.
- Installation of solar PV mounting system on existing rooftops.
- Installation of solar PV panels on mounting system.
- Installation of cabling, ancillary electrical infrastructure.
- Connection to new underground transmission line to Kosrae Power Station.

83. **Project construction (subproject 2).** Construction of the Walung subproject will generally include:

- Installation of solar PV mounting system on school roof.
- Installation of solar PV panels on mounting system.
- Construction of solar powerhouse including placement of fill, installation of earth grid, pouring of concrete slab and erection of power house building.
- Installation of generator, control system and batteries in solar powerhouse.
- Trenching and installation of underground cables and conduit (distribution system).
- Commissioning (load testing) of all equipment.

84. **Project operation (subproject 1).** A BESS and control system are planned to be installed in the Kosrae Power Station prior to commissioning of subproject 1 (not part of this project). The control system will combine the existing and new solar PV arrays together with the new BESS an existing diesel generators to manage operation of the power station to minimise diesel consumption while ensuring reliability of customer electricity supply.

85. **Project operation (Walung subproject).** The Walung subproject will deliver over 93% of electricity from the solar PV system. This is achieved using the solar PV modules to deliver electricity to the distribution gird and charge the batteries when the solar resource is adequate (e.g. sunny or light clouds) and batteries to deliver electricity when the solar resource is not (e.g.

during the night or heavy clouds). When the solar system can't meet the load demand the diesel generator will be used to charge the batteries and deliver electricity directly the distribution grid. The control system will manage grid stability by controlling the source of electricity input into the grid as the output from the PV system fluctuates (e.g. a cloud passes of PV modules) and as the load changes. The control system also manages the charging of the battery storage. In the event of a system failure of the solar system, the existing diesel generators will be able to meet continuous load, and hence provide a level of redundancy.

86. **Project decommissioning.** The subprojects are expected to have a lifespan of approximately 25 years. It is likely that the system will be replaced with similar equipment. Solar PV modules, batteries, inverters and other electronics and metal will be collected for recycling in the FSM (where facilities exist) or be transported to another country.

87. **Implementation schedule.** The proposed implementation schedule is shown in Table 3.

Table 3: Implantation schedule

Activity	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021
Award EPC Contract	■							
Subproject detailed design, procurement and mobilisation.		■	■	■	■	■		
Earthworks & Civil works				■	■	■		
Install PV and electrical equipment					■	■		
Integration with KUA						■		
Install Walung Village equipment				■	■	■		
Install Walung Dist. Network						■		
Walung Household connections						■	■	
Commissioning							■	
Training of KUA operators and handover of manuals						■	■	

90. **Soils**⁶. There are estimated to be 17 different kinds of soil on Kosrae. The soils in the mountainous areas generally are moderately deep to shallow, well drained and gravelly or cobbly. The use of these soils is limited mainly by the steepness of the slope.

91. The soils are categorised into various types:

Soils on coastal strands and in coastal tidal marshes

- Naniak-Insak – moderately deep and very deep, very poorly drained, level and nearly level soils; in coastal tidal marshes. Slope is 0 to 2 percent. The main limitations of this soil type for most uses are wetness and flooding.
- Ngedebus-Ngedebus Variant – very deep, somewhat excessively drained, level and nearly level soils; on coastal strands. Slope is 0 to 2 percent. The main limitations of this soil type is the hazard for flooding and seepage potential.

Soils on bottom lands

- Nansepsep-Inkosr – very deep, somewhat poorly drained and poorly drained, level and nearly level soils; on bottom lands. Slope is 0 to 2 percent.
- Ngerungor – very deep, very poorly drained, level and nearly level soils; on bottom lands. Slope 0 to 1 percent. The main limitations for most uses are wetness and flooding.

Soils on uplands

- Fomseng-Oatuu – shallow and very shallow, well drained, steep to extremely steep soils; on uplands. Slope is 30 to 100 percent. The main limitations for most uses are shallow rooting depth, steepness of slope, and a hazard of erosion.
- Finol-Dolen – moderately deep and very deep, well drained, steep to very steep soils; on uplands. Slope is 30 to 60 percent. The main limitations for most uses are steepness of slope and a hazard of erosion.

92. Detailed soil map units include

- Dolen silty clay loam, 30 to 60 percent slopes. Very deep, well-drained soil on mountain sides. Permeability of Dolen soil is moderately rapid, and the hazard of water erosion is high.
- Finol very gravelly silty clay loam, 30 to 60 percent slopes. Moderately deep, well-drained soil on mountainsides. Permeability of this Finol soil is moderately rapid, and the hazard of water erosion is high.
- Fomseng gravelly silty clay loam, 30 to 60 percent slopes. Shallow, well-drained soil on mountain sides. Permeability of this Fomseng soil is moderately rapid, and the hazard of water erosion is high.
- Fomseng gravelly silty clay loam, 60 to 100 percent slopes. Shallow, well-drained soil on mountainsides. Permeability of this Fomseng soil is moderately rapid, and the hazard of water erosion is high.
- Inkosr silty clay loam, 0 to 2 percent slopes. Very deep, poorly drained soil on the bottom lands. Permeability of this Inkosr is moderate, and the hazard of water erosion is slight. This soil is subject to occasional, brief periods of flooding throughout the year.
- Insak peaty loamy sand, 0 to 2 percent slopes. Moderately deep, very poorly drained soil in coastal tidal marshes. Permeability of this Insak soil is rapid, and the hazard of

⁶ Laird, W.E. 1983. Soil Survey of the island of Kosrae, Federated States of Micronesia. US Department of Agriculture, Soil Conservation Science.

https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/pacific_basin/PB931/0/Kosrae.pdf

water erosion is slight. This soil is flooded daily with ocean saltwater during periods of high tide.

- Naniak mucky silt loam, 0 to 2 percent slopes. Very deep, very poorly drained soil in coastal tidal marshes. Permeability of this Naniak soil is moderate, and hazard of water erosion is slight. This soil is flooded daily with saltwater during periods of high tide.
- Nansepsep silty clay loam, 0 to 2 percent slopes. Very deep, somewhat poorly drained soil on the bottom lands. Permeability of this Nansepsep soil is moderate, and the hazard of water erosion is slight. This soil is subject to occasional, very brief periods of flooding throughout the year.
- Ngedebus loamy sand, 0 to 2 percent slopes. Very deep, somewhat excessively drained soil is on coastal strands. Permeability of this Ngedebus soil is rapid, and hazard of water erosion is slight. The soil is subject to occasional, very brief periods of flooding.
- Ngedebus-Urban land complex, 0 to 2 percent slopes on coastal strands. Permeability of the Ngedebus soil is rapid and the hazard of water erosion is slight. Soil is subject to occasional, very brief periods of flooding.
- Ngedebus Variant very cobbly loamy sand, 0 to 2 percent slopes. Very deep, somewhat excessively drained soil on coastal strands. Permeability of the Ngedebus Variant is rapid, and hazard of water erosion is slight. Soil is subject to occasional, very brief periods of flooding.
- Ngerungor mucky peat, 0 to 1 percent slopes. Very deep, very poorly drained soil on the bottom lands. Permeability of this Ngerungor soil is rapid, and the hazard of water erosion is slight. This soil is subject to frequent, very long periods of flooding.
- Oatuu-Fomseng complex, 60 to 100 percent slopes. Complex mountainside slopes. Permeability of Oatuu and Fomseng soils are moderate and moderately rapid respectively, and the hazard of water erosion for both soil types very high.
- Sonahnpil very stony, silty clay loam, 0 to 5 percent slopes. Very deep, well-drained soil on alluvial flood plains and alluvial fans. Permeability of this Sonahnpil soil is moderately rapid, and the hazard of water erosion is slight. This soil is subject to occasional, very brief periods of flooding during prolonged, high-intensity storms.
- Tolonier very stony silty clay loam, 6 to 30 percent slopes. Very deep, well-drained soils on toe slopes and foot slopes. Permeability of this Tolonier soil is moderately rapid, and the hazard of water erosion is moderate.
- Umpump very gravelly clay loam, 2 to 8 percent slopes. Moderately deep, moderately well-drained soil on plateaus. Permeability of this Umpump soil is moderate, and the hazard of water erosion is slight.

93. Soil erosion and drainage are strongly related to slope. Oatuu-Fomseng complex, Tolonier very stony silty clay loam, and Fomseng gravelly silty clay loam are the soil types on Kosrae most prone to erosion (Figure 6).

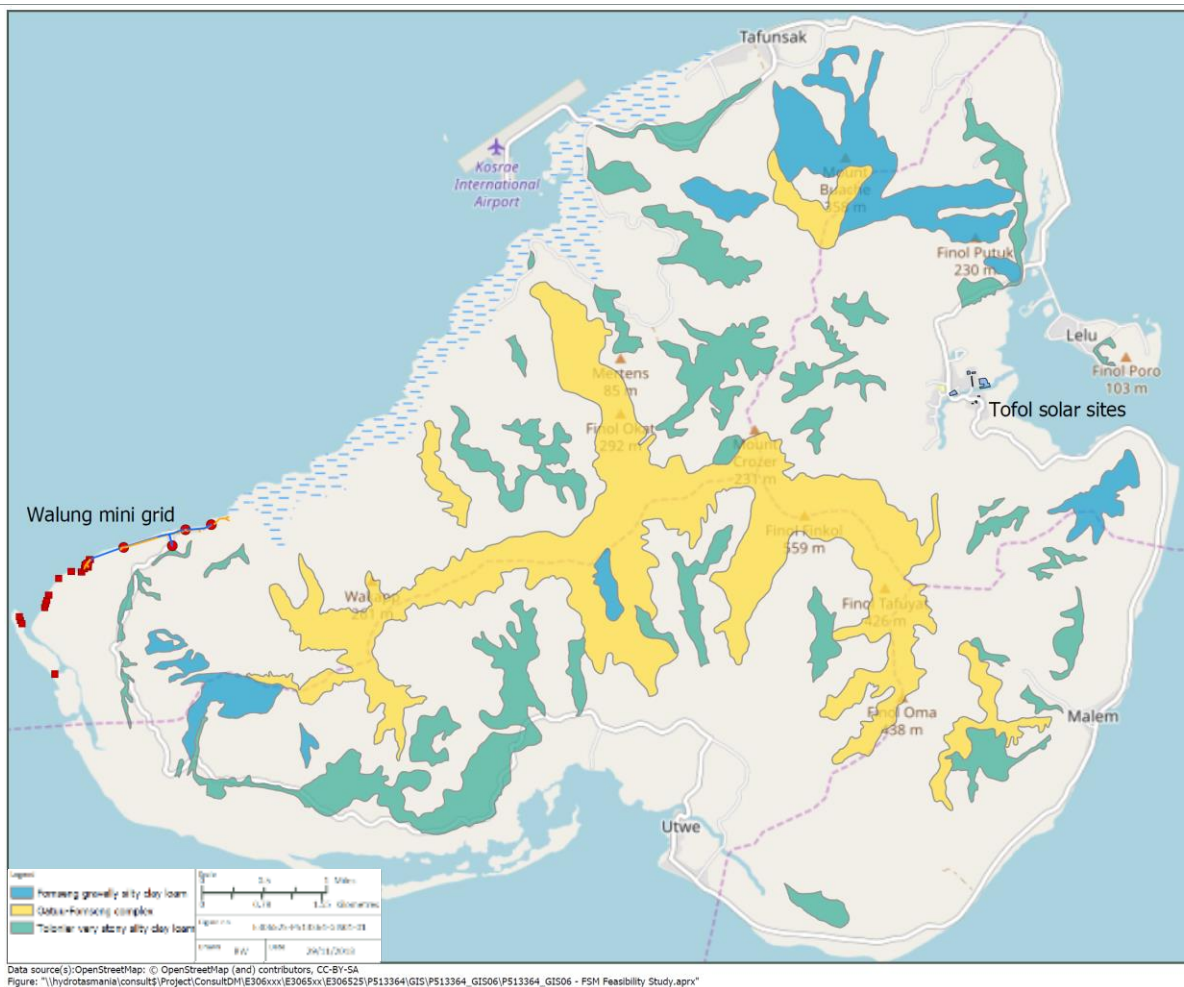


Figure 6: Highly erodible soils of Kosrae

94. **Seismicity.** Kosrae is situated in a relatively quiet seismic area. No significant earthquakes have been observed in recent history. While significantly damaging earthquakes have not been observed in recent times, FSM is subject to large tsunamis, as evident by the large tsunami run-ups of 1837, 1849 and 1899 which caused death and financial loss in the Caroline Islands (Figure 7).

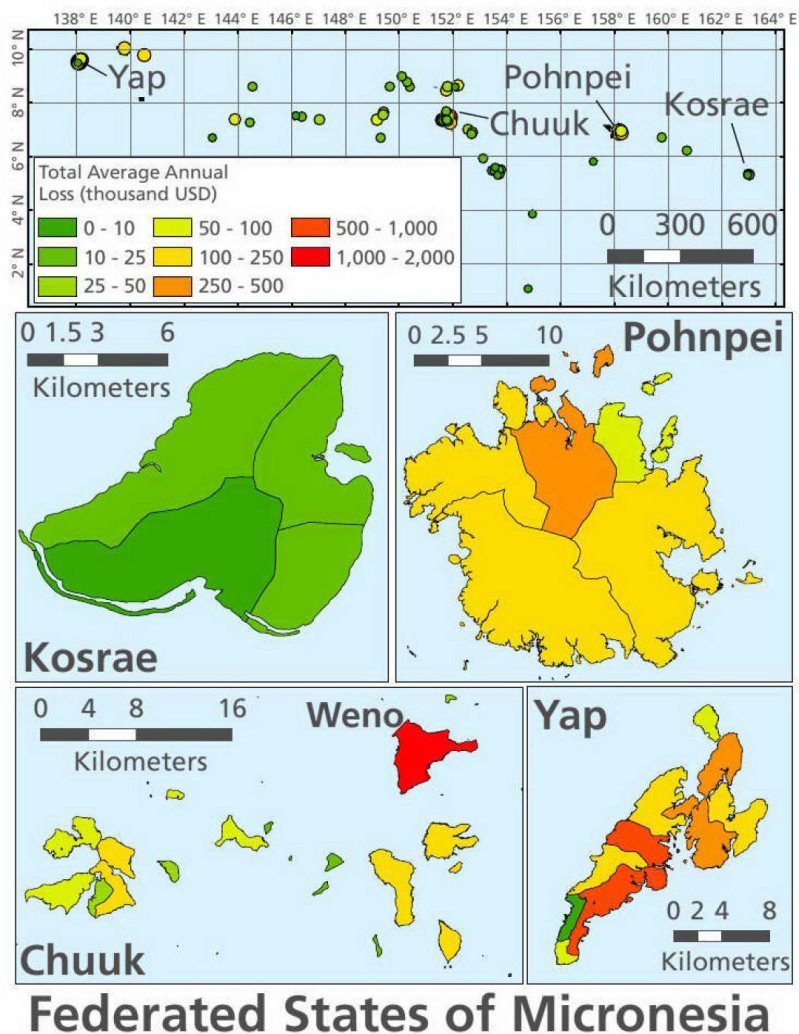


Figure 7: Contribution from the different FSM islands to the average annual loss for tropical cyclone and earthquake (ground shaking and tsunami)⁷

95. **Coastal processes.** Kosrae has a varied coastline influenced by the width of the surrounding reef flat and the relative exposure to trade wind waves and occasional, severe, storm or typhoon waves⁸. The coastal characteristics have also defined how development on the island has occurred, how vulnerable parts of the coastline are to inundation events, and how the shoreline has changed and will continue to change in the future.

96. Kosrae also has considerable natural resilience through its natural resources, such as the mangrove vegetation providing direct coast protection to around 22% of Kosrae's coastline⁹. Reef flat mangroves that occur along the coastline between Tafunsak and Mwot, harbour mangroves located around the fringes of Okat, Lelu and Utwe and lagoon mangroves located behind storm or beach berms, also provide various degrees of coastal protection depending on their location. However, climate change stress is likely to impact the natural protection functions provided by mangrove stands, in addition to reef systems, seagrass beds, wetland areas and the coastal berm.

⁷ World Bank's Country Risk Profile for the Federated States of Micronesia 2011

<http://documents.worldbank.org/curated/en/379211468000603774/pdf/96744-BRI-Box391446B-PUBLIC-FSM.pdf>

⁸ NIWA 2013. Kosrae Shoreline Management Plan – Repositioning for Resilience. <http://kosraecoast.com/wp-content/uploads/2014/04/Kosrae-SMP-Final.pdf>

⁹ BSRP 2016. Federated States of Micronesia – Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change. http://bsrp.gsd.spc.int/wp-content/uploads/Publications/Kosrae_JSAP.pdf

97. **Tides.** Flooding of land from the sea on Kosrae tends to occur episodically due to three types of events (Table 4). Flooding of land on Kosrae most commonly occurs due to higher than normal high tide levels, or high tides occurring at the same time as moderate to large wave conditions. This is because high water levels tend to occur when a number of components combine:

- Astronomical tide – regular rise and fall of water level due to the influence of the moon and the sun. Tide levels on Kosrae tend to be higher between November and February and between June and August,
- Influence of El Niño and La Niña oscillations which can cause variations in sea level of up to 0.25 m or more,
- Effect of continuous north-east trade winds which tend to increase tide levels between November and April.

98. Damaging events on Kosrae as a result of high tides combined with La Niña were recorded in December 1999 to January 2000, and November 2007 to February 2008.

Table 4: Events that cause flooding on the land on Kosrae¹⁰

Inundation event	Indicative frequency of occurrence
Higher than normal high tide levels.	Every year: Particularly between Dec to Feb Much higher than normal every 2 to 4 years during period of La Niña.
Large swell waves caused by distant storms in the north Pacific.	Once in a generation.
Typhoon events that track close to Kosrae.	Once in a lifetime: The last cyclone to directly impact Kosrae was in 1905.

99. Inundation due to high tides is of particular concern in the Lelu Island, Pukusruk, Utwe, Walung and Tafunsak regions of Kosrae due to their low-lying location that is barely above high spring tide levels.

100. **Climate.** Kosrae has a wet tropical climate with an average annual temperature of 26°C, with little seasonal variation, and Kosrae is characterised by two distinct seasons, with a dry season between May and October, and a rainy season from November to April.

101. Humidity is high, with relative humidity typically above 80% throughout the year. North-easterly trade winds are also dominant between December and February. An increase in westerly winds and reduction in trade winds tends to occur during El Niño with stronger trade winds experienced in La Niña periods.

102. Kosrae has an average annual rainfall in excess of 5,000 mm that is generally well distributed throughout the year with April tending to be the wettest month. During periods of El Niño, Kosrae can experience drought conditions with the typical rainfall pattern being reduced between October and December, and significantly reduced rainfall between January and March in the following year.

103. Heaviest rainfall tends to occur between July and October, particularly when typhoons, tropical depressions and storms track close to Kosrae, and when El Niño conditions are developing. Many of the typhoons that affect western Micronesia often originate around Kosrae as tropical depressions or storms developing into full typhoons to the west and north of the island. Short periods of extremely high intensity rainfall are common, for example an hourly rainfall of 100 mm has approximately a 16% likelihood of occurring in any one year.

¹⁰ BSRP 2016. Federated States of Micronesia – Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change. http://bsrp.gsd.spc.int/wp-content/uploads/Publications/Kosrae_JSAP.pdf

104. **Climate change**^{11,12}. Observational data shows that annual mean air temperatures have increased by 0.5-1°C across the FSM since 1951, projected to continue to rise by 0.8°C by 2030, 1-2°C by 2050, and 2-4°C by 2090. Increased air temperatures could result in impacts to human health, increase the energy requirements for cooling systems, in addition to impacting sea surface temperature, storms, precipitation, and water resources.

105. Consistent with global projections, Kosrae will experience an increase in the number of hot days and warm nights, and a general decline in cool weather. In addition, most models predict an enhanced hydrological cycle, with increases in annual and seasonal rainfall and a reduced frequency of droughts.

106. Projections for typhoon frequency and severity in FSM show a decrease in formation (20-50%) however the confidence for these projects is low. Average rainfall is projected to increase by 3% by 2030, 6% by 2050, and 12% by 2090, in addition to more intense heavy rainfall events expected.

107. Approximately 97% of all current high tides are less than 2 m high. Sea level is expected to rise in Kosrae as follows:

- In 2030s: high-tide level of 2 m will be exceeded by 12% of all high tides
- In 2050s: high-tide level of 2 m will be exceeded by 27% of all high tides
- In 2070s: high-tide of 2 m will be exceeded by 69% of all high tides.
- In 2090s: the high-tide level of 2 m will be exceeded by 95% of all high tides.

108. Combined with natural variability, sea level rises are expected to enhance storm surges and flooding in Kosrae. Seventy-five percent (75%) of Kosrae's housing and infrastructure is located in the coastal zone and is at risk of damage due to storm surges.

109. **Water resources**^{13, 14}. There are six sources of freshwater on Kosrae: wells and springs (groundwater), streams, dams, swamps, and rainwater catchments attached to tin roof buildings or structures (Figure 8). All take advantage of the Island's abundant rainfall, which averages 200 inches near the coast and 240 inches in the mountainous interior.

110. The abundance of rainfall feeds many streams and rivers, with 22 perennial streams recognized on the island. Some of the most significant rivers on Kosrae are the Finkol, Innem, and Okat. The high relief of central Kosrae results in a radial drainage pattern through small catchments. The streams run quickly through narrow valleys in steep mountain slopes but slow down when they reach the lowlands. Most flow into the three harbors of Utwe, Okat, and Lelu. A number of other smaller perennial and intermittent streams and springs also occur around the base of the volcanic part of the island. Variations in discharge of the rivers and streams can be significant and rapid due to the high rainfall intensities, small catchment sizes and steep slopes.

111. The Kosrae Land Use Plan proposes a Central Watershed Reserve, to be generally located in the central part of the island, on steep mountain slopes. By encompassing the steepest land, the most erosive soils, and the upper elevations with the highest rainfall, the reserve would protect the most sensitive parts of the island's watersheds. The Kosrae Land Use Plan also recognises eleven primary watersheds draining into dams that supply water to the villages:

- Mutunte River Basin

¹¹ BSRP 2016. Federated States of Micronesia – Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change. http://bsrp.gsd.spc.int/wp-content/uploads/Publications/Kosrae_JSAP.pdf

¹² Pacific-Australia Climate Change Science and Adaptation Planning (PACCSAP) Program 2015. https://www.pacificclimatechangescience.org/wp-content/uploads/2013/06/7_PACCSAP-FSM-11pp_WEB.pdf

¹³ NIWA (2016) *Malem to Utwe Inland Road Relocation Initiative: Environmental Impact Statement for the inland road*. Prepared for the Kosrae State Government and the Regional Technical Support Mechanism

¹⁴ Water for Life (2013) *Fresh Water in Micronesia: An Island-by-Island Overview Guide*.

- Yekula River Basin
- Pukusruk River Basin
- Innem River Basin
- Tofol River Basin
- Tafuyat River Basin
- Malem River Basin
- Mosral River Basin
- Palusrik River Basin
- Tafuot River Basin
- Walung River Basin

112. Streams and rivers discharging from the catchments are filtered through the various areas of freshwater, brackish and mangrove swamp. The hydrology of these low-lying swamp and mangrove areas is complex. However, during the Japanese era, many of the rivers and streams were straightened to aid drainage to support intensive agriculture and the development of a runway within the freshwater swamp between Yeseng and Mosra. This results in rivers discharging straight to the reef flat which, despite the healthy vegetative cover in the catchment, can result in high suspended sediment loads during periods of heavy rain.

113. Relatively little water seeps through the soil and into cracks and pores in the volcanic rocks. In some parts of the coastal fringe, wells tap a shallow layer or lens of freshwater underlain by saltwater. However, these wells only rarely provide drinking water because their water quality is poor. Groundwater is, therefore, not an important water source on Kosrae. There are, however, many natural springs that issue water from the ground and are highly respected as sources of water of excellent quality.



Figure 8: Important watersheds of Kosrae Island¹⁵

114. **Coastal resources.** Marine and coastal reef biodiversity is high across FSM, however Kosrae has lower recorded biodiversity than the western states¹⁶, Kosrae has one protected marine area – the Utwe-Walung Conservation Area on the north-west coast.

115. Kosrae is surrounded by a fringing coral reef that is dissected by four natural breaks (harbours) that occur at the mouths of the four main catchment systems (Okat, Yela, Finkol and Innem Rivers). In addition to the fringing coral reef, there is an intertidal reef flat which is generally 100 m to 150 m wide in the Malema area.

116. The beach and backshore areas of Kosrae provide key coastal protection functions whereby they provide a natural adaptable buffer that protect the land behind from waves and coastal flooding. The key threatening activities to the beach and backshore coastal resources include sand mining and removal of reef flat coral rubble, vegetation removal from behind the beach, and land reclamation or seawalls that impact on the natural beach processes.

117. The key activities that impact on the coral reef, reef flat and seagrass include detrimental fishing practises, pollution or excessive sedimentation, and removal of reef flat sand and coral rubble.

¹⁵ U.S. Forest Service and the FSM (2010) [Federated States of Micronesia State-Wide Assessment and Resource Strategy 2010–2015+](#).

¹⁶ BSRP 2016. Federated States of Micronesia – Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change. http://bsrp.gsd.spc.int/wp-content/uploads/Publications/Kosrae_JSAP.pdf

B. Biological Resources

118. **Vegetation/habitat types**¹⁷. The island of Kosrae is characterised by steep mountains covered with dense forest. Several mountain peaks rise to 600 m (1,970 ft.) above sea level. Mountainous areas make up about 70% of the island, with foot slopes, alluvial fans and bottomlands comprising 15% of the total land area. Approximately 14% of the island is vegetated by mangrove swamps and only about 2% is classified as nonforest.

119. Major vegetation/habitat types of Kosrae, as identified by Whitesell et al. (1986)¹⁸, include:

- *Mangrove Forest*: Mangrove forests have multiple values for fisheries habitat, wood production, trapping sediments and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The “fringe” (seaward) mangrove is most valuable for this coastal protection function. The mangroves of Kosrae differ from those of other FSM Islands in that they usually occur behind a protective strip of coastal strand vegetation. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation and salt spray.
- *Swamp Forest*: Swamp forest occurs where soils are inundated with fresh or brackish water. The most common habitat for such forests is in low, wet areas just inland of mangroves, usually above tidal influences but lower in elevation than the surrounding terrain. Swamp forest is also found inland where water collects in low areas along rivers and in areas of impeded drainage. Swamp forests are valued for their canoe logs, timber, wildlife products and as a habitat for modified wetland agroforest that provides freshwater taro and other food crops.
- *Upland Forest*: The steep slopes of Kosrae are covered with well-developed native rain forest, with a number of natural plant associations occurring at different elevations. These forests protect the watersheds, hold the soil and provide habitat for wildlife. They also provide building materials, medicine, and recreation for people. Upland forests provide important habitat for native biodiversity including a number of endemic species.
- *Dwarf/Cloud (Moss) Forest*: Moss forests of Kosrae and nearby Pohnpei Island occur at much lower elevations than moss forests in other parts of the world. These scrubby, wet moss or dwarf forests occur in the cloud zone of mountain tops and ridges. Such forests consist of stunted trees covered with epiphytic bryophytes, ferns, fern allies, and orchids. The understory and ground are covered with similar growth. These forests contain many different native species. Moss forests tend to be more common and better developed on the leeward sides of the highest mountains.
- *Agroforests* provide food, fibre, medicines and materials needed to support culture while at the same time providing the ecosystem services of forests. Agroforests occupy areas generally along the coast and near dwellings and are characterized by a mix of food producing trees and other plants. These “tree gardens” represent a sustainable system of food production and wise use of limited resources. The canopy is often uneven and may be interspersed with small taro patches, open canopy gardens, and areas of secondary vegetation too small to be mapped as separate types.
- *Secondary Vegetation*: Areas of small weedy trees, scrub, vines, and grasses growing in recently disturbed areas. Such areas sometimes represent traditional garden areas left fallow. To some extent they function as a natural “bandage” protecting disturbed soils from Kosrae’s heavy rains, allowing humus and nutrients to accumulate in the soils. Kosrae has less weedy vegetation than the islands of Pohnpei, Chuuk and Yap.

¹⁷ U.S. Forest Service and the FSM (2010) [Federated States of Micronesia State-Wide Assessment and Resource Strategy 2010–2015+](#).

¹⁸ Whitesell, C., C.D. MacLean, M.C. Falanruw, T.G. Cole, A.H. Ambacher. 1986. *Vegetation of Kosrae, Federated States of Micronesia*, USDA Forest Service, Resource Bull. PSW-17.

120. The cover and distribution of vegetation/habitat types on Kosrae is shown in (Table 5 and Figure 9). This shows that upland forest is the dominant vegetation type (46% coverage) and occupies the central portions of the island. Agroforest is the next dominant vegetation/habitat type occupying 23% of Kosrae. Agroforest is found around the coastal fringe, especially on the northern, eastern and southern fringe. Mangrove forest (14%) is more prominent on the northeast, western and southern shorelines. Secondary vegetation (11%) is dispersed across the island. Other vegetation types (dwarf forest, swamp forest and non-forest types) make up a minor component of the vegetation/habitat types of Kosrae island.

Table 5 - General vegetation/habitat types of Kosrae's high island¹⁹

Major class/ land habitat type	Vegetation/habitat type	Cover in 1983 (ha)	Percent cover
Closed Forest	Mangrove	1,562	14%
	Swamp Forest	345	3%
	Upland Forest	5,090	46%
Agroforest	Agroforest	1,659	15%
	Agroforest with coconuts	926	8%
Shrub	Dwarf Forest	69	1%
	Secondary vegetation	1,272	11%
Nonforest	Nonforest (grasslands, savannah, developed/ disturbed areas, marshes)	263	2%
Total Area		11,186	100%

¹⁹ Falanruw, M. (2002) [Terrestrial Biodiversity of the Federated States Of Micronesia](#). Prepared for the FSM National Biodiversity Strategy and Action Plan Project

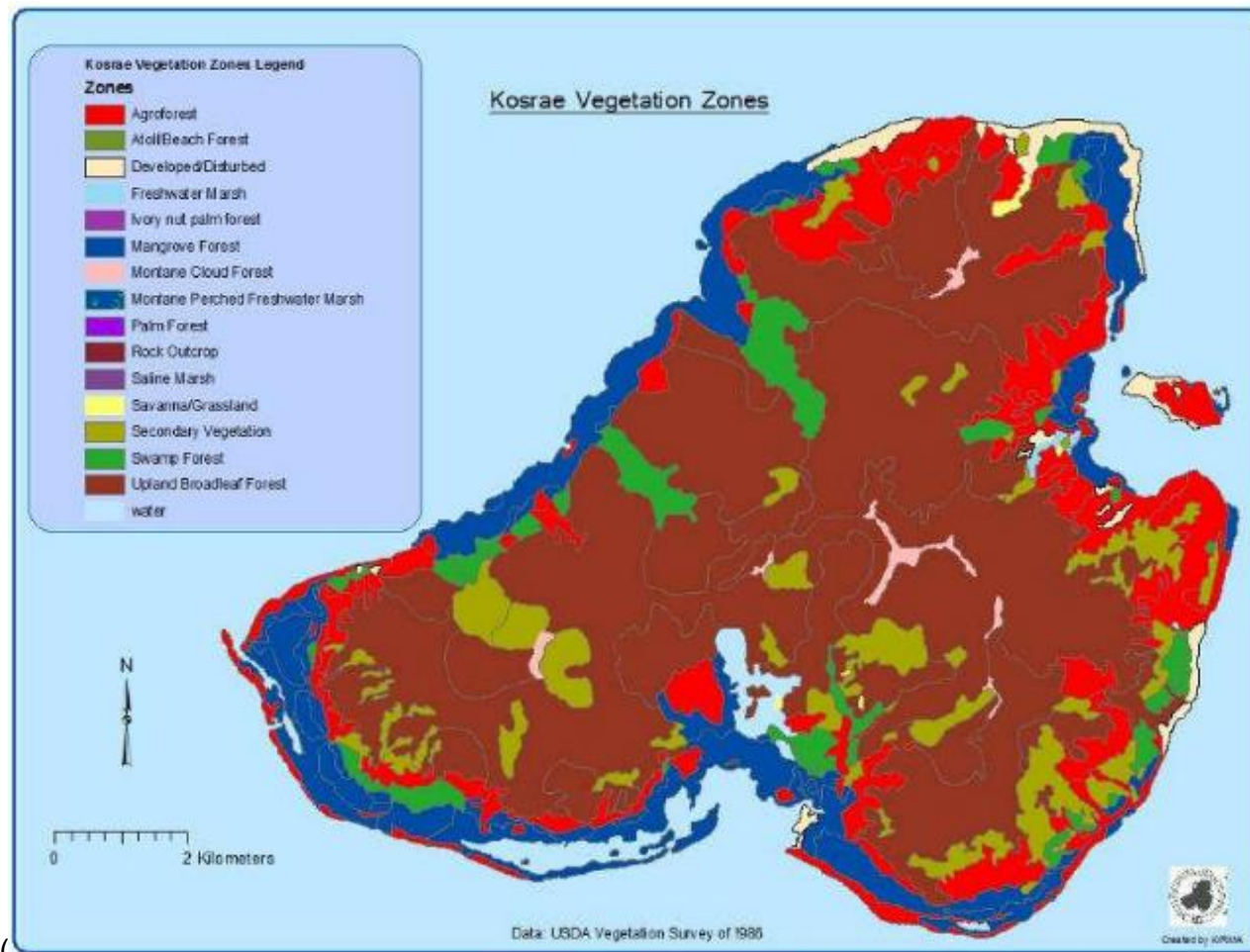


Figure 9: Vegetation map of Kosrae Island²⁰

²⁰ U.S. Forest Service and the FSM (2010) [Federated States of Micronesia State-Wide Assessment and Resource Strategy 2010–2015+](#).

121. **Flora.** There are over 1239 species of ferns and flowering plants in the FSM. Approximately 782 species are native (63%), including about 145 native ferns, 267 native monocots, and 370 native dicots²¹. Approximately 421 species occur in Kosrae including 75 ferns, two gymnosperms, 82 monocots (76 natives, 20 introduced) and 227 dicots (195 natives, 53 introduced);
122. Table 6). Kosrae has the highest percentage of native species (83%) of all the FSM states, with the flora of other states composed of 60 - 63% native species.
123. Species composition of the native rain forest in Kosrae has a close affinity with the India-Malaysian flora. The general physiognomy is characterized by large canopy species with dense understories of shrubs, vines, and ferns²². At lower elevations, upland forest is a mix of *Canipnosperma brevipeiilaia*, tall *Horsfieldia nunu*, and other co-dominant species—including *Adenanihera pavonina*, *Elaeocarpiis carolinensis*, *Ficus* spp., *Neuhergia celebica*, *Eugenia sielechantha* and thickets of *Parinarium laurina* and *Hibiscus liliaceus*. Species commonly found in the understory include the tall fern *Angiopteris evecta*, *Ixora casei*, *Pulyscias subcapitata*, *Cyathea* spp., *Cyclosorus heterocarpus*, the lianas *Freycenetia ponapensis* and *Flagellaria indica*, and the vines *Derris elliptica* and *Piper ponapense*. Many terrestrial and epiphytic ferns are present. Common herbs include *Zingiber zerumbet*, *Costus sericeus*, and *Curcuma* spp. At higher elevations, *Canipnosperma brevipeiilaia* is more commonly found in association with *Elaeocarpus*, *Eugenia stelechanloides*, the palm *Ptychusperma ledermanniana*, and other species.
124. Species found in the moss forests of Kosrae include an upper layer of scattered stunted trees, including *Elaeocarpus carolinensis*, *Cyathea* spp., and *Astronidiuni kusaianum*. Lower layers include *Polyscias subcapitata* and *Eugenia stelechantha*. Undergrowth includes *Marattia fraxinea* and *Pteris spinescens*. Vascular epiphytes include *Elaphoglossum carolinense*, *Phreatia pacifica*, *Prosaptia serraeformis*, *Pleuromanens pallidum*, *Mecodium polyanthos*, *Lindsaea rigida*, *Meringium holochilum*, and *Peperomia kusaensis*.
125. Common agroforest trees on Kosrae are breadfruit, coconuts, bananas, mangoes, guava, *Inocarpus fagifera*, *Terminalia catappa* and *Cananga odorata*. The island of Kosrae is especially noted for its limes, oranges, and tangerines, which are exported.
126. The woody secondary vegetation of Kosrae is notable in often consisting of almost pure stands of *Hibiscus tiliaceus*. This low tangled scrubby tree, useful for its fibre, grows in a variety of conditions from swampy areas to hillsides. It is the principal woody species revegetating abandoned agricultural areas and other disturbed areas such as landslides.
127. Over 457 species of plants, including many food plants have been introduced to the FSM, with 73 species recorded in Kosrae (34 invasive species and 39 weed species)²³. Some of these introduced species have become invasive pests that have spread out of control, with the top ten invasive weed species of FSM listed in Table 7. The spread of invasive species is a continual threat due to increased movement of people and machinery between the islands.
128. Kosrae generally has less weedy vegetation than Pohnpei, Chuuk, and Yap. The most extensive species is possibly the aggressive vine *Merremia peltata*. *Premna ohtusifolia*, *Ludwigia* spp., *Clerodendrum inerme*, and *Wollastonia hibflora* are also common. Cassava (*Manihot esculenta*) which is normally a cultivated food plant, grows wild in grassy areas. The wild raspberry (*Ruhrus moluccanus*) grows among the weedy vegetation of open areas in the Kapluh plateau forest.

²¹ Falanruw, M. (2002) [Terrestrial Biodiversity of the Federated States Of Micronesia](#). Prepared for the FSM National Biodiversity Strategy and Action Plan Project

²² Maxwell, B. (1982) Floristic Description of Native Upland Forests on Kosrae, Eastern Caroline Islands. *Micronesia* **18**: 109-120.

²³ Josekutty, P.C., Wakuk, E.E. and Joseph, M.J. (2002) Invasive/Weedy Angiosperms in Kosrae, Federated States of Micronesia. *Micronesica Suppl* **6**:61-65.

Table 6 – Approximate number (and % of total) of flora species in Kosrae^{24, 25}

	Native	Introduced	Total
Ferns	75 (22%)	0 (0%)	75 (18%)
Gymnosperms	2 (1%)	0 (0%)	2 (0%)
Monocots	76 (22%)	20 (27%)	96 (23%)
Dicots	195 (56%)	53 (73%)	248 (59%)
Total	348	73	421

Table 7 – Top ten invasive weed species within the FSM²⁶

Invasive Plant Species	Pohnpei	Chuuk	Kosrae	Yap
<i>Coccinia grandis</i>	NWS			
<i>Chromolaena odorata</i> Siam weed	WS	WS	WS	WS
<i>Clerodendrum paniculatum</i> Pagoda flower	WS	NWS		
<i>Clerodendrum quadriloculare</i>	WS	WS	WS	WS
<i>Clerodendrum chinense</i> Honolulu rose	NWS	NWS		
<i>Costus speciosus</i> Crepe ginger	WS			
<i>Merremia peltata</i>	NWS	WS	WS	WS
<i>Mimosa diplotricha</i> Giant Sensitive plant	WS			WS
<i>Piper auritum</i> False kava	NWS			
<i>Spathodea campanulata</i> African tulip-tree	WS	NWS	?	NWS
<i>Wedelia trilobata</i> Wedelia	WS	WS	WS	WS

WS – widespread, NWS – not widespread

²⁴ Smithsonian Institution (2018) [Flora of Micronesia](#).

²⁵ Josekutty, P.C., Wakuk, E.E. and Joseph, M.J. (2002) Invasive/Weedy Angiosperms in Kosrae, Federated States of Micronesia. *Micronesica Suppl* 6:61-65.

²⁶ FSM (2002) [FSM National Biodiversity Strategy and Action Plan](#).

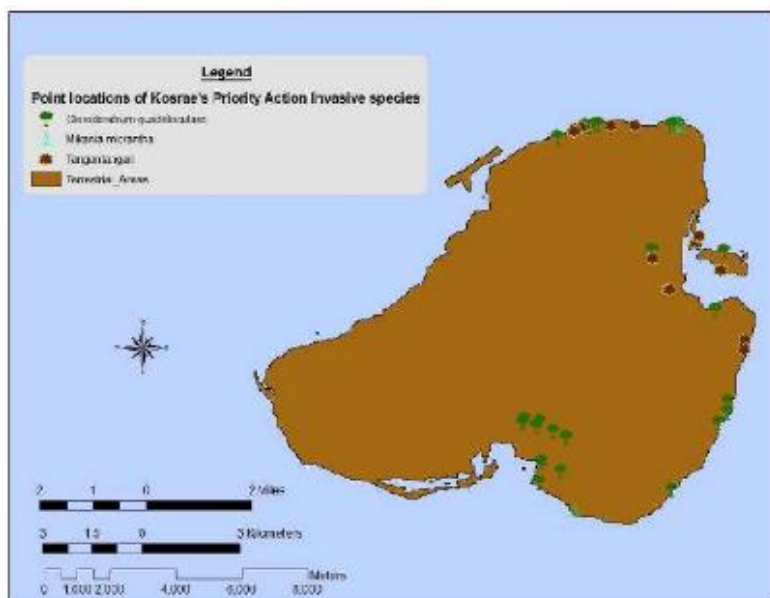


Figure 10: Incidence of targeted invasive species in Kosrae (*Clerodendrum quadriloculare*, *Mikania micrantha* and tangantangan (*Ricinus communis*)). Other, more dispersive species have not been mapped²⁷

129. **Rare, regionally significant or protected flora species.** There are three IUCN listed threatened (one Endangered and two Vulnerable) and one near threatened (NT) flora species associated with Kosrae (Table 8). Of these species, one species (NT) is not endemic to Kosrae, but instead a cultivar from the islands of Pohnpei and Chuuk (*Metroxylon amicarum* - Ivory nut palm). Two of the threatened species are lowland forest tree species (*Intsia bijuga* – thorrot, *Pterocarpus indicus* - lach) with *Pericopsis mooniana* from coastal forest and *Cycas micronesica* - from closed forest. The other threatened species, *Dendroceros japonicas*, is a hornwort that grows on tree-trunks or occasionally rocks in temperate and subtropical evergreen forest.

130. In addition to IUCN listed species, there are 364 vascular plant species that are considered endemic to Micronesia; most of them are restricted to the Caroline Islands (FSM and Palau) with a large percentage restricted to Palau²⁸. Kosrae itself supports 18 endemic plant species, with a further 20 found only in the Eastern Carolines (Kosrae, Pohnpei and Chuuk) and one species only found in Kosrae, Pohnpei and Palau (see Table 9). In addition, 19 endemic species are found across the Caroline Islands (FSM and Palau), including Kosrae²⁹.

Table 8: Threatened or near threatened flora species of Kosrae^{30, 31}

²⁷ U.S. Forest Service and the FSM (2010) [Federated States of Micronesia State-Wide Assessment and Resource Strategy 2010–2015+](#).

²⁸ Costion, C. and Lorence, D. (2012). The Endemic Plants of Micronesia: A Geographical Checklist and Commentary. *Micronesica*. **43**. 51-100

²⁹ Costion, C. and Lorence, D. (2012). The Endemic Plants of Micronesia: A Geographical Checklist and Commentary. *Micronesica*. **43**. 51-100

³⁰ Falanruw, M. (2002) [Terrestrial Biodiversity of the Federated States Of Micronesia](#). Prepared for the FSM National Biodiversity Strategy and Action Plan Project

³¹ IUCN (2018) [International Union for Conservation of Nature's \(IUCN\) Red List of Threatened Species](#). Accessed November 2018.

Common name	Scientific name	IUCN Category	Comments	Habitat
	<i>Dendroceros japonicus</i>	Endangered	Recorded from Taiwan, central Japan (Honshu, Kyushu, Shikoku, Tokunoshima Island, Yakushima Island, Nansei-shoto (Ryukyu islands) and Ogasawara (Bonin) Islands and Kosrae (FSM)	Grows on tree-trunks or (more seldom) on rocks in temperate and subtropical evergreen forest
“thorrot”	<i>Intsia bijuga</i>	Vulnerable	Produces one of the most valuable timbers of South East Asia	Lowland rainforest tree
“lach”	<i>Pterocarpus indicus</i>	Vulnerable	Widespread tree	Found in lowland primary and some secondary forest, mainly along tidal creeks and rocky shores.
Ivory nut palm	<i>Metroxylon amicarum</i>	Near Threatened	This tree species is endemic to the islands of Pohnpei and Chuuk but is cultivated more widely. Also occurs on Guam, but the lack of local name indicates that it is probably not a native species.	A few trees have been planted in moist areas in Kosrae. Occurs from sea level up to 550 m asl.

Table 9: Endemic plant species specific to Kosrae³²

Species	Distribution	Form	Notes
Endemics limited to Kosrae			
<i>Selaginella kusaiensis</i>	Kosrae	Herb	often occurring along rocky stream banks or moist rocky outcroppings
<i>Elaphoglossum kusaiense</i>	Kosrae	Herb	
<i>Peperomia kusaiensis</i>	Kosrae	Epiphyte	epiphytic in the cloud forests of Kosrae
<i>Agrostophyllum kusaiense</i>	Kosrae	Epiphyte	Orchid
<i>Bulbophyllum fukuyamae</i>	Kosrae	Epiphyte	Orchid
<i>Bulbophyllum kusaiense</i>	Kosrae	Epiphyte	Orchid
<i>Phreatia kusaiensis</i>	Kosrae	Epiphyte	Orchid
<i>Rhynchophreatia pacifica</i>	Kosrae	Epiphyte	Orchid
<i>Robiquetia kusaiensis</i>	Kosrae	Epiphyte	Orchid
<i>Pandanus amissus</i>	Kosrae	Tree	
<i>Pandanus kusaicolus</i>	Kosrae	Tree	
<i>Polyscias subcapitata</i>	Kosrae	Tree	
<i>Cyrtandra kusaimontana</i>	Kosrae	-	
<i>Medinella diversifolia</i>	Kosrae	WL	
<i>Psychotria hosokawae</i>	Kosrae	Tree/shrub	
<i>Psychotria rhombocarpa</i>	Kosrae	Tree/shrub	
<i>Planchonella micronesica</i>	Kosrae	-	
<i>Elatostema fenkolense</i>	Kosrae	Herb	
Endemics limited to Kosrae and Carolines			
<i>Cinnamomum carolinense</i>	Carolines (Pohnpei, Kosrae and Palau)	Tree	
Endemics limited to Kosrae and Eastern Carolines			

³² Costion, C. and Lorence, D. (2012). The Endemic Plants of Micronesia: A Geographical Checklist and Commentary. *Micronesica*. **43**. 51-100

Species	Distribution	Form	Notes
<i>Selaginella kanehirae</i>	Eastern Carolines (Kosrae and Pohnpei)	Herb	
<i>Dicranopteris weatherbyi</i>	Eastern Carolines (Kosrae and Pohnpei)	Herb	
<i>Terminalia carolinensis</i>	Eastern Carolines (Kosrae and Pohnpei)		large buttressed tree found in the swamp forests
<i>Elaphoglossum carolinense</i>	Eastern Carolines	Herb	
<i>Diplazium ponapense</i>	Eastern Carolines	Herb	
<i>Ponapea ledermanniana</i>	Eastern Carolines	Tree	
<i>Hypolytrum dissitiflorum</i>	Eastern Carolines	Herb	
<i>Mapania pacifica</i>	Eastern Carolines	Herb	
<i>Dendrobium carolinense</i>	Eastern Carolines	Epiphyte	Orchid
<i>Dendrobium ponapense</i>	Eastern Carolines	Epiphyte	Orchid
<i>Freycinetia ponapensis</i>	Eastern Carolines	WL	
<i>Garcinia ponapensis</i>	Eastern Carolines	Tree	
<i>Elaeocarpus carolinensis</i>	Eastern Carolines	Tree	
<i>Elaeocarpus kusaiensis</i>	Eastern Carolines	Tree	
<i>Elaeocarpus kusanoi</i>	Eastern Carolines	Tree	
<i>Cyrtandra urvillei</i>	Eastern Carolines	-	
<i>Syzygium stelechanthum</i>	Eastern Carolines	Tree/shrub	
<i>Maesa carolinensis</i>	Eastern Carolines	Tree/shrub	
<i>Hedyotis ponapensis</i>	Eastern Carolines	Herb	
<i>Timonius ledermannii</i>	Eastern Carolines	Tree	
<i>Elatostema kusaiense</i>	Eastern Carolines	Herb	

131. **Fauna.** FSM terrestrial ecosystems support unique avian, mammalian, reptilian and other species, including 128 species of birds (including 22 endemic species, 34 resident seabirds, 85 migratory birds, and 65 waterbirds); 25 mammals (including six endemic species or subspecies of bats); and over 27 species of reptiles (skinks, geckos, snakes) and amphibians (most of them native with at least four endemic)³³. Studies of the reptiles of Micronesia are incomplete, and it is likely that there will be additional records as well as new species as more surveys are completed³⁴. While there has been some work undertaken on the terrestrial invertebrates of the FSM, reports are scattered, and mostly located outside of the FSM³⁵. In addition, 40 species of freshwater fish have been recorded in FSM³⁶.

132. Introduced mammals include three species of rats, a mouse, deer, pigs, dogs, cats, and from time to time goats, rabbits and cattle, all of which can have damaging impacts on native biodiversity³⁵. There is one introduced amphibian (cane toad - *Bufo marinus*). Several species of lizards have been introduced but thus far, there have been no confirmed introductions of the brown tree snake (*Boiga irregularis*), which has decimated bird and reptile populations on nearby Guam.

133. **Rare, regionally significant or protected fauna species.** Due to the sparse knowledge of FSM's biodiversity, a list of threatened "species in peril" has not been compiled at National or State levels³⁵. Some species present in the FSM are, however, included in the IUCN Red List of threatened species as well as appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the U.S. Endangered Species Act listing of Threatened and Endangered species. The *Endangered Species Act* of

³³ Wortel, O. (2010) *Federated States of Micronesia Fourth National Report on the Convention on Biological Diversity*

³⁴ Falanruw, M. (2002) [Terrestrial Biodiversity of the Federated States Of Micronesia](#). Prepared for the FSM National Biodiversity Strategy and Action Plan Project.

³⁵ FSM (2002) [FSM National Biodiversity Strategy and Action Plan](#).

³⁶ Pippard, H (2012). *The current status and distribution of freshwater fishes, land snails and reptiles in the Pacific Islands of Oceania*

the FSM was carried over from the Trust Territory of the Pacific Islands and is still incomplete with no inventory or list of threatened FSM species in peril³⁵.

134. Six endemic bird species are known from Kosrae, two of which are considered to be extinct as they were last recorded in the 1800s: Kosrae Starling, *Aplonis corvine*, and Kosrae Crake, *Zapornia monasa* (Table 10)³⁷. The other four endemic species are considered to be relatively common in their restricted range and are considered to be of Least Concern: Caroline Reed-warbler, *Acrocephalus syrinx*; Caroline Swiftlet, *Aerodramus inquietus*; Kosrae Fruit-dove, *Ptilinopus hernsheimi*; Kosrae White-eye, *Zosterops cinereus*. The Caroline Reed-warbler, Kosrae Fruit-dove and Kosrae White-eye are found across a range of habitats, while the Caroline Swiftlet prefers caves and subterranean habitats.

135. In addition, there are two additional, restricted-range bird species, including the Critically Endangered migratory species, Beck's petrel *Pseudobulweria becki*; and the Micronesian Imperial-pigeon, *Ducula oceanica*, which is considered Near Threatened (Table 10).

136. Kosrae may also be visited by 19 IUCN listed migratory bird species (Table 10), including two Endangered, six Vulnerable and 11 Near Threatened.

137. A major threat to native bird species is loss of habitat, due to human-set fires during the dry season. In addition, all endemic and native bird species are at risk from introduced predators, the most notorious being the brown tree snake *Boiga irregularis*, which is responsible for many extinctions on Guam. At present the snake is not known in FSM, however dead two snakes have found in FSM associated with cargo ships from Guam.

138. Two endemic species of bats of the genus *Pteropus* occur in Kosrae state; the Kosrae flying fox (*Pteropus ualanus*; Vulnerable) which is endemic and Kosrae fruit bat (*Pteropus mariannus ualans*; Endangered) both of which are endemic to Kosrae Island (Table 11).

139. Three threatened reptiles are known to occur in Kosrae: two migratory marine turtle species that nest on beaches and the Micronesia saw tailed gecko (*Perochirus ateles*) which is endemic to the Marianas Islands and FSM and listed as Vulnerable (Table 12).

140. There are two Endangered freshwater fish species that may occur in Kosrae, the Japanese eel (*Anguilla japonica*) which has previously been recorded as a vagrant in FSM and *Sicyopterus eudentatus* a large, herbivorous riverine goby found on rocky substrate which is endemic to Pohnpei and Kosrae (Table 13).

141. No threatened invertebrate's species listed on the IUCN Red List are known to occur in Kosrae.

³⁷ Zirkus, S. (2001) [Yap Islands State, Federated States of Micronesia](#) WWF unreviewed document

Table 10: Restricted-range and threatened birds of Kosrae (source: Birdlife International, IUCN)^{38, 39}

Common name	Scientific name	IUCN Category	Comments	Habitat
Non-migratory species				
Kosrae Starling	<i>Aplonis corvina</i>	Extinct	<i>Aplonis corvina</i> was endemic to Kosrae. It is only known from two specimens collected in 1828 and was extinct by 1880.	Its inhabited mountain forests.
Kosrae Crane	<i>Zapornia monasa</i>	Extinct	<i>Zapornia monasa</i> was endemic to Kosrae. Two specimens were collected in 1827-1828, and the species was regarded as uncommon then. It declined to extinction over the next half-century.	It inhabited coastal swamps and marshes, taro patches and "continually wet, shadowy places in the forest.
Beck's Petrel	<i>Pseudobulweria becki</i>	Critically Endangered	Only known from Papua New Guinea and Solomon Islands. Has been seen in the Vanuatu archipelago. May occur in FSM as the extent of its breeding range and at-sea distribution is still unknown	Marine species that is likely to nest in burrows on the slopes of high mountains on larger islands, but may also breed on small islets
Micronesian Imperial-pigeon	<i>Ducula oceanica</i>	Near Threatened	This species occurs in the Micronesian islands of Palau, Yap, Chuuk, Pohnpei and Kosrae, including many small offshore islands. It is probably extinct on Kiribati and many or all of the Marshall Islands. There were estimated to be 572 birds on Yap, 51 on Chuuk, 822 on Pohnpei, 7,474 on Kosrae in 1983-1984. Numbers on Pohnpei are known to have declined by about 70% between 1983 and 1994. The population on Kosrae is inferred to have declined less severely due to the lower rate of forest loss and smaller human population on that island.	Forest species, found predominantly in the mountains of Pohnpei and Kosrae, but widespread where not hunted, including secondary forest, beach forest and mangroves.
Caroline Reed-warbler	<i>Acrocephalus syrinx</i>	Least Concern	Endemic to FSM	Found in subtropical/tropical dry grasslands but has also been recorded in subtropical/tropical moist montane forest and rural gardens

³⁸ BirdLife International (2018) [Micronesia, Federated States of](#)

³⁹ IUCN (2018) [International Union for Conservation of Nature's \(IUCN\) Red List of Threatened Species](#). Accessed November 2018.

Common name	Scientific name	IUCN Category	Comments	Habitat
Caroline Swiftlet	<i>Aerodramus inquietus</i>	Least Concern	Endemic to FSM and is described as common to abundant. The population on Kosrae has not been quantified but the species's population in the rest of its range is estimated to be 83,500 individuals.	Found in caves and subterranean habitats (non-aquatic) but can also occur in subtropical and tropical moist lowland forest
Kosrae Fruit-dove	<i>Ptilinopus hemsheimi</i>	Least Concern	Endemic to Kosrae and RMI	Prefers subtropical/tropical mangrove vegetation above high tide level but also found in subtropical/tropical moist lowland forest, subtropical/tropical moist forest and rural gardens
Kosrae White-eye	<i>Zosterops cinereus</i>	Least Concern	Endemic to Kosrae	Found across a range of habitats including subtropical/tropical moist lowland and degraded former forests, subtropical/tropical seasonally wet/flooded grasslands, dry savanna, subtropical/tropical moist shrubland, plantations and arable land
Migratory species				
Great Knot	<i>Calidris tenuirostris</i>	Endangered	Migratory species that has been recorded in FSM during the non-breeding season	In its wintering range the species occurs in sheltered coastal habitats such as inlets, bays, harbours, estuaries and lagoons with large intertidal mud and sandflats, oceanic sandy beaches with nearby mudflats, sandy spits and islets, muddy shorelines with mangroves and occasionally exposed reefs or rock platforms
Far Eastern Curley	<i>Numenius madagascariensis</i>	Endangered	Migratory species that has been recorded in FSM during the non-breeding season	In the non-breeding season, it is essentially coastal, occurring at estuaries, mangrove swamps, saltmarshes and intertidal flats, particularly those with extensive seagrass (<i>Zosteraceae</i>) meadows. It often roosts in saltmarshes, behind mangroves, or on sandy beaches.
Buller's shearwater	<i>Ardenna bulleri</i>	Vulnerable	Migratory species. The species migrates to the northern Pacific Ocean, from Japan to North America and east to California, and is occasionally found off South America	Pelagic marine species in non-breeding season
Bristle-thighed curlew	<i>Numenius tahitiensis</i>	Vulnerable	Migratory species that has been recorded in FSM during the non-breeding season	It winters on coral reefs, sandy beaches, intertidal flats, rocky shores and in palm forests and dense vegetated understorey
White-necked petrel	<i>Pterodroma cervicalis</i>	Vulnerable	Migratory species that has been recorded in FSM during the non-breeding season	Pelagic marine species in non-breeding season

Common name	Scientific name	IUCN Category	Comments	Habitat
Stejneger's Petrel	<i>Pterodroma longirostris</i>	Vulnerable	Migratory species that has been recorded in FSM during the non-breeding season	Pelagic marine species in non-breeding season
Pycroft's Petrel	<i>Pterodroma pycrofti</i>	Vulnerable	Migratory species. Studies utilising geolocators have shown that, when not breeding, birds disperse to the central and eastern tropical Pacific	Pelagic marine species in non-breeding season
Providence Petrel	<i>Pterodroma solandri</i>	Vulnerable	Migratory species. Its non-breeding distribution is across the western Tasman Sea with some dispersing to the north and northwest Pacific Ocean perhaps as far north as the Bering Sea	Pelagic marine species in non-breeding season
Flesh-footed shearwater	<i>Ardenna carneipes</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	Pelagic marine species in non-breeding season
Sooty shearwater	<i>Ardenna grisea</i>	Near Threatened	Migratory species. The species migrates to the northern hemisphere during the austral winter.	Pelagic marine species in non-breeding season
Curlew sandpiper	<i>Calidris ferruginea</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	In the winter the species chiefly occurs on coastal brackish lagoons, tidal mud- and sand-flats, estuaries, saltmarshes, exposed coral, rocky shores and tidewrack on sandy beaches, and also inland on the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and saltpans.
Red-necked Stint	<i>Calidris ruficollis</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	In the non-breeding season, it mainly uses coastal and intertidal mudflats, sheltered inlets, bays and lagoons but it also uses freshwater, brackish and saltwater wetlands and occasionally sandy beaches and rocky shorelines
Buff-breasted sandpiper	<i>Calidris subruficollis</i>	Near Threatened	Migratory species, recorded as a vagrant in FSM	During migration it is found on many short grass habitats
Streaked shearwater	<i>Calonectris leucomelas</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	Found over both pelagic and inshore waters during non-breeding season
Bar-tailed godwit	<i>Limosa lapponica</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	During the winter it is more common in intertidal areas along muddy coastlines, estuaries, inlets, mangrove-fringed lagoons and sheltered bays with tidal mudflats or sandbars
Black-tailed godwit	<i>Limosa</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season. Subspecies melanuroides breeds in disjunct populations in Mongolia, northern China, Siberia (Russia) and	Subspecies melanuroides often winters in saline habitats such as sheltered estuaries and lagoons with large intertidal mudflats, sandy beaches, saltmarshes and salt-flats

Common name	Scientific name	IUCN Category	Comments	Habitat
			the Russian Far East. These birds migrates across a broad front to winter from western South Asia to Australia, encompassing India, Indochina, Taiwan, the Philippines, Indonesia, and Melanesia	
Tahiti Petrel	<i>Pseudobulweria rostrata</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	Pelagic marine species in non-breeding season
Mottled Petrel	<i>Pterodroma inexpectata</i>	Near Threatened	Migratory species. It migrates to the north Pacific as far as the northern Gulf of Alaska and the southern half of the Bering Sea and in summer can range as far south as the pack ice	Pelagic marine species in non-breeding season
Grey-tailed Tattler	<i>Tringa brevipes</i>	Near Threatened	Migratory species that has been recorded in FSM during the non-breeding season	In the non-breeding season, it is found on sheltered coasts with reefs and rock platforms or with intertidal mudflats, as well as shorelines with rocks, shingle, gravel or shells, often roosting in mangroves. On migration, it is predominantly coastal, but may occur at inland wetlands

Table 11 –Threatened mammals of Kosrae (source: IUCN) ⁴⁰

Common name	Scientific name	Category	Comments	Habitat
Kosrae fruit bat	<i>Pteropus mariannus ualans</i>	Endangered	Endemic to Kosrae Island	Found in areas of native tropical forest, coastal strand, and mangroves. roosting within healthy forest – both atoll and upland forests
Kosrae flying Fox	<i>Pteropus ualanus</i>	Vulnerable	Endemic to Kosrae Island	Natural history of this species is not well known. Suggested that it is similar to <i>Pteropus mariannus</i> in that it forms congregations in native forest and mangrove habitats.

⁴⁰ IUCN (2018) [International Union for Conservation of Nature's \(IUCN\) Red List of Threatened Species](#). Accessed November 2018.

Table 12: Restricted-range and threatened reptiles of Kosrae (source: IUCN) ⁴¹

Common name	Scientific name	Category	Comments	Habitat
Hawksbill turtle	<i>Eretmochelys imbricata</i>	Critically Endangered	Migratory species. Has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic Ocean, Indian Ocean, and Pacific Ocean	Marine species that nests on insular and mainland sandy beaches in more than 70 countries worldwide
Green turtle	<i>Chelonia mydas</i>	Endangered	Migratory species. Has a circumglobal distribution, occurring throughout tropical and, to a lesser extent, subtropical waters Listed as Endangered on US Endangered Species Act 1973	Marine species that nests on beaches in more than 80 countries worldwide
Micronesia saw-tailed gecko	<i>Perochirus ateles</i>	Vulnerable	Species is distributed throughout the Marianas Islands (including Guam, where it is now presumed to be extinct); FSM where it is present on about a third of the islands (including Yap, Truk, Chuuk, Pohnpei, Kosrae, Kapingamarangi Atoll); and the Marshall Islands.	This species has been collected from palm leaf axils, in shrubs and bushes, and under loose flaking bark on standing trees. It is apparently highly arboreal and appears to be somewhat adaptable, occurring on islands where the only vegetation consists of coconut and breadfruit trees, as well as in natural forest.

⁴¹ IUCN (2018) [International Union for Conservation of Nature's \(IUCN\) Red List of Threatened Species](#). Accessed November 2018.

Table 13: Threatened fishes of Kosrae (source: IUCN)⁴¹

Common name	Scientific name	Category	Comments	Habitat
Japanese eel	<i>Anguilla japonica</i>	Endangered	Migratory species. Occurs as a native species in Japan, China, Taiwan and Korea. The range of this species extends from the southern Pacific coast of Japan and further south to Hainan Island covering large areas of mainland China, Taiwan and the Republic of Korea. It has been recorded as a vagrant in FSM.	The species is catadromous, spending its lifetime in freshwater, estuaries and coastal environments, including rivers, streams and wetlands, but migrates thousands of kilometres to spawn
	<i>Sicyopterus eudentatus</i>	Endangered	Endemic to the FSM where it is known from Pohnpei and Kosrae Islands. This species is amongst the least common, if not the rarest, of the gobies in Pohnpei and Kosrae rivers. It used to be found in the Nanpil-Kiepw river. However, in 2001, no specimens were found in the Nanpil-Kiepw river and only one specimen was found in the Senipehn River at 92 m.	This is a large, herbivorous riverine goby. The species is found in rivers on rocky substrates and feeds on algae.

142. **Protected and areas of biodiversity significance areas.** Current policy and legislation, both at the State and National level, is inadequate to support the development of a national protected areas network. The nation's decentralized political system will require the development of a unique legal and policy framework, conceivably consisting of a National policy enabling each of the four States in their protected area development⁴². In addition, FSM is not a contracting party to the Ramsar Convention and, as such, there are no internationally protected wetlands associated with FSM.

143. A two-year multi-stakeholder process including all levels of government, the U.S. Forest Service, The Nature Conservancy, university scientists, and local scientists resulted in the identification of 130 Areas of Biodiversity Significance (ABS) in 2002 throughout the 607 inhabited and uninhabited islands of FSM, of which 23 are strictly terrestrial related, mainly upland native forests^{43, 44, 45}. Of the 130 ABS, 12 were identified in Kosrae State, including two terrestrial, one marine, five coastal marine and two coastal freshwater ecosystems, totalling 8,261 ha (Figure 12).

Table 14 – Number and size of Areas of Biodiversity Significance by type⁴⁶

	Terrestrial Sites		Marine Only Sites		Coastal Marine Sites		Coastal Freshwater Sites		Total	
	# sites	Area (ha)	# sites	Area (ha)	# sites	Area (ha)	# sites	Area (ha)	# sites	Area (ha)
Yap	3	651.94	6	9,471.10	21	24,007.43	2	31.76	32	34,162
Chuuk	9	4,328.06	10	20,683.29	20	77,089.91	11	936.66	50	103,038
Pohnpei	9	12,833.28	5	12,480.50	18	75,695.26	3	5,283.09	35	106,292
Kosrae	2	4,835.04	1	54.52	5	1,466.07	4	1,904.89	12	8,261
Total	23	22,648.32	22	82,689.39	64	178,258.67	20	8,156.39	130	291,753

144. Since 2002, more than five upland forests have been placed under protection, more than 15 new marine protected areas have been established, and the designation of two UNESCO Biosphere Reserves has occurred, all with NGOs and communities central to the process⁴⁴. As of 2014, the current status (% areas protected) was: Kosrae 7% marine, 8% terrestrial; Yap 10%, 0%; Pohnpei 29%, 20%; and Chuuk 2%, 18%⁴².

145. In Kosrae, there are three officially protected terrestrial areas:

- *Yela Ka Forest* is a conservation area of ka trees (*Terminalia carolinensis*) in the Yela Valley on the island of Kosrae in the Federated States of Micronesia. A conservation easement, the first achieved outside the Americas, protects 78 acres of the 1,400 acre valley (Figure 13).
- *Olum Watershed Protected Area* is an ABS site (310.3 ha) with native upland forest that includes cultural and historical sites. The area is managed by KIRMA in partnership with landowners.
- *Mahkontowe Conservation Area* was enacted into Kosrae State Law 11-156 on June 7, 2018. This area refers to a 15 square kilometer area which hosts a variety of significant cultural, archaeological, and natural aspects (Figure 11).

⁴² Takesy, A. (2014) *Action Plan for PoWPA and Target 11*. Report by FSM Department of Resources and Development to the Convention on Biological Diversity.

⁴³ TNC (2002) *A Blueprint for Conserving the Biodiversity of the Federated States of Micronesia*.

⁴⁴ Wortel, O. (2010) *Federated States of Micronesia Fourth National Report on the Convention on Biological Diversity*.

⁴⁵ The Yap State Environmental Stewardship Consortium (2004) *Yap State Biodiversity Strategy and Action Plan*.

⁴⁶ TNC (2002) *A Blueprint for Conserving the Biodiversity of the Federated States of Micronesia*.

146. Figure 13 shows areas of Kosrae Island currently protected (pre 2018) while

147. Table 15 lists informally and formally protected area of Kosrae.

148. In addition, during the period of Japanese occupation (1930 to 1945), public lands were expanded to include all upland forest areas above an arbitrary line, the 'Japanese Line' (Figure 11). This was to restrict access to upland areas and manage the development of upland forest areas, with all land above the Japanese line removed from traditional ownership and declared state land. The land above the Japanese line is still under control of the Kosrae State Government with minimal development having occurred above it. As a result, large areas of upland forest have essentially been protected from development and other land-use activities, and are in a relatively natural state providing significant watershed protection.

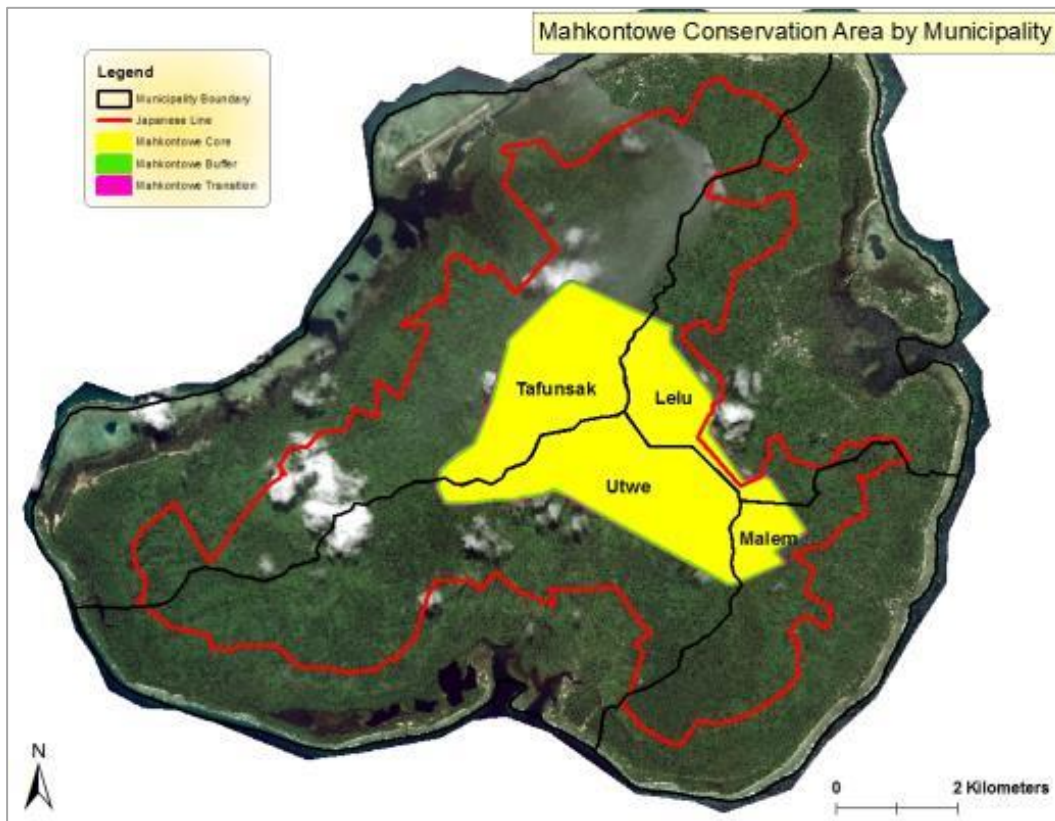


Figure 11: Mahkontowe Conservation Area (yellow) and the Japanese Line (red)⁴⁷

⁴⁷ Kosrae State Historic Preservation Office (2018) [Mahkontowe](#).

Table 15: Protected areas of Kosrae

0	Protected area name	Terrestrial or Marine	Area (ha)	Gazette d
1	Tafunsak	Marine	58.8	yes
2	Utwe Biosphere Reserve (includes the Utwe- Walung Marine PA)	Marine	130.88	yes
3	Awane	Marine	131.2	yes
4	Tukasungai (<i>Trochus niloticus</i>) Sanctuary	Marine	277.8	yes
5	Olum Watershed PA	Terrestrial	310.3	yes
6	Pikensukar MPA	Marine	20	no
7	Kuuplu Mangrove Forest Reserve	Terrestrial	44.8	no
8	Tofol Watershed Area	Terrestrial	305.9	no
9	Tukunruh MPA (Mangrove Forest)	Marine	150A	no
10	Yela Ka Forest	Terrestrial	520.3	yes
11	Mahkontowe Conservation Area	Terrestrial	1,500	yes

149. **Subproject localities biological resources.** A flora and fauna habitat survey was completed at the subproject sites where ground disturbing activities are expected (ground mounted solar PV array sites in Tofol and solar power house and distribution alignment in Walung). The survey identified 13 flora species at the ground mounted solar sites in Tofol, and 75 flora species in Walung (Annex 1). The proposed ground mounted solar sites in Tofol were dominated by introduced species, with only two native species recorded, one of which is endemic to Kosrae and Eastern Carolines (*Terminalia carolinensis*). By comparison, the majority of the flora at the Walung sites were native, with 7 introduced species and 67 native species recorded, one of which is endemic to Kosrae and Eastern Carolines (*Maesa carolinensis*). In addition, two potentially endemic to Kosrae or the Eastern Carolines (dependent upon determination of the species identification) were identified at Walung. Only one IUCN listed species, *Pterocarpus indicus* (Vulnerable), was recorded at the Walung subproject site, with none being recorded at the Tofol subproject sites.

150. Three endemic bird species were observed during the fauna habitat survey at Tofol, with wetland habitat suitable for migratory species identified adjacent to the survey areas. Habitats were also identified as suitable for geckos, toads and skinks. This habitat could potentially provide habitat for the IUCN Vulnerable listed species Micronesia saw-tailed gecko (*Perochirus ateles*). The fauna habitat surveys at Walung identified suitable habitat for Crustacea (land crab), and three skink species were observed. No IUCN listed species were observed during the fauna habitat surveys at the Tofol or Walung sites.

151. Additional flora and fauna surveys are currently being completed for each of the proposed project sites.

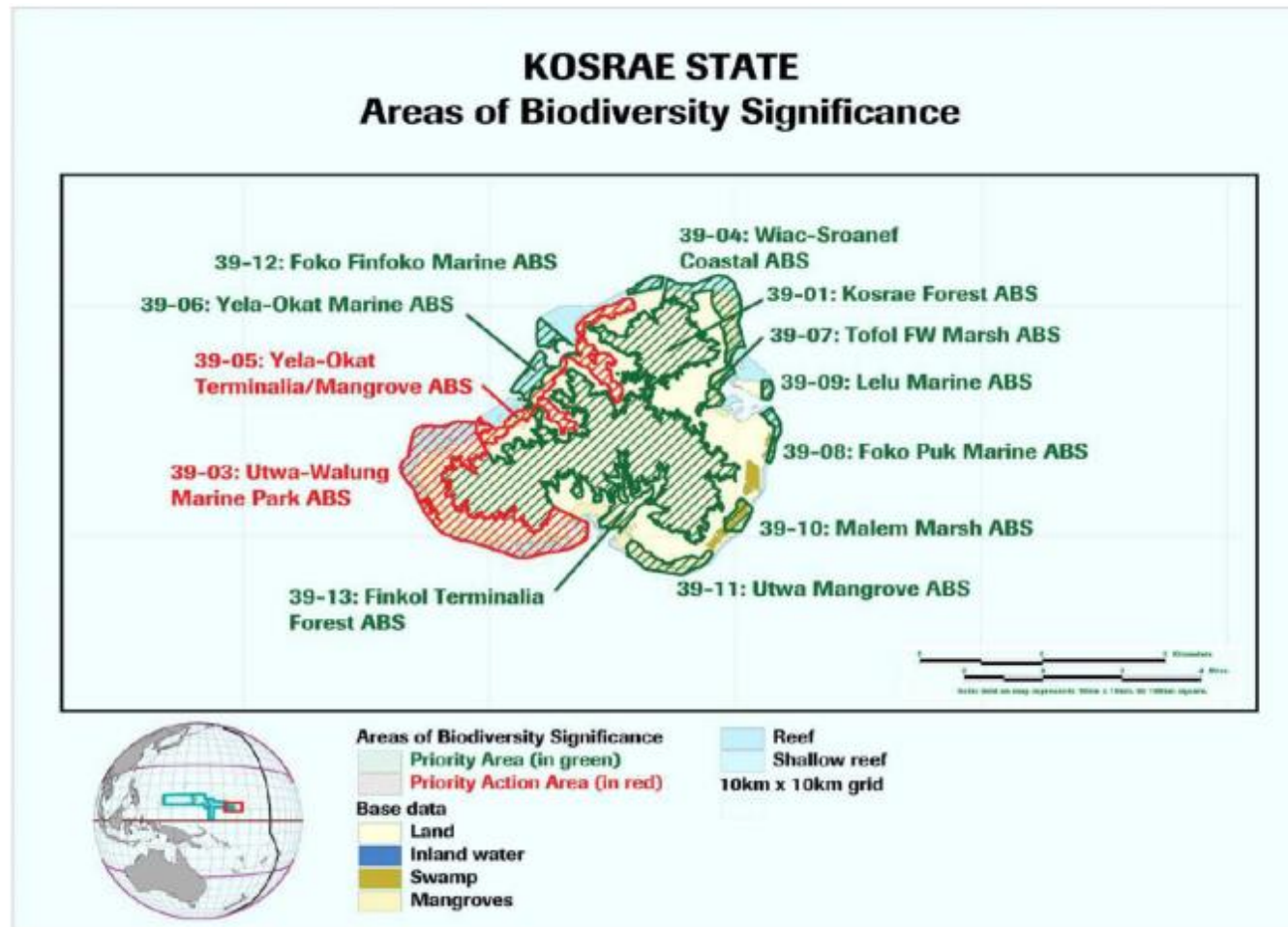


Figure 12: Areas of biodiversity significance in Kosrae⁴⁸

⁴⁸ TNC (2002) *A Blueprint for Conserving the Biodiversity of the Federated States of Micronesia*



Figure 13: Conservation base map for Kosrae Island, 2014⁴⁹

⁴⁹ Takesy, A. (2014) *Action Plan for PoWPA and Target 11*. Report by FSM Department of Resources and Development to the Convention on Biological Diversity.

C. Socio-economic Resources

152. **Demographics**^{50, 51}. FSM's 2010 census recorded a total population of 102,843, comprising of 52,193 males and 50,650 females (Table 16). This represented a decline in population of 4,178 since the 2000 census, at an average annual growth rate of -0.40%. According to the 2010 census, Yap state had a population of 11,377 (11% of FSM), with 5,741 males and 5,635 females, which represents a population density of 247 people per square mile (Table 16). By comparison, Chuuk state had the highest population (48,654; 47% of FSM) and population density (993 people/sq mile). Yap state recorded the second highest average annual growth rate (0.12%) after Pohnpei state (0.48%), while Chuuk and Kosrae both recorded a declining growth rate as a result of a declining economy resulting in population movement interstate (Pohnpei) or to other countries.

Table 16: Demographic information for FSM (source 2010 census)

Feature	FSM	Yap State	Kosrae State	Pohnpei State	Chuuk State
Land area (sq Km)	702	102	110		127.2
Land area (sq m)	271	45.6	42		49.2
Population	102,843	11,377	6,616	36,196	48,654
Male	52,193	5,635	3,352	18,371	24,835
Female	50,650	5,742	3,264	17,825	23,819
Average annual growth Rate	-0.40%	0.12%	-1.50%	0.48%	-0.97%
Population Density (person/sq mile)	379	247	156	274	993
Population -Percent urban	22.3	7.4	32.6	16.8	28.5
Population -Percent rural	77.7	92.6	67.4	83.2	71.5
Place of birth - FSM	96.9	94.4	93.9	95.3	99.0
Place of birth - Yap	10.5	92.7	0.1	0.6	0.0
Place of birth - Chuuk	47.6	0.9	0.4	2.2	98.8
Place of birth - Pohnpei	32.7	0.8	2.4	91.8	0.2
Place of birth - Kosrae	6.1	0.1	90.9	0.6	0.0
Median age (years)	21.5	25.1	21.6	21.8	20.7
Median age - male (years)	21.5	23.8	21.4	21.4	20.5
Median age - female (years)	21.9	26.4	21.9	22.2	20.9
Average family size	4.4	3.7	4.2	4.2	4.8
Average household size	6.1	4.9	5.7	5.6	6.9
No. of Households	16,767	2,311	1,143	6,289	7,024

153. With a population of 6,616, Kosrae is the smallest state by population in FSM. It also has the lowest population density of all the FSM states (156 persons/sq mile) and recorded an average annual growth rate of -1.5% since the last census in 2000 (Table 16). This was the greatest rate of change of all the FSM states. Of Kosrae's population, 50.6% is males (3,352) and 49.4% female (3,264).

⁵⁰ Division of Statistics, Office of SBOC (2010) Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing.

⁵¹ Division of Statistics, Office of SBOC (2012) *2010 Census of Population and Housing National and State Basic Tables*.

The distribution of Kosrae's population varies considerably between rural (4,456 people) and urban (2,160) areas, with the population in both rural and urban areas declining growing at an average annual rate of -1.34% and -1.82% respectively. The greatest population in Kosrae is located in Lelu municipality (22.7%) followed by Tafunsak (32.0%), Malem (20.4%) and Utwe (13.9%)⁵² Figure 14 shows the location of urban areas on Kosrae and municipal boundaries.

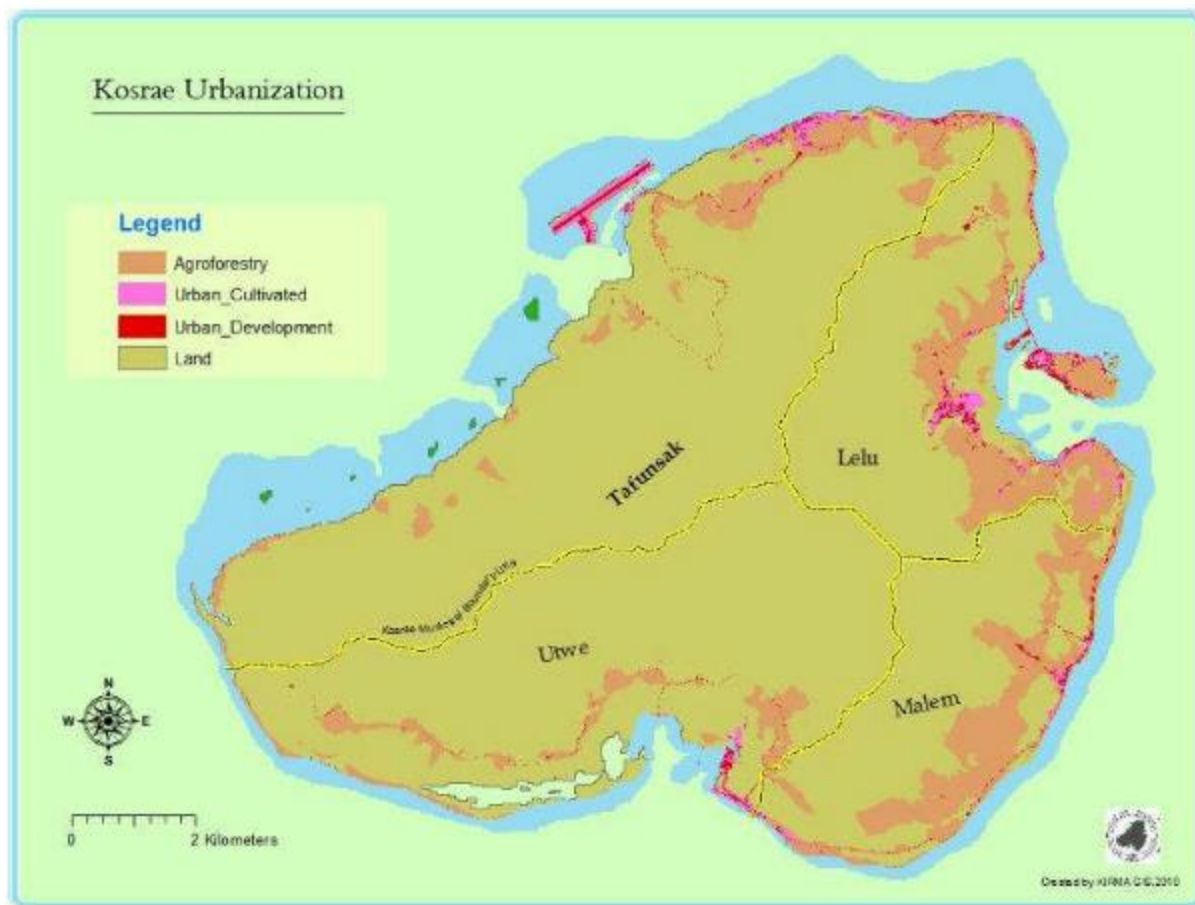


Figure 14: Urban areas of Kosrae Island⁵³

154. The average household size in FSM declined from 6.7 persons in 2000 to 6.1 persons in 2010 (Table 16). Similarly, average family size declined from 7.0 in 2000 to 4.4 in 2010, indicating a preference for smaller families by couples. This also reflects the decline in fertility as well, as young people delaying first marriage. In Kosrae the average household size (5.7) is slightly smaller than the national average, as is the average family size (4.2).

155. FSM's population is predominately Micronesian and is comprised of eight major ethnolinguistic groups and numerous spoken dialects. English is the country's official language of government (although less so at the state or municipal levels), and for secondary and tertiary education. Each state has its own languages, culture, local government, and traditional systems, with the official language in Kosrae, Kosraean, with English used in government discourse. According to the 2010 census, 75.9 % of FSM's population speaks English. In Kosrae, 90.1% of the population speaks English and 90.7% speaks Kosraean.

156. In 2010, the median age in Kosrae was the same as for FSM at 21.5 years. There are 1,143 households in Kosrae. Of these:

- 1,1079 households (94%) source power from a public utility

⁵² Division of Statistics, FSM Department of Economic Affairs (2002) *Kosrae State Census Report 2000 FSM Census of Population and Housing*.

⁵³ U.S. Forest Service and the FSM (2010) [Federated States of Micronesia State-Wide Assessment and Resource Strategy 2010–2015+](#).

- 990 (87%) have access to drinking water via public or community water supply or household tank
- 1119 (98%) are connected to a sewer or have a septic tank
 - 872 (76%) have access to a car, bus/truck or motorbike
 - 490 (43%) have access to a mobile phone
 - 246 (22%) have access to a computer, with 156 (14%) having access to the internet.

157. **Education**^{54, 55}. Education in the FSM is compulsory for children aged 6 to 13 (elementary school). The national education agency is the FSM Department of Education. Each state has its own education agency operating public schools. The curriculum in this eight-year program includes subjects such as science, mathematics, language arts, social studies and physical education. Public elementary and secondary schools are free for all Micronesian students. There are five secondary schools (one per island) as well as several private secondary schools. In FSM, the College of Micronesia provides accredited post-secondary education from six campuses spread across all States.

158. According to the 2010 census, in Kosrae, 101% of 6-13-year olds go to elementary school (indicating students repeating years), 93% of 14-17 year olds attended high school and 25% of 18-24 year olds attend college. The 2010 FSM census also showed that 85% percent of Kosraeans aged 25 years and over had completed elementary education; 55% had completed high school, and 39% had attended college or other higher-level education institute with approximately 16% graduating. A further 2% were recorded as never having attended school.

159. **Public health**⁵⁶. The Department of Health Services in each state provides medical and public health services through a hospital, community health centres and dispensaries. Each state system is autonomous. Health services are highly subsidized by the state governments, except in private clinics. The national Department of Health and Social Affairs oversees health programmes, including 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.

160. In total, there are six private health clinics in the country and one private hospital. Access to hospital services remains an issue, particularly for outer-islands residents due to transportation difficulties between islands. Furthermore, noncommunicable diseases (NCDs) such as diabetes, cardiovascular diseases and cancers are major health problems. The overconsumption of imported packaged food, lack of physical activity and use of tobacco products are contributing to the high prevalence of NCDs and obesity in the country. Intentional (violence) injury and suicide are other issues, whose contributing factors are likely to be the burden of cultural and economic dislocation, particularly among young adult males. Alcohol use often leads to violent incidents. Tuberculosis (TB) also has a high prevalence, as does leprosy, the latter being among the highest in the Pacific.

161. **Poverty**⁵⁷. Based on a 2008 poverty assessment, 11 percent of the FSM population suffered from food poverty, while 29.9 percent of the population suffered from basic needs poverty. Opportunities for income generation were seen to be limited, especially in rural areas.

⁵⁴ Division of Statistics, Office of SBOC (2010) *Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing*.

⁵⁵ Division of Statistics, Office of SBOC (2012) *2010 Census of Population and Housing National and State Basic Tables*.

⁵⁶ World Health Organization (2018) *Country Cooperation Strategy at a Glance – Micronesia (Federated States of)*.

⁵⁷ FSM Department of Transportation, Communications & Infrastructure (2015) *Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025*

With the stagnation of real incomes since 2005, accentuated by sharp decreases in gross domestic product (GDP) since 2012, it is expected that poverty will have worsened since 2008.

162. **Economy.** Economic activities consist primarily of subsistence farming and fishing. Primary farm products include black pepper, tropical fruits and vegetables, coconuts, cassava, betel nuts, sweet potatoes, pigs and chickens. The islands have few mineral deposits worth exploiting, except for high-grade phosphate. The potential for a tourist industry exists, but the remote location, lack of adequate facilities and limited air connections hinders development.

163. In 1986 FSM entered into a Compact of Free Association (Compact) with the US. The Compact of Free Association is an agreement between FSM and the United States, which provides for US economic assistance (including eligibility for certain US federal programmes), defence of the FSM, and other benefits in exchange for US defence and certain other operating rights in the FSM. A second Compact agreement, the Amended Compact of Free Association (Amended Compact), came into effect in 2004 and provides \$1.8 billion of funding over twenty years, including contributions to a Compact Trust Fund (CTF) intended to replace the direct financial assistance that concludes in 2023.

164. The FSM economy has languished over the last decade and real GDP growth has averaged -0.4 percent⁵⁸. This has resulted in declining living standards and contributed to net outward migration. An ongoing excess of imports over exports sees a continuing deficit in the trading account of the balance of payments. The economy is firmly tied to overseas aid which is significant relative to domestic revenues at the State level and is dominated by funding coming from the Amended Compact.

165. The country has a severe trade deficit. In 2005, total imports were valued at US\$ 117.5 million and exports were valued at only US\$ 1.3 million (exclusive of long-liner and purse seiner catches). Private remittances are also limited, especially compared with other Pacific island countries.

166. Kosrae's GDP in 2015 was estimated at USD\$14.6 million (or USD\$1,963 per person). While the population of Kosrae is partially dependent upon fishing and farming for their livelihoods, nonfarm activities contribute significantly to income. Major economic sectors in the State of Kosrae are marine resources, tourism, agriculture and small-scale businesses. The reopening of a fish processing and cold storage plant in Kosrae contributed to a reported 4% national economic growth rate in 2010. The tourism sector is small, with only 13 415 tourists reported for 2005. The combined output from these sectors contributed an estimated USD\$1.6 million, or 10% of the state product.

167. The State Government owns and operates all infrastructure facilities, health facilities, and most education services, small enterprises, and an extensive commercial activity in the fishery. The private sector provides employment through retail outlets, restaurants, resorts, farming and some service businesses. The employee earnings per institution in 2015 was US\$1.822 million for the private sector and US\$17.051 million from the State Government. The subsistence economy is based on small-scale horticulture and fishing. These two activities are not mutually exclusive as most farmers are also fishermen. Some have livestock for food production. This traditional subsistence economy is still vital for the Kosraeans.

168. **Livelihoods and income**^{59, 60}. FSM is at an early stage of the process of urbanization with about 22% of its population living in the urban areas (urban areas include Colonia in Yap, Weno in Chuuk, Kolonia in Pohnpei and Lelu in Kosrae), a slight increase from the level estimated in 2000⁶¹. According to the 2010 FSM Census, 22,924 out of the total population of

⁵⁸ FSM Department of Transportation, Communications & Infrastructure (2015) *Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025*

⁵⁹ Division of Statistics, Office of SBOC (2010) *Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing*.

⁶⁰ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*.

⁶¹ Division of Statistics, Office of SBOC (2010) *Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing*.

102,843 live in the various defined urban areas across the four states compared to 79,919 in rural areas.

169. Like many households in the Pacific, agricultural and livestock raising activities are almost universal among FSM households (95% and 82% respectively; 96% and 81% in Kosrae). In addition, fishing activities accounted for 71% of all households (70% in Kosrae). These activities were carried out for own household or family use and consumption purposes. About 10 percent of households reported to be engaged in these activities for sale or marketing for cash. These activities were common throughout all four states, particularly the outer island households reported heavy involvement in these activities for family use and consumption.

170. In FSM, according to a household income and expenditure surveys in 2013/14, heads of households are primarily male (80%), with 53% of heads aged 40 – 59 years old (Table 17). The annual average income in FSM was estimated to be USD 16,950, with the average annual income in Kosrae the highest of all the FSM states at USD 18,461. However, at a national level, 20% of the households earned less than US\$ 2,600 and approximately 37% of household heads earned less than USD 5,000; with the majority of household heads earning between USD 5,000 – 29,000. Households headed by males earn on average 9% more than female headed households (total net income excluding imputed rents) and 11% more based on cash income.

171. Headed households who are involved in paid work earn on average 36% more than the retired and obviously much higher than the ones who work for free (e.g. home production for consumption or volunteers). Households in FSM are dependent on cash income as over 63% of their total income is cash (76% in Kosrae), with additional income (or its equivalent) gains from a range of other sources (i.e. home production, gifts, imputed rents and in-kind) (Table 18). The less cash dependent households are the one whose heads work for free (not for cash) as they are involved in subsistence activities for own consumption.

172. While approximate 55% of households report cash income from a current wage and salary job (55.5%) the most common source of income for households in FSM was the home production (mainly agriculture items) with 76% of the households involved in some form of subsistence activity. A large proportion of households also receive remittances i.e. cash from outside of FSM (41.6%).

Table 17: Distribution of households by household head characteristics⁶²

Sex	No. HHs	Age	No. HHs	% HH	Annual income (USD)	total group	% Male	% Female
Male	13,365	< 30	712	4%	<5,000		37.4%	36.7%
Female	3,312	30 – 39	2,972	18%	5,000 – 9,999		23.2%	28.2%
		40 – 49	3,993	24%				
		50 – 59	4,756	29%	10,000 – 29,000		29.2%	28.4%
		60 – 69	2,682	16%				
		70+	1,562	9%	>30,000		10.2%	6.7%
<i>Total</i>	<i>16,677</i>	<i>Total</i>	<i>16,677</i>	<i>100%</i>	<i>Total</i>		<i>100%</i>	<i>100%</i>

⁶² Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*.

Table 18: Household income by state 2013/14⁶³

	Total annual household income (USD 000)	Average annual income (excluding imputed rent) (USD)			Income source				
		Total	Male	Female	Cash	Home production	Gifts	Imputed rents	Income in-kind
FSM	282,683	16,950	13,311	12,208	63.1	10.3	3.4	22.8	0.4
Yap State	41,807	17,768	16,103	15,085	67.1	16.7	5.3	10.8	0.1
Chuuk State	77,726	11,398	8,858	6,197	58.6	13.2	1.8	26.2	0.2
Pohnpei State	143,042	22,293	17,033	15,517	62.6	7.9	3.8	25.1	0.6
Kosrae State	20,109	18,461	15,190	14,896	75.6	3.0	3.0	18.0	0.4

Cash: wage and salary income, business income, and sales of home production (agriculture, handicraft, livestock and/or fisheries)

Home production: value of home production that the household produces themselves and then consumes

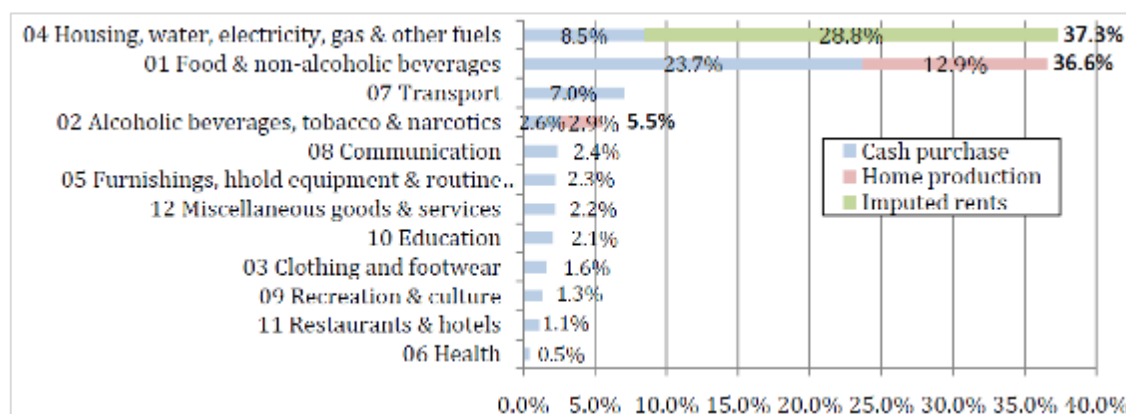
Gifts: all goods given receive are treated as income

Imputed rents: represent the value of a house for owner if they were to receive rent

Income in-kind: any income received by the household which was not in the form of cash

173. Most household expenditure/disbursements are associated with consumption expenditure (94.1%), which represents items that the household consume itself. This analysis includes cash/in-kind purchases as well as home production consumed, and gifts given away outside the household. Non-consumption expenditure accounts for only 4.9%, followed by only a small amount on investment/savings (1.0%).

174. The majority of consumption expenditure is associated with “housing” (37.3%) especially imputed rents (Figure 15). Food and non-alcoholic beverages is the next most significant group (36.6%). Transport and Alcohol and tobacco (including sakau and betel nuts) account for 7.0% and 5.5% of the total household consumption expenditure respectively, with eight other divisions registering contributions lower than 3%. Only a small amount is spent on education and health due to government assistance in this area.



Cash purchases: represent any purchases made by the household for goods or services for which a payment was made by the household. The payment can be made in the form of a cash payment or payment in-kind

Home production: covers the value of items which were home produced by the household and then consumed by that household.

Imputed rents: represent the value of the house for owner and people who live in their main house for free (rent free)

Figure 15: Household expenditure 2013/14⁶⁴

⁶³ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*

⁶⁴ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*

Table 19: Household expenditure by state 2013/14⁶⁵

	Total annual expenditure (USD)		Average expenditure per capita (USD)	Average expenditure per household (USD)
FSM	237,132	100.0%	2,293	14,218
Yap State	32,471	13.7%	2,707	13,801
Chuuk State	70,637	29.8%	1,450	10,358
Pohnpei State	116,517	49.1%	3,154	18,159
Kosrae State	17,507	7.4%	3,046	16,072

175. **Employment and unemployment**^{66, 67}. According to the 2010 FSM census, the working age population, defined as people aged 15 years and older, accounted for 66,146 people, representing an increase of 2,310 people (3.6 percent) since the last census in 2000. However, the actual labour force comprised of 37,919 people (22,076 males, 15,843 females); representing a national labour force participation rate of 57.3 percent (66% for males, 48% females). Of this group, 31,789 people considered themselves as employed, while 6,130 reporting to be unemployed, revealing an unemployment rate of 16.2 percent for FSM (15% males, 17% females).

176. Kosrae's labour force (2,240 people) has a 53.3% participation rate and an unemployment rate of 23%. Almost two thirds of those formally employed, work for government agencies and services (822 out of 1,390) with 475 people employed in the private sector. A large number of people working in the private sector are employed in wholesale/retail, construction, and transport, storage, and communication.

177. Only 40% of FSM households were employed in paid work, resulting in an average annual income between USD 18,000 – 20,000. For households where the head had no paid work, was retired, had home duties or other (60%) the average income was less than USD 13,624 (Table 20).

178. For those that are employed and working for salaries and wages, over half are involved in education (24.6%), public administration and defence (18.6%), wholesale/retail trade and motor vehicle repair (9.7%) and health and social work (9.1%) (Table 21). Very few earn a wage or salary in the fishing (1.8%) or agriculture (0.6%) sectors, as income from these sectors is generated from subsistence activities.

Table 20: Occupational status of households 2013/14⁶⁸

Occupation status	Average income (USD)	% cash income	No. HHs
Work for pay employee	18,365	88.2%	5,755
Work for pay – other	20,078	89.8%	871
Work – no pay	8,496	62.8%	4,705
Retired	13,624	86.6%	2,121
Home duties	7,613	72.6%	2,646
No work – other	10,623	76.7%	581
<i>Total</i>	<i>13,092</i>	<i>81.7%</i>	<i>16,677</i>

⁶⁵ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*

⁶⁶ Division of Statistics, Office of SBOC (2010) Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing.

⁶⁷ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*

⁶⁸ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*

Table 21: Total wage and salary income by industry 2013/14⁶⁹

Industry	USD 000	Percent
Education	25,965	24.6%
Public administration & defence	19,571	18.6%
Wholesale & retail trade, repair of motor vehicles	10,193	9.7%
Human health & social work	9,590	9.1%
Construction	4,896	4.6%
Transportation & storage	4,597	4.4%
Accommodation and food service activities	3,779	3.6%
Financial & insurance activities	3,704	3.5%
Electricity, gas, steam & air conditioning supply	3,165	3.0%
Professional, scientific & technical activities	3,020	2.9%
Activities of extraterritorial organizations	2,949	2.8%
Information & communication	2,386	2.3%
Activities of households as employer	2,352	2.2%
Manufacturing	2,072	2.0%
Fishing	1,921	1.8%
Other services activities	1,863	1.8%
Administrative & support service activities	1,801	1.7%
Agriculture	612	0.6%
Water supply, sewerage, waste management	312	0.3%
Quarrying	255	0.2%
Arts, entertainment & recreation	231	0.2%
Forestry	87	0.1%
Real estate activities	76	0.1%
<i>Total</i>	105,394	

179. **Land tenure, ownership and use**^{70, 71}. The government describes landownership in the FSM as one of smallholdings. Most property is held as family trusts and land use rights are passed down from generation to generation within the extended family system. With the exception of Yap and a few atolls in Pohnpei state where patrilineal affiliations govern inheritance of land rights, matrilineages traditionally controlled estates in Micronesia⁷². Clans tend to hold many parcels, leading to fractional ownership and uncertain boundaries and titles. In FSM subsurface property rights are synonymous with surface rights such that there are no state-owned subsurface mineral or water rights in any of the states. FSM citizens treat land as their most significant asset and leasing of private lands can be time-consuming due to fractional ownership and uncertain boundaries and titles.

180. Landownership is limited by the Constitution to citizens. Even domestic corporations that have noncitizen shareholders may not own land. However, noncitizen individuals and corporations may lease either public or private lands.

181. In FSM the majority of land is privately owned (68%), with only 32% considered to be public land (Table 22). The amount of public land varies considerably between states, with 64% of Kosrae public land and the rest privately owned. Kosrae has by far, the greatest percentage of public land of all FSM states due to the creation of the Japanese Line during the war, with Pohnpei having the second highest percentage of public land (36%). While land above the Japanese line is still under control of the Kosrae State Government, Amendment 19 of the 1995 Kosrae State Constitutional Convention now allows reclamation of land above the Japanese line by descendants of the original landowner. However, the process for reclamation has not been established by law.

⁶⁹ Government of FSM (2014) *Household Income and Expenditure Survey 2013/14 Main Analysis Report*

⁷⁰ ADB (2015) *Understanding Land Issues and Their Impact on Tourism Development: A Political Economy Analysis of Pohnpei, Federated States of Micronesia*.

⁷¹ FSM Department of Transportation, Communications & Infrastructure (2015) *Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025*.

⁷² Ryan, B and Les, P. (2018) [Countries and Their Cultures: Culture of Federated States of Micronesia](#)

Table 22: Landownership in FSM⁷³

	FSM		Chuuk		Kosrae		Pohnpei		Yap	
Dry land area (sq miles)	165		16.7		42.3		67.4		38.6	
Public land	52.7	32%	0.2	1%	27.2	64%	24.4	36%	0.9	2%
Private land	111.9	68%	16.4	98%	15	35%	42.8	64%	37.7	98%
Commercial land	0.5	0%	0.1	1%	0.1	0%	0.2	0%	0.1	0%

182. **Transport^{74, 75}**. FSM has 388 km of roads, 184 km sealed and 204 km unsealed. The majority of these roads are on the four main state islands. Few of the outer islands have any roads and islanders rely on small walking tracks to get between villages. None of the states have widely available public transportation options except for taxis, and a school bus service between Yap's capital of Colonia and smaller villages is the only significant public bus network in FSM. Road and pedestrian facilities are largely the responsibility of state departments for infrastructure/public works.

183. Roads and pedestrian facilities are a key priority sector for expenditure under the FSM Infrastructure Development Plan, with US\$120.9 million earmarked for spending in the sector in the 20 years to 2023. An additional US\$88.5 million investment for maritime transportation and US\$68.4 million for air transportation has also been planned.

184. Most residents of the main islands of FSM own vehicles, making roads a crucial infrastructure sector. In 2003, Kosrae had approximately 30 km of sealed and 10 km of unsealed roads around the island and a sealed airport access road. A coastal road circles two-thirds of the island built largely on the coastal strand at the seaward edge of the mangrove forest, from Utwe in the south through to the Airport at Okat in the north-west. Kosrae roads are reportedly in good condition; however, most lacked sidewalks. The paving of the entirety of the circumferential road was deemed to be a priority to avoid deterioration. Poor transportation was identified in the FSM Agriculture Strategic Action Plan as a key limiting issue for agriculture, resulting in limited market opportunities for farmers in FSM.

185. There are five major airports in FSM, with an international airport located in each state. In addition, there are nine smaller airports located on outer islands, two in Yap state, three in Chuuk state and four in Pohnpei state. Airport development and management is the responsibility of independent authorities in Kosrae and Pohnpei that retain revenue generated from operations and have responsibility for operating costs and making investments. In Chuuk and Yap, the airport is the responsibility of the Department of Transportation and Public Works. Generally, facilities at these airports are inadequate for accommodating cargo, and interface with public transportation is poor. Kosrae is in need of a cargo terminal with cold storage facilities.

186. The islands of Yap, Pohnpei, and Chuuk all contain major international ports which welcome cruise and trading ships from around the world. Port development and management is the responsibility of independent authorities in Kosrae, Pohnpei and Yap that retain revenue generated from operations and have responsibility for operating costs and making investments. In Chuuk the port is the responsibility of the Department of Transportation and Public Works. FSM depends heavily upon maritime transportation, and potential tourism income derives strongly from exploitation of marine resources – for which adequate maritime transportation infrastructure is required. Kosrae's main port is Okat Port, a natural harbour on the northwest coast of Kosrae. The port serves only a small number of vessels and is capable of only serving one vessel at any time. In 2003, the storage facilities of the port were earmarked for upgrade through the Infrastructure Development Plan.

⁷³ Doran, K. (2004) *Private Lands Conservation in the Federated States of Micronesia*. A Report by the Natural Resources Law Center University of Colorado School of Law

⁷⁴ FSM Department of Transportation, Communications & Infrastructure (2015) *Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025*.

⁷⁵ Government of FSM (2016) *Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change*.

187. According to the 2010 census, approximately 61% of Kosraean households have a car, 13% a bus or truck and 2% a motorbike. Overall, Kosrae has the highest ownership of motor vehicles in FSM at 76%, compared with ~ 50% in Yap and Pohnpei and 14% in Chuuk. In Kosrae, 8% of households own a boat with a motor, while 10% have a canoe or boat without a motor. Boat ownership in Kosrae is generally lower than in other states.

188. **Energy.** Based on the 2010 census and those that have access to electric lighting, 95% of Kosraean households have access to electricity, with electricity sourced from Kosrae Utilities Authority (KUA) (94%; current reports indicate that 98% of Kosrae's population is connected to the grid) or generators (1%). Only one household was recorded as having solar panels. The Kosrae Utility Authority is the only FSM energy utility that serves a single island. A high percentage of customers have a metred supply and operation and maintenance costs are largely covered from tariff revenue. Improvements to and/or rehabilitation of generation and distribution assets and major network extensions, as well as the integration of renewable energy sources into the grid, are dependent on external financing.

189. Besides lighting, electricity is used to power common appliances such as televisions, VCRs/DVD players, fridges/freezers and radios. In addition, a small portion (10%) of households in FSM and Kosrae have air conditioners (Table 23).

Table 23: Appliances owned by FSM households

	Yap		Chuuk		Pohnpei		Kosrae	
# households (HH)	2,311		7,024		6,289		1,143	
Air conditioners	225	10%	261	4%	610	10%	107	9%
Fridge/freezer	1234	53%	617	9%	2932	47%	820	72%
VCR/DVD	1197	52%	2272	32%	4015	64%	777	68%
TV	1012	44%	1928	27%	3487	55%	650	57%
Radio	1269	55%	2717	39%	3410	54%	784	69%
Telephone	770	33%	591	8%	2377	38%	802	70%
Mobile phone	1363	59%	2314	33%	2603	41%	490	43%
Computer	315	14%	236	3%	869	14%	246	22%
Internet	180	8%	135	2%	581	9%	156	14%

190. **Water supply and sanitation**⁷⁶. Out of the total households in FSM, about two in every five households (18.5%) do not access improved drinking water. Most houses in Kosrae have access to water from the municipal systems as well as from roof catchment water tanks, with only a small number of people having private, gravity-fed piped sources where they have springs on their land (NIWA 2016)⁷⁷. Municipal supplies are sourced primarily from Malem and Finfokoa catchments (Malem) and Palusrik (Utwe). No treatment is conducted of the water resulting in unacceptable water quality for consumption due to its high level of suspended sediments, brown discoloration and foul odour, which causes concern to the islands inhabitants and impacts upon the developing tourism industry. As such, the majority of residents (59%) tend to use roof-catchment tank water for consumption, with 99% using the public water system for non-potable uses such as laundry, washing, crops and animal feeding since the public water system is not fit for drinking purposes.

191. According to the 2010 census, most households (98%) have flushing toilets and private septic tanks (94%) with draining services available. Lelu is the only municipality maintaining a public sewer system, with raw sewage from each household or commercial unit being treated

⁷⁶ Division of Statistics, Office of SBOC (2010) Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing.

⁷⁷ NIWA Taihoro Nukurangi May 2016. Malem to Utwe Inland Road Relocation Initiative – Environmental Impact Statement for the inland road.

through a primary treatment process. Once the primary tanks are full, homeowners pay \$100 to the Department of Transport and Infrastructure to drain the septic tanks and transport the sewage to the oxidation pond.

192. **Waste management**^{78, 79}. The impact of pollution and the need for waste management programs in the past in the FSM were small as most waste products were biodegradable and populations were dispersed. However, recent increases in urbanization and the importation of non-biodegradable materials and chemicals have brought with them ever-increasing pollution problems and the urgent need for correct collection, disposal and management programs for wastes. The current level of pollution from solid and liquid waste in the FSM is increasing particularly in the vicinity of main population centers. It is clear that the generation of wastes will increase both in quantity and type in the future. Increased ship traffic, both domestic and international has greatly increased pollution in the marine environment and directly affects biodiversity within the nation's major ports.

193. There are effective, regulated solid waste management systems in place for the primary state population/activity centers in all states and there is developing private sector involvement in solid waste management services. All primary landfill sites utilize the Fukuoka method and there is increasing separation of recyclable and hazardous wastes from general refuse. Solid waste management at Kosrae's central landfill site is the responsibility of the Department of Transportation and Infrastructure and licensed by Kosrae Island Resource Management Authority. There are also unlicensed landfill sites in the municipalities despite an initial objective to close and rehabilitate these sites after establishing the central site. Small collection vehicles collect and transport solid waste to the central site.

194. **Physical and cultural resources.** Humans are believed to have first settled on Kosrae around 2000 years B.P. with European contact first made in 1824. History has taken a heavy toll on Kosrae and its traditional culture over the last two centuries as Kosrae has essentially remade itself to suit the demands of traders, colonizers and missionaries.

195. Kosrae society was highly stratified at the time of initial contact with the West. In pre European times, Kosrae shared many common cultural features with surrounding islands, including: matrilineal lineages and clans; social rank defined by affiliation with kin groups defined as 'noble' or 'commoner'; noble control over land worked mainly by commoners; elaborate redistributive exchanges; and settlements oriented around a group of close relatives sharing access to a single cook house. For several decades after their 1824 discovery by Europeans, Kosraeans were used by whaling crews, who made deals with chiefs for the Island's abundant foods, water, and female companionship. The first missionary established a station in 1852 and virtually the entire population was Christianised in the 1870s. Kosrae was then occupied by the Japanese from 1914-1945, with the US granted control over Micronesia after WWII.

196. Kosrae (and Pohnpei) are where political centralization and complex social ranking appeared in Micronesia in prehistoric times, with Kosrae representing a highly stratified society. On both islands, social status was marked by house platform size and ritual feasting. These two features, as well as stone tombs constructed in sizes to reflect the relative status of the localized kin group possessing a certain land area, were also features of the pre-contact social system. There are a number of prehistoric sites known on Kosrae including:

- *Menka* which rests at the heart of Kosrae's culture as it was the centre of the old religion and is acknowledged in oral histories as the primary force in moulding Kosrae's traditional cultural system and the cultural systems of eastern Micronesia.
- *Leluh* a major prehistoric and historic archaeological site, encompassing the remains of a city on Lelu Island.

⁷⁸ FSM (2002) [FSM National Biodiversity Strategy and Action Plan](#).

⁷⁹ FSM Department of Transportation, Communications & Infrastructure (2015) *Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025*.

- *Likinlulem* the place from which traditional titles originated and is said to have housed the island's highest chiefs with the oldest lineages, at least until about AD 1400 when Leluh, its political rival, began to amass the political will and strength to conquer and unify the island.
- *Safonfok* one of the largest prehistoric industrial complex found in the islands of the Pacific.
- *Finol Tokosra* stone statues are group of large stones shaped like fish (manta rays), turtles, and geometric figures within the Tofol River drainage. Also, in the southern coast of Kosrae has been found large slab of basalt which might be an ancient statue, similar to statues of Rapa Nui.

197. Other items of tangible cultural heritage include historic sites associated with European contact and WWII relics.

198. Intangible cultural heritage of Kosrae includes *fafa* pounding (pounding of banana and/or taro into a thick paste), banana fibre weaving and traditional house construction.

199. A number of the buildings, sites, districts, and objects in FSM have been listed on the US National Register of Historic Places. There are currently 26 listed sites located FSM with five listed in Yap. No areas on Kosrae have been nominated for World Heritage consideration.

200. **Subproject localities physical and cultural resources.** Physical and cultural resource surveys of each project sites are proposed to identify any tangible cultural heritage associated with each site that may be impacted by the proposed project.

Table 24: Heritage sites listed on the US National Register of Historic Places⁸⁰

Name on the Register	Date listed	Location	Municipality	Description
Leluh Ruins	August 16, 1986	Address Restricted	Lelu	Leluh is a major prehistoric and historic archaeological site, encompassing the remains of a city on Lelu Island, a satellite of the larger island of Kosrae. The remains are those of a civilization that peaked around the 14th and 15th centuries, with elements still visible at the time of European contact in the early 19th century. The rulers of Leluh gradually conquered and thus unified the island of Kosrae. From the capital at Leluh, they ruled the island with a monarchy that archaeologists believe was similar to the kingdoms of Tonga or Hawaii.
Safonfok	February 17, 2002	Address Restricted	Walung	Safonfok is a prehistoric archaeological site near Walung. At the time of its discovery in 1999, it was one of the largest prehistoric industrial complexes found in the islands of the Pacific. The site, whose full extent has not been fully determined, was excavated in 1999-2000, revealing a major complex where an estimated hundreds of workers manufactured coral fishhooks and other tools.
Likinlulem	April 14, 2004	Walung 5°17'32"N162°54'40"E 5.292361°N 162.911111°E	Walung	Likinlulem is a major archaeological site in Kosrae. The site encompasses more than 2.8 ha on either side of Likinlulem Stream on the island's southwestern coast, in an area that is now overgrown mangrove swamp. It includes at least nine large enclosures with extensive internal features, a channelized stream, canoe landing, and a large open platform that is subject to inundation at high tide. Occupancy of the site has been dated to 1200-1800 CE, with one area possibly dating as far back as 1000 CE. The site is an important element of the island's oral history as it was here that its paramount chiefs are said to have held court prior to the ascendancy of Leluh c. 1400.

⁸⁰ US Government (2018) [National Register of Historic Places listings in the Federated States of Micronesia](#).

5. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Overview

201. This IEE provides an analysis of the anticipated impacts associated with the identified subprojects. Environmental safeguard measures will be incorporated into the project as follows:

- Pre-construction phase – the period of time from the preparation of this IEE to the time that the ‘notice to proceed’ is issued. This IEE and EMP will be included in technical specifications and bidding documents. The successful contractor shall prepare a construction EMP (CEMP) that will be reviewed and approved by the PMU and PIC. The PMU will update the IEE based on the detailed design prepared by the contractor. The contractor will incorporate environmental mitigation measures identified in the IEE and EMP into detailed design.
- Construction phase - the period from the time that the ‘notice to proceed’ is issued to the contractor to when the ‘certificate of completion’ is issued. The contractor will complete the project as per the design and technical specifications and implement the measures included in the approved CEMP, IEE any conditions issued by KIRMA. This process will be monitored and documented by the PMU with assistance of the PIC.
- Operation and maintenance phase - the period starting when the ‘certificate of completion’ has been issued until the end of the agreed lifetime of the project. The KUA will be responsible for implementing the measures identified in the operation phase of the EMP.

B. Design and Pre-construction Impacts

202. **Access to land.** Subproject 1 is located on land owned by the Kosrae State Government. The land for subproject 2 in Walung includes land owned by the Kosrae State Government (Walung School) as well as private land. All the land required for Walung subproject will be acquired voluntarily either through donation (easements) or negotiated lease. A due diligence report (DDR) has been prepared and found that the project will not displace anyone physically or economically and no land will be taken involuntarily. No negative land acquisition and resettlement impacts are expected.

203. **Adaptation for climate change.** Sea level is projected to rise over the life of the project which will exacerbate flooding caused by storm surges and tides in susceptible areas including Walung. With the exception of sections of distribution system and solar home systems for the Walung subproject, all subproject components are either located inland or on elevated sites and will not be impacted by projected increased flooding.

204. The distribution system and solar home systems for the Walung subproject are necessarily located on land projected to be susceptible to increased flooding as that is where existing residences are located. Whilst the KUA is committed to electrifying Walung Village there are alternative house sites that have been made available by the Kosrae State Government further inland and at a higher elevation. Electrification of the alternative house sites may encourage movement from existing low-lying residences however, there is reportedly little desire from residents to relocate in the short to medium term. Installation of the distribution system to existing houses is proposed in order to meet KUAs commitments and achieve the electrification objectives of the FSM National Electricity Policy.

205. To mitigate against the impacts of flooding all parts of the distribution system and solar home systems will be sited to avoid flooding as far as is practicable. Where infrastructure is susceptible to flooding all components will be designed, specified and installed to be able to

withstand seawater inundation. The distribution system will be designed and installed in such a way as to reduce the potential for the cable to become exposed as a result of erosion.

206. All components procured for the subprojects will be suitable for tropical marine and coastal environments, preferably be preassembled and will be as resistant to corrosion as practicable (e.g. stainless or galvanized steel mounting systems). Components will meet international standards (e.g. IEC 61730 Photovoltaic (PV) module safety qualification). The subprojects will be designed to withstand extreme winds (e.g. typhoons) and temperatures.

207. **Noise.** The installation of a diesel generator within the Walung powerhouse will emit noise which has the potential to disturb the amenity of nearby residences. The nearest residence is located approximately 70 m from the proposed powerhouse location. Noise modelling has been undertaken for the proposed powerhouse at Walung⁸¹. Using measured standard noise emissions from a generator typical of one which may be used on site it was found that the noise level at the closest occupied residence was naturally attenuated to 36 dB(A).

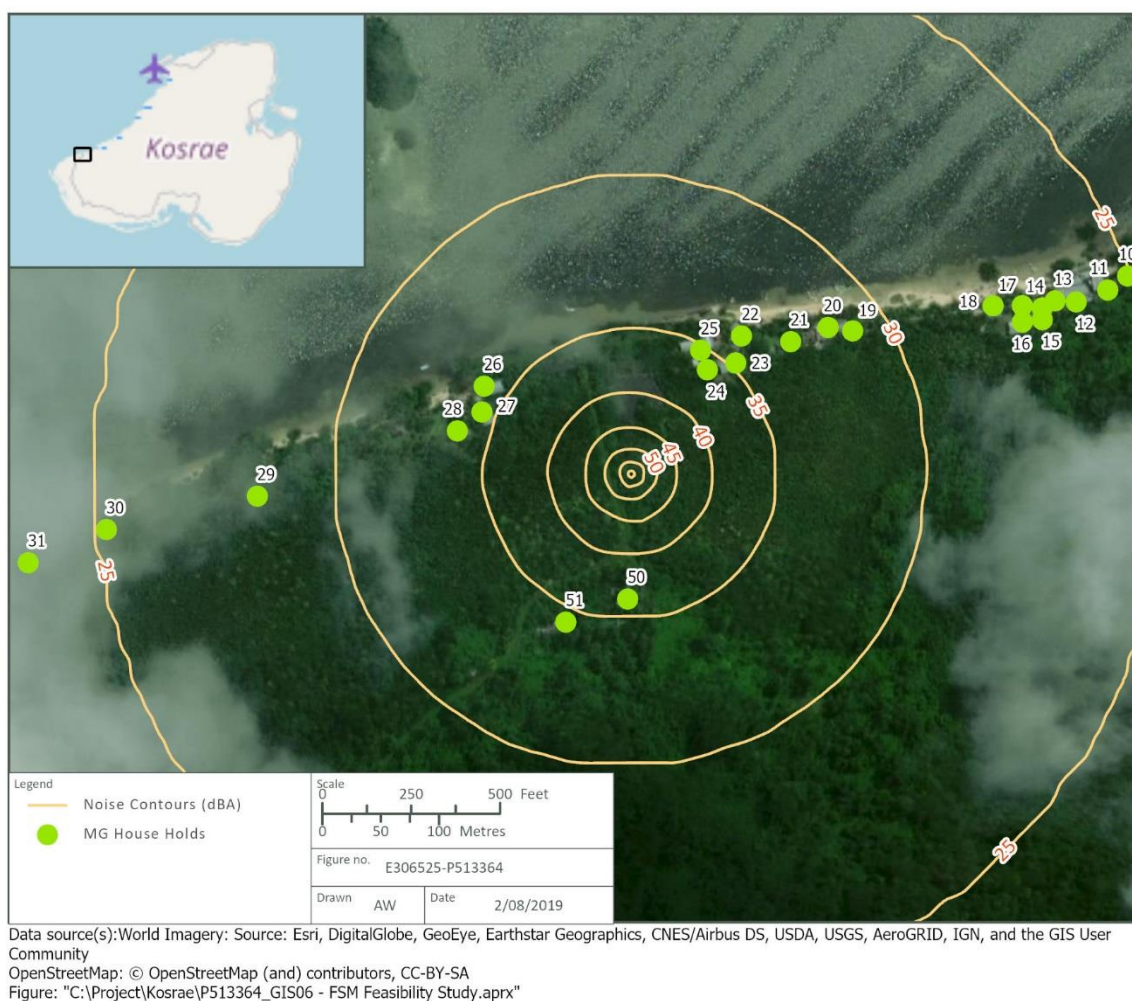


Figure 16: Modelled noise contours Walung

⁸¹ ISO 9613-2: First edition, 1996-I 2-15: Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation

208. *IFC General EHS Guideline – Noise Management Guidelines*⁸² stipulate that residential noise levels should not exceed 55 dBA during the day (07:00 to 22:00) and 45 dBA during the night (22:00-07:00). The modelled noise level at Walung falls within this level. The modelled levels are conservative and do not take into consideration attenuation provided by the concrete block power station building or vegetation between the power station and the residence. The measured noise levels would be expected to be significantly lower. Further, the generators will only run infrequently (<5% of the time). Noise modelling will be rerun using the selected generator to ensure modelled noise levels comply with IFC guidelines at nearby residences.

209. If modelled noise levels are found to exceed *IFC General EHS Guideline – Noise Management Guidelines* mitigation measures will be considered including:

- noise attenuation measures in the design of the solar powerhouse (e.g. specifying bay doors to help attenuate noise)
- specifying low noise diesel generator and/or noise attenuating devices (e.g. enclosures, silencers/mufflers)
- programming of the powerhouse control system (e.g. program battery charging to only occur during the day)

210. **Waste removal.** The site of subproject 1a currently contains a large number of disused cars and buses that will need to be removed and disposed of prior to commencement of site work. Removal and recycling of the cars and buses may be possible through scrap metal recycling contractors on Kosrae (no longer operating at the time of writing) or Pohnpei. The contractor will remove and dispose of cars and buses in manner that is approved by both KUA and KIRMA.

211. **Hazardous materials.** The powerhouse at Walung (subproject 2) will include the ongoing storage and use of hazardous materials (diesel and oils). The inappropriate storage of materials has the potential to result in spills of hazardous materials to the surrounding environment. The specifications for the powerhouse will include a diesel fuel storage tank and a bunded area to store oils and hazardous waste. Both the diesel fuel storage tanks and bunded area will be compliant with relevant American standards.

212. **Asbestos.** There is potential for discovery of asbestos containing material on rooftops (where solar panels will be installed) or used in the construction of new buildings. The subproject will ensure to avoid asbestos use as required by ADB's prohibited investments activities list (ADB SPS Appendix 5).

213. **Pathogens and invasive species.** The installation of the subprojects has the potential to introduce pathogens and invasive species on to Kosrae. The technical specifications will include the requirement for the contractor to obtain appropriate certificates for any material or equipment imported onto Kosrae for the subprojects.

214. **Visual impacts.** The installation of the subprojects has the potential to impact the visual amenity of the view shed in which they are constructed. Subproject 1 includes the construction of rooftop and ground mounted solar arrays in Tofol and will be visible to nearby residents and users of government and commercial buildings. The solar arrays will be viewed within the context of an already modified environment (buildings, sports fields, power station) not expected to impact visual amenity. The solar array and powerhouse at Walung will not be visible from nearby residences.

215. The design of the subprojects will minimise visual impacts by:

- Specifying the use of antireflective panels or coatings to ensure reflected light from PV surfaces does not create a nuisance to nearby residents.

⁸² <https://www.ifc.org/wps/wcm/connect/4a4db1c5-ee97-43ba-99dd-8b120b22ea32/1-7%2BNoise.pdf?MOD=AJPERES&CVID=Is4XYBw>

216. **Local engagement.** The construction of the subprojects is likely to lead to increased employment opportunities for local residents. To ensure opportunities are made available to local contractors a list of relevant local contractors available on Kosrae will be provided in tender documentation to facilitate the engagement of local contractors by the selected contractor(s).

217. **EMP update, bid documents and national requirements.** The IEE and EMP will be updated as the subprojects are developed. The update will include consideration of potential environmental impacts of changes or modification to the design of the subprojects during detailed design. The IEE and EMP will be incorporated into technical specifications and bidding documents. The IEE and EMP will be submitted to KIRMA with an EIA Checklist and, if required, an EIS prepared to obtain a development review permit from KIRMA.

218. The successful contractor will prepare a CEMP reflecting their approach to the work and construction methodology (detailed with sub-plans and work statements as required) including number of workers to be brought to the site, length of time they will be there, accommodation and water and food security/supply, emergency management etc. for the period. Prior to the contractor mobilising to each site the CEMP will be approved by KUA.

C. Construction Impacts on Physical Resources

219. **Erosion Control.** Clearing of vegetation and earthworks for the ground mounted solar arrays at subprojects 1a and 2 (powerhouse and distribution system) has the potential to result in erosion of the cleared sites. Erosion may also occur on material stockpiles and open trenches. Erosion can lead to instability of the project site and surrounds causing damage to vegetation and sedimentation of surrounding environments. The subprojects are not located on soils mapped as being susceptible to erosion (refer Figure 6). Further, the subproject sites are generally flat and not prone to erosion. The distribution systems at Walung will likely utilise the coastal path which is subject to infrequent inundation. The filling of a small section of wetland for the solar powerhouse at Walung has potential to elevate turbidity. Inundation during construction may lead to erosion of the trench and spoil stockpiles.

220. Mitigation measures will include:

- All land disturbances will be confined to the minimum practicable working area to ensure that the minimum area of land is exposed to erosion for the shortest possible time.
- Sedimentation control measures (e.g. silt curtains) will be installed in the wetland to control turbidity from the placement of fill for construction of the powerhouse.
- Existing drainage lines will be protected, and diversion of drainage lines avoided.
- Surface water will be diverted around the construction footprint using structures such as catch drains, silt fences or bunds. Surface water will not be diverted across erosion prone slopes.
- Erosion control works and measures will be installed to control surface water runoff and prevent the export of sediments from the site by ensuring;
 - discharge of storm water is to stable preferably vegetated land.
 - erosion control measures closely follow land contours to reduce runoff velocity from exposed soils.
- Sediment traps (e.g. silt fences) will be constructed across all drainage lines and erosion controls from site that are likely to receive runoff from exposed or disturbed soils.
- Sediment and erosion control measures will be monitored regularly to ensure their continued correct functioning.

- Cable trenches will remain open for the shortest duration possible to reduce erosion and where possible will not be open during periods of heavy rain or forecast weather events that may inundate the trench.
- Spoil from excavated trenches will be stored on the uphill side of the trench such that any sediment from the spoil is deposited in the trench.
- A shade tolerant low groundcover (e.g. grass) will be established across the ground mounted Tofol solar PV arrays sites as soon as practicable after site clearance. The species of groundcover used will be selected in consultation with KIRMA and will not shade the PV modules.

221. **Water resources and quality.** The construction of the subprojects has the potential to interfere with local water resources (ground or surface water) through inappropriate abstraction for construction, alteration of surface water flow across the site leading to sedimentation of adjacent environments (refer Erosion Control below) and pollution of water resources through accidental spillage of hazardous materials (refer Hazardous Materials below). Mitigation measures will include:

- Where feasible construction techniques will be specified that minimise the need to alter the topography (e.g. piling of ground mounted solar arrays) and hence surface water drainage on the site.
- Water required for construction (e.g. concrete mixing) will be sourced with the agreement of KIRMA.

222. **Use of local materials.** The construction of the subprojects may involve the use of local materials such as fill and aggregate (sand or coralline) and water (refer above). The requirement for fill and aggregate will be dependent on the contractors preferred construction method but may be used for the powerhouse at Walung (subproject 2) and to level the ground mounted solar PV site (subproject 1a) and the as well as in concrete for solar PV anchors (if not pre-cast off site). If fill or aggregate is sourced locally there is potential to negatively impact the source site through clearing of vegetation, erosion and sedimentation, noise and over extraction impacting local projects. Mitigation measures will include: If required sources of fill and aggregate will be agreed with KIRMA.

223. **Hazards materials.** Hazardous materials will be required for the construction of the subprojects. Hazardous materials (e.g. fuels and oils) will be appropriately managed during construction to prevent pollution of surrounding land and water. Mitigation measures will include:

- Contractor(s) will prepare a hazardous materials management plan that shall, at a minimum, include:
 - The type and quantity of hazardous materials that will be present on site.
 - Safety Data Sheets for all hazardous materials.
 - A spill response plan including training for staff in the use of spill kits.
 - Details of planned transport, storage and disposal of hazardous materials (including compliance with commitments contained within this IEE).
- The transport of hazardous materials will be undertaken by an appropriately qualified, experienced and equipped contractor.
- Hazardous materials will be stored in appropriate containers that are in good condition with adequate labelling.
- Hazardous materials (including fuel and oils) storage will be appropriately banded.
- Hazardous materials storage areas will be located at least 50m from the marine or aquatic environments.

- Spill kits and containment devices appropriate for the type and volume of hazardous materials on site will be located at the storage area(s), on the site and on vehicles carrying hazardous materials.
- All personnel involved in the handling of hazardous materials will be trained in the handling, emergency procedures and storage requirements for the materials they are handling.

224. **Air quality and dust.** The construction of the subprojects has the potential to generate dust through activities such as earth moving, by the movement of vehicles and machinery and by exposed soil on cleared sites or in soil stockpiles. Exhaust emissions will also be generated from machinery and vehicles. Measures to mitigate impacts to air quality and the generation of dust will include:

- Vehicles and machinery will be maintained in good order.
- Vehicles will not be left idling when not in use
- Vehicles carrying soil, sand, crushed aggregate or other fine materials to or from the subproject sites will be covered.
- The subproject site, material stockpiles and access roads, including those from the wharf, and material stockpile areas, will be wetted or stabilised if dust is generated.
- Earth moving equipment will be cleaned prior to leaving site to prevent the tracking of soil on nearby roads.

225. **Waste management.** The inappropriate management of waste during construction of the subprojects has the potential to pollute surrounding water and land. Waste management during all phases of the subprojects will seek to reduce, reuse and recycle waste as far as possible and dispose of waste in an appropriate way. There are expected to be few hazardous wastes generated during construction however, there are limited facilities to process hazardous wastes on Kosrae. Mitigation measures will include:

- Hazardous waste (if generated) will be disposed of in accordance with the manufacturers requirements at a facility licenced to accept the type and quantity of waste (or approved by KIRMA). If no such facility exists on Kosrae hazardous waste will be shipped to an appropriately licenced facility either within FSM or another country.
- Vegetation cleared from subproject sites will be disposed of in consultation with KIRMA.
- The construction contractor will consult with KUA and KIRMA to identify opportunities to avoid and reduce the generation of waste and to recycle or re-use waste generated.
- If excess spoil is generated during site preparation it will be stored at an existing stockpile site for re-use.
- Bins for recycling and general rubbish will be provided at the project site and materials laydown area for the disposal of construction wastes.

D. Construction Impacts on Biological Resources

226. **Flora, vegetation, fauna and fauna habitat.** Subprojects 1a and c and 2 will result in the loss of approximately 0.75 ha of vegetation. Subprojects 1b and d do not require the clearance of vegetation.

227. A flora and fauna assessment has been undertaken at both subproject sites (Annex 1). The survey found that subproject sites 1a and C were highly degraded and dominated by introduced weeds, grasses and vines. The sites are located on land that was reclaimed in the 1980's. Several avifauna species were observed or are known to utilise the site and the site is suitable for a variety of other species including toads, skinks and geckos that were not

observed during the surveys. Numerous weed species were recorded, and controls will be put in place (refer construction and operational impacts) to prevent their spread.

228. The survey of the Walung subproject sites identified a mix of agro forest and secondary forest containing a diversity of coastal species including native species. The proposed powerhouse would require the clearance of wetland vegetation. However, the wetland is in poor condition as a result of restricted water movement from the inappropriate designing and construction of the road and seawall. The area of the proposed powerhouse is dominated by *Nypa fruticans*, *Barringtonia racemose*, *Premna serratifolia* and secondary vegetation. Clearing for the subproject will result in the loss of native species. However, all native vegetation types recorded are widespread on Kosrae and the clearance of a relatively small area does not represent a significant adverse impact. The vegetation located on along the shoreline at Walung plays a crucial role shoreline stabilisation and erosion protection. The installation of the distribution line along the shoreline will utilise the existing water reticulation alignment and/or the existing footpath to keep vegetation disturbance to a minimum. No mature trees will be cleared along the shoreline.

229. The subproject 2 site also provides habitat for avifauna, skinks and land crabs. Several species of birds and skinks were observed during the survey.

230. **Threatened and protected species and habitats** Three flora species listed as threatened on the IUCN Red List and one species listed as near threatened have been recorded from Kosrae. Only one flora species, the forest tree *Pterocarpus indicus* (lach), listed as Vulnerable on the IUCN Red List was recorded at the Walung subproject site (Annex 1). Lach trees will be marked prior to construction and will not be cleared.

231. The subproject sites also provide habitat for several threatened or protected fauna species:

- The Micronesian Imperial-pigeon (*Ducula oceanica*), listed as Near Threatened on the IUCN Red List has the potential to occur at the Walung subproject site. The population on Kosrae is thought to have declined less severely than on the other Micronesian islands because it has retained a greater forest cover. The Micronesian Imperial-pigeon is a forest species which is found predominantly in the forested mountains of Kosrae but can also occur in secondary forest, beach forest and mangroves. The pigeon is a canopy species where it feeds on fruits and fleshy seeds. Coastal vegetation habitat is not priority habitat for the predominantly forest species and the clearing of a small area of vegetation is unlikely to have an impact on this species, particularly when all mature trees which are likely to provide foraging habitat will be avoided.
- The Micronesia saw-tailed gecko, listed as Vulnerable on the IUCN Red List, occurs in a variety of habitats and suitable habitat may occur at both subproject sites. However, it is unlikely the subproject will have a significant impact on this species as it is highly arboreal and considered somewhat adaptable (IUCN 2018), and the proposed vegetation clearing for the subprojects are predominantly invasive species and will not include habitat trees. In addition, the subprojects will require the clearance of a relatively small amount of vegetation in comparison to the available habitat elsewhere on Kosrae.
- The Kosrae fruit bat (*Pteropus mariannus ualans*) listed as Endangered on the IUCN Red List and the Kosrae flying fox (*Pteropus ualanus*) listed as Vulnerable on the IUCN Red List are considered to potentially occur at or in vegetation close to the Walung project site. Clearing for the subproject will only involve a small area (approx. 0.15 ha) and is unlikely to include any priority habitat (good condition native forest). It is unlikely that the subproject will result in the loss of habitat or significant impact on either of these species.

232. **Vegetation removal.** Vegetation clearance for the subprojects is not anticipated to result in the loss of any flora species listed on the IUCN Red List. Nor will the clearance result in the significant loss of habitat for any fauna species listed on the IUCN Red List. The loss of vegetation from the sites has the potential to impact the surrounding environment through

unauthorised clearing outside the site boundary, clearing additional areas (e.g. to store materials) or by causing damage to surrounding vegetation through erosion or the introduction of invasive species. Mitigation measures will include:

- To ensure vegetation clearing is restricted to within the site boundary and is the minimum practically required a representative of KUA will be on site during marking out of the area to be cleared and/or during clearing. The subproject site boundary will be clearing marked on a plan and approved by the PIC and PMU prior to the commencement of clearing.
- A representative of the PMU will be on site during marking out of the area to be cleared and/or during clearing
- No mature trees will be cleared along the shoreline to install the distribution cable for the Walung subproject.
- Cleared vegetation will be removed and will not be stockpiled on site or pushed into existing vegetation adjacent to the site.
- Machinery storage and materials lay down areas will be established in previously disturbed areas to avoid increasing the footprint of the project site.
- As far as is practicable existing stockpiles of fill material will be used. If new fill material is required it will be sourced from locations approved by KIRMA that do not result in the disturbance of native vegetation.

233. **Pathogens and invasive species.** Kosrae generally has invasive species than Pohnpei, Chuuk, and Yap. Ten terrestrial invasive species are listed on the IUCN Global Invasive Species Database (GISD) as potentially occurring in Kosrae⁸³. The aggressive vine *Merremia peltata* is the most common species and was recorded at the site of subproject 1a.

234. Pathogens and invasive species may be carried on, or in, materials, equipment (including vessels used to transport materials or workers) and any workers travelling to Kosrae for the subprojects. This includes materials, equipment and workers bought from other countries or elsewhere in FSM. Invasive species also have potential to be spread by the construction of the subprojects e.g. through tracking of seeds on vehicles or machinery to or from the subproject's sites and elsewhere on Kosrae.

235. Mitigation measures to prevent the introduction or spread of invasive species and pathogens will include:

- The bidding documents will specify that the contractor must obtain all required biosecurity and phyto-sanitary clearances (e.g. permits) for any material or equipment imported onto Kosrae.
- The contractor will comply with all measures stipulated in relevant FSM Acts and regulations obtain all permits and clearances for import of any materials and equipment to be used for the project as required by relevant FSM and State departments.
- As soon as practicable after vegetation clearing, the subproject 4 site will be planted with low growing species (e.g. grass) to help stabilise the site and minimise the spread of weeds (there is a risk of weeds spreading into newly cleared sites at subproject locations). The species to be planted will be selected in consultation with the KIRMA.
- Weed hygiene measures will be implemented to prevent introduction or spread of invasive species, including cleaning machinery before it enters and leaves the subproject sites.

⁸³ <http://www.iucngisd.org>

E. Construction Impacts on Socio-economic Resources

236. **Traditional and cultural heritage** – A cultural heritage assessment will be completed by the Kosrae Heritage Protection Office (Kosrae HPO) in conjunction with the EIA process (refer Section 2). No ground disturbing work will commence prior to approval of the project application by KIRMA. Initial consultation with KIRMA did not identify any cultural heritage values associated with the subproject sites. It is noted that Subproject 1 sites are located on reclaimed land and are unlikely to contain any cultural heritage values. To mitigate the impact to unanticipated discoveries a representative of KIRMA will be present on site during all earth works. Should an artefact of grave be found work will cease immediately and the subproject site will be managed in accordance with the KIRMA's requirements.

237. **Noise and vibration.** The construction of the subprojects will generate noise through the operation of machinery on the subproject sites and movement of vehicles and machinery transporting equipment and materials to sub project sites. Construction noise impacts will be sporadic and are expected to be minor. Mitigation measures will include:

- Wherever possible working hours will be between 8am and 5pm Monday to Friday. Where safety or technical reasons require work to be completed outside of these hours, noise levels will be kept to a minimum and KIRMA together with nearby residents will be informed.
- Noise generating activities will be carried out in the least sensitive time periods to be determined in consultation with building managers (roof top) and representative residents bodies or KIRMA (ground mount). Wherever possible works will be scheduled to avoid disruption to the normal use of the building.
- Equipment and plant will be maintained in good order. Noise reduction components (e.g. mufflers) will be inspected prior to the commencement of works to ensure they are fully functional. Noise emissions from construction equipment will not exceed 75 dBA.

238. **Non-local workers.** The subprojects are likely to require foreign contractors and technical specialists for the duration of construction. There is potential for conflict between foreign workers and local communities. The size of the non-local workforce is expected to be relatively small, particularly in comparison to the population of Kosrae. Mitigation measures will include:

- All non-local workers will receive an induction that outlines the social and cultural expectations when working on Kosrae. Any worker not complying with these expectations will be expelled from Kosrae and repatriated at the contractor's expense.
- A grievance redress mechanism (GRM) has been established for the project (refer Section 8) and will be communicated through the engagement programme and by prominent display of the GRM process at the subproject sites prior to the commencement of onsite works.

239. **Health and safety – workers and community.** The construction of the subprojects will involve health and safety risks to contractors, KUA staff and the community. Except by agreement with the KUA, the contractor will be responsible for access to the subproject sites during construction. The contractor shall be required to prepare a Health and Safety Management Plan that complies with the IFC's *Environmental, Health, and Safety (EHS) Guidelines General Guidelines: Occupational Health and Safety*⁸⁴ and *Environmental, Health, and Safety (EHS) Guidelines – General EHS Guidelines: Community health and safety*⁸⁵ that

⁸⁴<https://www.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES>

⁸⁵<https://www.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES>

describes the safety measures that will be implemented to protect staff and contractors during construction. The Health and Safety Management Plan will at a minimum:

- Identify responsibilities and authorities within the contractor's staff for adhering to occupational health and safety (OHS) requirements.
- Identify and provide required personal protection equipment (PPE) for staff and sub-contractors (before they start work).
- Child and/or trafficked labor will be strictly prohibited for any activities associated with the project.
- Install fencing on all areas of excavation greater than 1m deep whether temporary or permanent.
- Define appropriate emergency and medical process including evacuation procedures.
- Prepare appropriate work method statements for each construction activity.
- Provide daily hazard identification checklists, risk assessments
- Identify mandatory meeting requirements including toolbox sessions, to ensure all personnel understand the task before commencing work for the day.
- Provide for training for all workers on environmental safety, environmental hygiene prior to the commencement of construction.
- Set procedures for safe handling of toxic materials and other hazardous substances.
- Provide for installation of lights and cautionary signs in hazardous areas.
- Ensure operators of vehicles and equipment are properly licensed and trained.
- Ensure safety and inspection procedures are implemented, setting schedules for regular checking.
- Ensure movements of heavy vehicles is managed so as to minimise impacts to existing traffic and the wider community.
- Provide for the provision of adequate sanitation and potable water for staff and contractors for the duration of construction works.
- Access will be controlled to subproject sites (e.g. through the use of security fencing or restricting access to roof tops) for the duration of construction to prevent public access.
- Children will be prohibited from entering the sites (including worker's accommodation, works area/construction zone) and prohibited from playing on any equipment or machinery.
- All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Kosraen, the language of the main nationality of workers and repeated in English, if required.

F. Operation Impacts

240. **Waste and hazardous materials:** the operation of the subprojects will use hazardous materials (e.g. diesel and oil) and generate waste, including hazardous waste (e.g. inverters and batteries will require replacement during the life of the subprojects) which must be appropriately managed to prevent contamination. Mitigation measures will include:

- Inverters and batteries that have been replaced during the operating lifetime of the subprojects will be removed, transported and disposed of by an appropriately experienced and equipped contractor.

- Where possible batteries and inverters will be recycled. If recycling is not possible, they will be disposed of at a facility approved by KIRMA or, if no facility is available, transported to an appropriately licenced facility elsewhere in FSM or another country.
- Waste oil and other hydrocarbons from the Walung solar powerhouse will be stored in a bunded hydrocarbon storage area.
- Waste will be sent for disposal at regular intervals and not allowed to accumulate at the Walung solar powerhouse.
- A hazardous materials management plan will be developed by KUA that documents how hazardous materials (e.g. diesel fuel) are transferred, stored and transported to and from the powerhouse at Walung. The hazardous materials management plan will be approved by KIRMA.
- Washing of solar PV panels will only be undertaken on an 'as needs' basis to minimise the generation of wastewater. Disposal of wastewater will be agreed with KIRMA.
- All infrastructure containing hazardous materials (e.g. batteries, transformers, generators) will be inspected regularly to ensure it is functioning correctly and no hazardous materials are being discharged.

241. **Water resources.** Water will be required for washing solar PV modules during operation of the subproject. A source of water will be agreed with KIRMA prior to the commencement of operation.

242. **Erosion control.** If localised erosion is detected during operation of the subproject effective mitigation measures such as application of mulch, covering with open weave jute matting and reseeded with ground cover, protection with geotextile fabric or localised flow dispersal and diversion structures will be installed.

243. **Employment.** It is expected that existing employees will be retained to operate the new solar power systems. Training will be provided for KUA employees in the operation and maintenance of the infrastructure.

244. **Emergency response.** KUA will prepare (or update) an operational emergency response plan. The plan will be included in the training provided to employees and be implemented during the operation of the solar power system.

G. Decommissioning impacts

245. The subproject's solar PV modules are expected to have an economic life of at least 25 years. At this time, it is expected that they will be replaced by new solar PV modules. The removal of the solar PV modules will be contracted to a specialist supplier. The batteries installed in the KUA power station and Walung solar powerhouse are expected to have an economic life of between 10 and 20 years dependent on the battery type selected. All equipment will be removed from the subproject sites (e.g. PV modules, batteries, invertors) and will be reused or recycled where possible. Equipment that cannot be reused or recycled will be disposed of at a facility approved by KIRMA or, if no facility is available, transported to an appropriately licenced facility elsewhere in FSM or another country.

246. The decommissioning contractor will be required to develop a hazardous materials management plan prior to the commencement of any works on site.

247. If the site is not reused it will be replanted with species appropriate to the future land use of the site.

6. ANALYSIS OF ALTERNATIVES

248. Kosrae is committed to transitioning from an electricity generating system that relies primarily on diesel generation to one that relies on renewable energy generation. This transition is required to enable Kosrae to meet its renewable energy generation targets and in turn for FSM to meet its commitments under the National Energy Policy and Paris Accord.

249. For Kosrae, with a large population and existing centralised diesel power station, it is not cost effective to fully replace the existing power station with a renewable energy generation in a single step. This limitation is reflected in Kosrae's staged renewable energy generation targets of 30% renewable energy generation by 2020 and 50% by 2030.

250. The mid-term feasibility assessment undertaken for the project concluded that a mix of increased solar PV, a BESS and control system was the most cost-effective way to increase renewable energy penetration within the time and anticipated funding constraints of the project.

251. Seventeen potential locations for solar PV arrays were considered as part of feasibility assessments. The selected roof top and ground mounted locations were considered to be those with the least potential technical, environmental and social constraints.

252. Alternatives to the installation of a mini grid at Walung include connecting Walung to the main electricity grid or installing solar home systems on every house in Walung. Extend the existing distribution line from Utwe to Walung was considered as an alternative to installing an isolated minigrid in Walung. However, the road is in very poor condition, and the likelihood of any significant increase in revenue from new customers is so low that extending the grid to Walung was deemed to be financially infeasible. KUA has in fact already cut service to existing homes along the route simply because their trucks cannot reach them due to safety concerns and because of the impassibility of the road due to lack of public works maintenance.

253. The installation of solar home systems of every house in Walung was not considered to meet the aim of providing electricity supply to Walung of an equivalent standard to other residents of Kosrae. Solar home systems have also been found to be difficult to tariff when installed elsewhere. Some residences in Walung will have solar home systems installed however, to connect these residences would require the voltage of the minigrid to be increased which was not considered financially viable for the number of additional residences.

254. A 'do nothing' option was not considered viable as it does not enable Kosrae to meet its State commitments and for FSM to meet its national and international commitments.

7. CONSULTATION AND INFORMATION DISCLOSURE

A. Consultation

255. Consultation with National and State stakeholders was undertaken in 2009 and 2010 during the development of the National Energy Policy and State Energy Action Plans. National and State working groups consisting of representatives from Government, State utilities, private sector and NGO's made up the working groups. The State action plans identified the need for further renewable energy, but specific projects were not identified.

256. Castalia and ITP were commissioned by the FSM National Government to prepare an Energy Masterplan for FSM, with individual plans for each of the States. The plan was completed in April 2018. As part of the preparation of the National and State plans consultation was undertaken with Government and Government agencies, representatives of the State Energy Working Group, municipal Governments, representatives of KUA and representatives of women's groups. The State master plans identified individual projects including the Walung mini grid.

257. For the current project a range of stakeholders from State and National Government, Government agencies, KUA, municipal representatives and residents of Walung Village were consulted (Annex 2).

258. Two formal consultations with Walung Mayor Jacob George regarding the Walung subproject were carried out—the first on 3 February and the second on 28 August 2018. In each case, the office meeting was followed by a lengthy site visit to Walung village in which KUA staff and the Entura team inspected local conditions, talked informally with local residents, and explained the nature of the proposed subproject. No formal group meetings were held in the village.

259. KUA has followed up with formal consultations in Walung to; inform landowners and residents about the proposed project and how it would proceed, answer questions and negotiate any uncertain terms and conditions with the community and to reach formal agreements with relevant landowners for grants of easement.

260. Further consultation has yet to be undertaken, including in Tofol. KUA will develop and implement a community consultation framework.

261. A draft consultation framework for future phases of the project is outlined below.

262. ADB requires projects to engage in and carefully document meaningful consultation with stakeholders. ADB defines “meaningful consultation” as a process that:

- begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;
- provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
- is undertaken in an atmosphere free of intimidation or coercion;
- is gender inclusive and responsive and tailored to the needs of disadvantaged and vulnerable groups; and
- enables the incorporation of all relevant views of affected people and other stakeholders into decision making such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues (ADB SPS, p. i).

263. KUA could meet consultation requirements for Subproject 1 by calling a public information meeting and inviting key institutional stakeholders along with the general public. KUA could send emails and letters to invite key stakeholders and use its official web site (<https://kosraepower.com/>) to invite members of the public. KUA could also use its web site to post reports and other information about the project. In addition to providing summary

information and answering questions about both Subprojects 1 and 2 at the meeting and on its web site, KUA would explain in some detail what effect, if any, the two subprojects are expected to have on KUA electricity rates. KUA would take stakeholder comments under consideration and modify project goals and procedures as appropriate.

B. Information Disclosure

264. All safeguard documents are subject to public disclosure, and therefore will be made available to the public. Following clearance of the IEE by ADB and updating as PEAR, the document will be posted on government and ADB websites as per the Public Communications Policy. Provided it does not contain any commercially sensitive information, approved contractor environmental plans will also be posted.

8. GRIEVANCE REDRESS MECHANISM

265. A Grievance Redress Mechanism (GRM) is proposed for the project to receive and facilitate the resolution of affected peoples' (AP) concerns, complaints, and grievances about the project's environmental and social safeguards performance. When and where the need arises, this mechanism will be used to address any complaints that may arise during the construction and operation of the project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses AP's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to all segments of affected people at no costs and without retribution. The mechanism does not impede access to FSMs judicial or administrative remedies.

266. Since all the proposed project works would be carried out by or under the guidance and authority of KUA, and since all landowners and the great majority of all households, businesses, and other institutions on the island already understand the operations of and deal directly with KUA on a regular basis, it would be best to use standard KUA channels for receiving and dealing with any project-related grievances relating to land acquisition and resettlement. Note here that "resettlement" impacts would include any temporary commercial, wage, or other income losses due to project works.

267. In serious cases, people would likely take grievances directly to the CEO or perhaps to a relative that happens to hold a senior position in KUA, but a project-specific staff member acting as grievance focal point within KUA will be designated once project implementation begins employing the following mechanism:

268. Environment complaints will be received through the Grievance Focal Point (GFP), these will be designated personnel from within KUA who will be responsible for receiving the environmental complaints. KUA will record the complaint in the onsite Environmental Complaints Register (ECR) in the presence of the GFP.

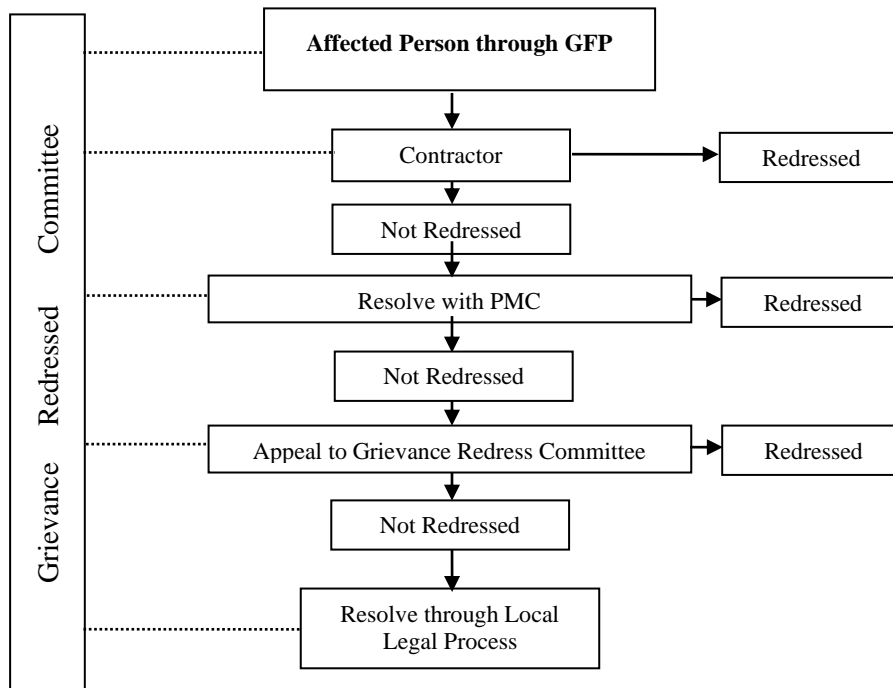
269. The GFP will discuss the complaint with the KUA Contractor and have it resolved. If the Contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the designated KUA Safeguard Specialist. The KUA Safeguard Specialist will then be responsible for coordinating with the Contractor in solving the issue.

270. If the Complaint is not resolved within 2 weeks the GFP will present the complaint to the Grievance Redress Committee (GRC). The GRC will be comprised of designated officials from the following organizations: Contractor's Environment Specialist, KUA Safeguard Specialist, GFP, Island Level representative, and a representative from the EA.

271. The GRC will have to resolve the complaint within a period of two weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register.

272. In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution. The EA through IA will also

keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the PMU and will ensure that they are resolved in a timely manner. Following figure shows that Grievance Redress Mechanism.



273. In any case, an appropriate public awareness campaign should precede and carry on through project implementation, and that campaign should include advice on where and how to direct any grievances that might arise.

9. ENVIRONMENTAL MANAGEMENT PLAN

A. Introduction

274. This EMP is intended to cover all phases of the Federated States of Micronesia (FSM) Renewable Energy Development Project: Kosrae (the project) implementation including design, construction, commissioning, operation and decommissioning. The EMP complies with ADBs SPS and includes the following information:

- Implementation arrangements including institutional roles and responsibilities for the EMP throughout all phases of the project.
- Environmental management matrices including:
 - Potential environmental impacts at each stage of the project
 - Proposed mitigation measures to address each potential impact
 - Institutional responsibility for implementing proposed mitigation measures
- Environmental monitoring matrices including:
 - Parameters to be monitored to ensure mitigation measures have been implemented effectively
 - Schedule and frequency of monitoring
 - Responsibility for implementing and supervising monitoring

B. Implementation arrangement and responsibilities

275. The DFA will be the executing agency for the project and R&D will be the implementing agency. The DFA will have overall responsibility for the project whilst R&D will be responsible for day to day implementation and management of the project including the project's compliance with environmental safeguard requirements. The IA will likely delegate the day to day operations to a PMU that will be supported by a PIC, both of which will include a safeguards expert. R&D will be responsible for implementing all environmental safeguards as per the SPS and country safeguard system. A Steering Committee has been established that is responsible for providing Government oversight of the project and reporting to Cabinet. An engineering, procurement and construction (EPC) contractor will be engaged to construct the project. Organisational responsibilities for environmental management are summarised in Table 25.

Table 25: Organisational environmental responsibilities

Project Organizations	Environmental Management Roles and Responsibilities
Executing Agency (FSM Department of Finance (DFA))	<ul style="list-style-type: none"> • General project oversight • Ensure overall compliance with the project agreements and covenants. Overall delivery of the project and reporting to Government • Ensure the compilation and presentation of all reporting requirements under the project
Implementing Agency (FSM Department of Resources and Development (R&D))	<ul style="list-style-type: none"> • Submission of environmental documentation to KIRMA as required. • Responsible for the overall implementation of the project • Ensure compliance with the provisions of the project agreements and government policies and guidelines • Responsible for procurement and services for the project • Issue contract change orders as appropriate
Project steering committee	<ul style="list-style-type: none"> • Composed of representatives of Kosrae Utilities Authority, YSPSC, DFA and R&D. • Provide Government oversight of project and reporting Cabinet
Project Management Unit (PMU)	<ul style="list-style-type: none"> • Responsible for oversight of the implementation of the project, under the direction of the IA, to ensure compliance of contractors with contracts, specifications and management plans. • Update the IEE including its EMP, as required • Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements • Supervise, monitor and report on contractor's implementation of CEMP and all other contractual obligations • Prepare reports and supporting information for the EA, IA and Steering committee as required • Submission of quarterly progress reports and semi-annual monitoring reports • Ensure readiness of all project sites for contractor including surveyed and staked out sites, any required permits in place and secured lease agreements (if required)
Project implementation committee (PIC)	<ul style="list-style-type: none"> • Review and approve selected contractor(s) project specific CEMP and other plans as required by the EMP. • Prepare semi-annual safeguards monitoring reports to be submitted to EA and ADB. All safeguards monitoring reports to be disclosed as per ADB policies. • Ensure contractors are aware of any consent conditions and the implications for the implementation of the project. • Assist PMU to supervise, monitor and report on contractor's implementation of CEMP and all other contractual obligations • Enforce contractual requirements • Audit construction phase through environmental inspections and review monitoring reports and data
Kosrae Island Resource Management Authority (KIRMA)	<ul style="list-style-type: none"> • Ensure compliance with government requirements • Review complicated issues, if any, arising from the project • Participate in environmental monitoring
Engineer, procure and construct contractor (EPC contractor)	<ul style="list-style-type: none"> • Preparation of the project CEMP and other plans as required prior to the commencement of any on site works. • Submit CEMP to PMU and PIC for review and approval (revising as necessary if required) • Compliance with the EMP • Identify materials and equipment sources and arrange necessary permits, consents and compliance certificates • Provide inductions prior to commencement of construction

	<ul style="list-style-type: none"> • Provide ongoing training, awareness and “tool box” sessions for workers. • Implement CEMP • Implement GRM • Monthly project compliance reports on CEMP and GRM implementation. • Implementation of corrective actions as requested by the PMU.
ADB	<ul style="list-style-type: none"> • Review all feasibility study documentation (incl. IEE) • Prepare documents package for Board review (incl. requirements and TOR in PAM and covenants in grant agreement) • Board approval of project • Undertake regular review missions • Review monitoring reports • Disclose project information as required

C. Mitigation Measures

276. Environmental mitigation measures have been designed to avoid potential impacts where possible and to mitigate impacts that cannot be avoided. Implementation of this EMP and mitigation measures will ensure compliance with obligations under the Federate States of Micronesia Acts and Regulations. The EMP will also ensure ADB safeguard standards are met.

277. To ensure mitigation measures contained in the EMP are successfully implemented:

- The EMP will be updated based on detailed design together with any conditions of the project approval issued by the KIRMA.
- The IEE and EMP will be included in bidding documentation.
- The contractor(s) shall prepare a site-specific construction EMP (CEMP) describing the project and measures that will be implemented to comply with the EMP. It is expected that the contractors CEMP will address specific environmental issues associated with the construction methods they propose and the subproject sites.
- The contractor(s) will submit its CEMP to the IA (or their delegate) for approval prior to the commencement of any construction (including site preparation, clearing and grubbing activities).
- The IA will ensure there are sufficient resources to oversee the implementation of the approved CEMP at each project site.
- The EMP and GRM will be disclosed to the public in accordance with Section 7, Consultations and Information Disclosure.

278. An environmental management and monitoring plan (EMMP) describing the potential impacts and proposed mitigation measures and responsible agency has been prepared in a matrix form and presented in Table 26.

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

D. Monitoring and reporting

280. **Monitoring:** Environmental monitoring will be carried out through all phases of the project development to ensure that the environmental mitigation measures are effective and

that actual environmental impacts accord with predicted impacts and are in compliance with Kosrae State Code and ADB safeguard standards.

281. The PMU/PIC will ensure appropriate monitoring is undertaken during construction in accordance with project progress.

282. Complaints received will be monitored and resolved in accordance with Grievance Redress Mechanism. If required, additional monitoring inspections will be undertaken.

283. An environmental monitoring plan is presented in Table 26 and outlines the parameters, frequency and responsibility for monitoring.

284. **Reporting.** In consultation with EA and ADB, the IA will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans. The quarterly report will include a summary of the contractor's monthly reports.

285. The EA will submit environmental monitoring reports on EMP implementation for ADB's review.

286. Contractors will prepare monthly reports which will describe the implementation of the CEMP including any non-compliances and corrective actions. The report will be submitted, reviewed and approved by the IA.

287. Throughout implementation of the project, ADB will monitor the implementation progress and impacts of the Project. Overall, the EMP will be implemented by the IA throughout project implementation. In consultation with the EA and ADB, the IA will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans.

288. The EMP will be part of the overall project monitoring and supervision and will be implemented by the PMU/PIC with oversight from the IA. Progress on the preparation and implementation of an EMP will be included in the periodic project progress reports. Specific monitoring activities defined in the IEE and EMP will be carried out by the contractor and supervised and monitored by the IA. The EA will submit semi-annual environmental monitoring reports on EMP implementation for ADB's review.

289. In general, the overall extent of monitoring activities, including their scope and periodicity, should be commensurate with the project's risks and impacts. The IA is required to implement safeguard measures and relevant safeguard plans.

Table 26: Environmental Management and Monitoring Plan

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Design and pre-construction phase						
Land access	Subproject delays or future legal land challenges.	<ul style="list-style-type: none"> Land ownership / lease arrangements validated, and agreements made as set out in the Social Safeguards Due Diligence Report (DDR). Social Safeguards DDR updated during detailed design. 	KUA, PMU	Verification of land access agreements	Once, visual inspection of agreements	PMU, PIC
Adaptation for climate change	Damage to subproject components due to inappropriate siting and/or design specification.	<ul style="list-style-type: none"> All parts of the distribution system and solar home systems will be sited to avoid flooding as far as is practicable. Where infrastructure is located in areas susceptible to flooding all components will be designed, specified and installed to be able to withstand seawater inundation. The distribution system will be designed and installed in such a way as to reduce the potential for the cable to become exposed as a result of erosion. Components will meet international standards (e.g. IEC 61730 Photovoltaic (PV) module safety qualification). The subprojects will be designed to withstand extreme winds (e.g. typhoons) and temperatures. 	PMU	Bidding and contract documents (BCD), detailed design	Once, visual inspection of BCD and detailed design	PMU, PIC

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
	Premature failure of components	<ul style="list-style-type: none"> All components procured for the subprojects will be suitable for tropical marine and coastal environments, preferably be preassembled and will be as resistant to corrosion as practicable (e.g. stainless or galvanized steel mounting systems). 	PMU	Selection of appropriate components	Once, visual inspection of BCD and detailed design	PMU, PIC
Noise	Disruption to amenity of nearby residences through use of generator at powerhouse.	<ul style="list-style-type: none"> Noise levels will not exceed IFC General EHS Guideline – Noise Management Guidelines. If required, mitigation measures will include: <ul style="list-style-type: none"> noise attenuation measures in the design of the solar powerhouse (e.g. specifying bay doors to help attenuate noise) specifying low noise diesel generator and/or noise attenuating devices (e.g. enclosures, silencers/mufflers) programming of the powerhouse control system (e.g. program battery charging to only occur during the day) The new diesel generator will comply with relevant American Environmental Protection Authority (EPA) emission standards. 	PMU, Contractor	Noise modelling results	Once (or as required until generator model is selected)	PMU, PIC
Waste removal	Inappropriate disposal of existing waste on the site of subproject 1a	<ul style="list-style-type: none"> The contractor will remove and dispose of cars and buses in manner that is approved by both KUA and KIRMA. 	KUA, Contractor, KIRMA	Disposal plan	Once, visual inspection	PMU PIC

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Hazardous materials	Contamination of surrounding environment through inappropriate storage of hazardous materials.	<ul style="list-style-type: none"> The specifications for the powerhouse will include a diesel fuel storage tank and a bunded area to store oils and hazardous waste. Both the diesel fuel storage tanks and bunded area will be compliant with relevant American standards. 	PMU, Contractor	Bidding and contract documents (BCD), detailed design	Once, visual inspection of BCD and detailed design	PMU, PIC
Pathogens and invasive species	Introduction of invasive species through importation of equipment, materials and personnel	<ul style="list-style-type: none"> The technical specifications will include the requirement for the contractor to obtain appropriate certificates for any material or equipment imported onto Kosrae for the subprojects. 	PMU	Importation certificates	Visual inspection of certificates as required	PMU, PIC
Visual impacts	Impacts to visual amenity to residents and visitors to Kosrae.	<ul style="list-style-type: none"> The design of the subprojects will minimise visual impacts by specifying the use of antireflective panels or coatings to ensure reflected light from PV surfaces does not create a nuisance to nearby residents. 	PMU, Contractor	Bidding and contract documents (BCD), detailed design	Once, visual inspection of BCD and detailed design	PMU, PIC
Local contractor engagement	Increased opportunity for local businesses and contractors	<ul style="list-style-type: none"> To ensure opportunities are made available to local contractors a list of relevant local contractors available on Kosrae will be provided in tender documentation to facilitate the engagement of local contractors by the selected contractor(s). 	PMU	BCD, detailed design	Once, visual inspection of BCD	PMU
Bid and contract documents preparation, tendering and contract award	Failure to identify and mitigate environmental risks, breach of state legal obligations.	<ul style="list-style-type: none"> Prepare and submit a EIA Checklist, with IEE accompanying, to KIRMA. Prepare EIS if required. IEE / EMP and conditions of environmental approval included in bidding documents. 	KUA, PMU	Bidding documents, Environmental Consent, CEMP.	Once, visual inspection bidding documents, environmental consent, CEMP	PMU, PIC

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> Bidding documents include requirement for contractor to prepare CEMP including required sub-plans, number workers and accommodation and food security arrangements. The contractor is required to prepare a CEMP that at a minimum addresses the commitments contained in this IEE and EMP and conditions of state approval. Approval of CEMP by KUA/PMU prior to mobilisation. 				
Construction phase – physical resources						
Erosion and sedimentation control	Erosion of subproject sites and sedimentation surrounding environment	<ul style="list-style-type: none"> All land disturbances will be confined to the minimum practicable working area to ensure that the minimum area of land is exposed to erosion for the shortest possible time. Sedimentation control measures (e.g. silt curtains) will be installed in the wetland to control turbidity from the placement of fill for construction of the powerhouse. Existing drainage lines will be protected, and diversion of drainage lines avoided. Surface water will be diverted around the construction footprint using structures such as catch drains, silt fences or bunds. Surface water will not be diverted across erosion prone slopes. 	Contractor	Erosion on subproject site and sedimentation of adjacent land or water bodies. Site drainage, erosion and runoff controls in place and functioning correctly. Inspection records.	Daily, visual inspection of subproject sites during construction. Monthly, visual inspection of sites for 6 months post construction. Monthly inspection of records during construction	PMU, PIC Contractor

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> • Erosion control works and measures will be installed to control surface water runoff and prevent the export of sediments from the site by ensuring; <ul style="list-style-type: none"> ○ discharge of storm water is to stable preferably vegetated land. ○ erosion control measures closely follow land contours to reduce runoff velocity from exposed soils. • Sediment traps (e.g. silt fences) will be constructed across all drainage lines and erosion controls from site that are likely to receive runoff from exposed or disturbed soils. • Sediment and erosion control measures will be monitored regularly to ensure their continued correct functioning. • Cable trenches will remain open for the shortest duration possible to reduce erosion and where possible will not be open during periods of heavy rain or forecast weather events that may inundate the trench. • Spoil from excavated trenches will be stored on the uphill side of the trench such that any sediment from the spoil is deposited in the trench. • A shade tolerant low groundcover (e.g. grass) will be established across the ground mounted Tofol solar PV arrays sites as soon as practicable after 				

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		site clearance. The species of groundcover used will be selected in consultation with KIRMA and will not shade the PV modules.				
Water resources and quality	Overuse or sedimentation of Kosrae water resources impacting local fresh and potable water supplies	<ul style="list-style-type: none"> Where feasible construction techniques will be specified that minimise the need to alter the topography (e.g. mass concrete blocks for ground mounted solar arrays) and hence surface water drainage on the site. Water required for construction (e.g. concrete mixing) will be sourced with the agreement of KIRMA. 	Contractor, KIRMA	Agree water sources, construction techniques	Water source agreed with KIRMA, Construction technique agreed with PMU/ PIC	PMU, PIC
Use of local materials	Environmental or social impacts to source location of materials (e.g. fill).	<ul style="list-style-type: none"> If required sources of fill and aggregate will be agreed with the KIRMA. 	Contractor, KIRMA	Agreement of KIRMA for material sources.	Once for each material source	PMU.
Handling hazardous materials	Spill of hazardous material	<ul style="list-style-type: none"> Contractor(s) will prepare a hazardous materials management plan that shall, at a minimum, include: <ul style="list-style-type: none"> The type and quantity of hazardous materials the will be present on site. Safety Data Sheets for all hazardous materials. A spill response plan including training for staff in the use of spill kits. Details of planned transport, storage and disposal of hazardous materials (including 	Contractor	Hazardous materials management plan in place and implemented.	Once, visual inspection of hazardous materials plan, as required visual inspection of controls and mitigations during construction.	PMU, PIC.

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<p>compliance with commitments contained within this IEE).</p> <ul style="list-style-type: none"> • The transport of hazardous materials will be undertaken by an appropriately qualified, experienced and equipped contractor. • Hazardous materials will be stored in appropriate containers that are in good condition with adequate labelling. • Hazardous materials (including fuel and oils) storage will be appropriately bunded. • Hazardous materials storage areas will be located at least 50m from the marine or aquatic environments. • Spill kits and containment devices appropriate for the type and volume of hazardous materials on site will be located at the storage area(s), on the site and on vehicles carrying hazardous materials. • All personnel involved in the handling of hazardous materials will be trained in the handling, emergency procedures and storage requirements for the materials they are handling. 				
Air quality and dust	Creation of dust and air emissions by vehicles	<ul style="list-style-type: none"> • Vehicles and machinery will be maintained in good order; • Vehicles will not be left idling when not in use; and 	Contractor	Dust generated complaints received via GRM	As required, visual	PMU

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> Vehicles carrying soil, sand, crushed aggregate or other fine materials to or from the subproject sites will be covered. 				
	Excessive dust from project sites, stockpiles and access roads	<ul style="list-style-type: none"> Subproject sites, material stockpiles and access roads, including those from the port and material stockpile areas, will be wetted or stabilised if dust is generated. Earth moving equipment will be cleaned prior to leaving site to prevent the tracking of soil on nearby roads. 	Contractor	Dust generated, application mitigation measures, inspection records, complaints received via GRM	Daily visual inspection of subproject sites during construction	PMU
Waste management	Inappropriate storage, transport or disposal of waste resulting in contamination	<ul style="list-style-type: none"> Hazardous waste (if generated) will be disposed of in accordance with the manufacturers requirements at a facility licenced to accept the type and quantity of waste (or approved by KIRMA). If no such facility exists on Kosrae hazardous waste will be shipped to an appropriately licenced facility either within FSM or another country. Vegetation cleared from subproject sites will be disposed of in consultation with KIRMA. The construction contractor will consult with KUA and KIRMA to identify opportunities to avoid and reduce the generation of waste and to recycle or re-use waste generated. 	Contractor, KIRMA.	All hazardous waste appropriately managed	Daily visual check of waste disposal bins during construction, monthly check of waste disposal documentation.	PMU

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> If excess spoil is generated during site preparation it will be stored at an existing stockpile site for re-use. Bins for recycling and general rubbish will be provided at the project site and materials laydown area for the disposal of construction wastes. 				
Construction phase - biological resources						
Vegetation removal	Over clearing of subproject locations resulting in loss of vegetation.	<ul style="list-style-type: none"> To ensure vegetation clearing is restricted to within the site boundary and is the minimum practically required a representative of KUA will be on site during marking out of the area to be cleared and/or during clearing. The subproject site boundary will be clearing marked on a plan and approved by the PIC and PMU prior to the commencement of clearing. A representative of the PMU will be on site during marking out of the area to be cleared and/or during clearing No mature trees will be cleared along the shoreline to install the distribution cable for the Walung subproject. Cleared vegetation will be removed and will not be stockpiled on site or pushed into existing vegetation adjacent to the site. 	PIC, PMU, Contractor.	No vegetation clearance outside subproject site boundary, no stockpiles of vegetation	As required during construction, at least verification of site boundary prior to clearance and verification of clearance during construction.	PMU, PIC

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> Machinery storage and materials lay down areas will be established in previously disturbed areas to avoid increasing the footprint of the project site. As far as is practicable existing stockpiles of fill material will be used. If new fill material is required it will be sourced from locations approved by KIRMA that do not result in the disturbance of native vegetation. 				
Pathogens and invasive species	Introduction and/or spread of pathogens and invasive species to Tuvalu or the subproject island	<ul style="list-style-type: none"> The bidding documents will specify that the contractor must obtain all required biosecurity and phyto-sanitary clearances (e.g. permits) for any material or equipment imported onto Kosrae. The contractor will comply with all measures stipulated in relevant FSM Acts and regulations obtain all permits and clearances for import of any materials and equipment to be used for the project as required by relevant FSM and State departments. As soon as practicable after vegetation clearing, the subproject 4 site will be planted with low growing species (e.g. grass) to help stabilise the site and minimise the spread of weeds (there is a risk of weeds spreading into newly cleared sites at subproject locations). The species to be planted will be selected in consultation with the KIRMA. Weed hygiene measures will be implemented to prevent introduction or spread of invasive species, 	Contractor	Pathogen and invasive species free status of all materials, equipment and workers.	Visual inspection of phyto-sanitary / quarantine certificate for each shipment	PMU

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		including cleaning machinery before it enters and leaves the subproject sites.				
Construction phase – socio economic impacts						
Traditional and cultural heritage	Unexpected discovery of artefact(s) of traditional or cultural heritage significance	<ul style="list-style-type: none"> No ground disturbing work will commence prior to approval of the project application by KIRMA. A representative of KIRMA will be present on site during all earth works. Should an artefact of grave be found work will cease immediately and management of the site will be in compliance with KIRMA's requirements. 	Contractor, KIRMA	Presence of KIRMA during all earth works	Confirmation from KIRMA of presence	PMU
Noise and vibration	Noise and vibration impacts local communities	<ul style="list-style-type: none"> Wherever possible working hours will be between 8am and 5pm Monday to Friday. Where safety or technical reasons require work to be completed outside of these hours, noise levels will be kept to a minimum and KIRMA together with nearby residents will be informed. Noise generating activities will be carried out in the least sensitive time periods to be determined in consultation with building managers (roof top) and representative residents bodies or KRIMA (ground mount). Wherever possible works will be scheduled to avoid disruption to the normal use of the building. Equipment and plant will be maintained in good order. Noise reduction components (e.g. mufflers) will be inspected prior to the commencement of works to ensure they are fully functional. Noise 	Contractor	Work carried out between agreed times, equipment in good order with appropriate noise reduction components	As required, daily visual inspection of all equipment	PMU

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		emissions from construction equipment will not exceed 75 dBA.				
Non-local workers	Presence of foreign workers resulting in conflict and social disruption in local community	<ul style="list-style-type: none"> All non-local workers will receive an induction that outlines the social and cultural expectations when working on Kosrae. Any worker not complying with these expectations will be expelled from Kosrae and repatriated at the contractor's expense. A grievance redress mechanism (GRM) has been established for the project and will be communicated through the engagement programme and by prominent display of the GRM process at the subproject sites prior to the commencement of onsite works. 	Contractor	Inductions carried out, GRM in place	As required, visual inspection GRM as well as records of induction.	PMU
Health and safety – workers and community	Health and safety of workers and communities inadequate managed leading to injury of fatality.	<ul style="list-style-type: none"> The contractor shall prepare a Health and Safety Management Plan that will at a minimum: <ul style="list-style-type: none"> Identify responsibilities and authorities within the contractor's staff for adhering to occupational health and safety (OHS) requirements. Identify and provide required personal protection equipment (PPE) for staff and sub-contractors (before they start work). Child and/or trafficked labor will be strictly prohibited for any activities associated with the project. 	Contractor	Health and Safety Management Plan in place, training completed	As required, visual inspection of Health and Safety Management Plan, health and safety controls, records of training and induction.	PMU, PIC

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> ○ Install fencing on all areas of excavation greater than 1m deep whether temporary or permanent. ○ Define appropriate emergency and medical process including evacuation procedures. ○ Prepare appropriate work method statements for each construction activity. ○ Provide daily hazard identification checklists, risk assessments ○ Identify mandatory meeting requirements including toolbox sessions, to ensure all personnel understand the task before commencing work for the day. ○ Provide for training for all workers on environmental safety, environmental hygiene prior to the commencement of construction. ○ Set procedures for safe handling of toxic materials and other hazardous substances. ○ Provide for installation of lights and cautionary signs in hazardous areas. ○ Ensure operators of vehicles and equipment are properly licensed and trained. ○ Ensure safety and inspection procedures are implemented, setting schedules for regular checking. 				

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> ○ Ensure movements of heavy vehicles is managed so as to minimise impacts to existing traffic and the wider community. ○ Provide for the provision of adequate sanitation and potable water for staff and contractors for the duration of construction works. ○ Access will be controlled to subproject sites (e.g. through the use of security fencing or restricting access to roof tops) for the duration of construction to prevent public access. ○ Children will be prohibited from entering the sites (including worker's accommodation, works area/construction zone) and prohibited from playing on any equipment or machinery. ○ All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Kosraen, the language of the main nationality of workers and repeated in English, if required. 				
Construction activities	Unexpected environmental impacts	<ul style="list-style-type: none"> ● If unanticipated environmental impacts occur during construction phase, the PMU will update the IEE/EMP and the Contractor will update the CEMP. The environmental protection measures will be designed to address the impacts. 	Contractor, PMU	Update of IEE / EMP and CEMP as required	As required, visual inspection of updated IEE / EMP and CEMP	PMU, PIC
Operation phase						

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Waste and hazardous materials	Inappropriate storage, transport or disposal of waste or hazardous materials resulting in contamination	<ul style="list-style-type: none"> • Inverters and batteries that have been replaced during the operating lifetime of the subprojects will be removed, transported and disposed of by an appropriately experienced and equipped contractor. • Where possible batteries and inverters will be recycled. If recycling is not possible, they will be disposed of at a facility approved by KIRMA or, if no facility is available, transported to an appropriately licenced facility elsewhere in FSM or another country. • Waste oil and other hydrocarbons from the Walung solar powerhouse will be stored in a bunded hydrocarbon storage area. • Waste will be sent for disposal at regular intervals and not allowed to accumulate at the Walung solar powerhouse. • A hazardous materials management plan will be developed by KUA that documents how hazardous materials (e.g. diesel fuel) are transferred, stored and transported to and from the powerhouse at Walung. The hazardous materials management plan will be approved by KIRMA. • Washing of solar PV panels will only be undertaken on an 'as needs' basis to minimise the generation of wastewater. Disposal of wastewater will be agreed with KIRMA. 	KUA	Appropriate disposal of wastes	As required, visual inspection of waste disposal certificates, operation of infrastructure containing hazardous materials	KUA

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		<ul style="list-style-type: none"> All infrastructure containing hazardous materials (e.g. batteries, transformers, generators) will be inspected regularly to ensure it is functioning correctly and no hazardous materials are being discharged. 				
Water resources	Overuse of water impacting fresh and potable water supplies	<ul style="list-style-type: none"> A source of water source for panel washing will be agreed with KIRMA prior to the commencement of operation. 	KUA, KIRMA	Agreed water source	As required, visual inspection of agreement.	KUA
Erosion control	Erosion of project sites	<ul style="list-style-type: none"> If localised erosion is detected during operation of the project effective mitigation measures such as application of mulch, covering with open weave jute matting and reseeding with ground cover, protection with geotextile fabric or localised flow dispersal and diversion structures will be installed. 	KUA	Effective control of erosion	As required, visual inspection of erosion mitigation	KUA
Employment	Staff unable to operate new power systems	<ul style="list-style-type: none"> Training to be provided for KUA employees in the operation and maintenance of the new infrastructure and power systems. 	KUA	Provision of training	As required, evidence of training completed	KUA
Emergency response	Emergency planning	<ul style="list-style-type: none"> KUA will prepare an operational emergency response plan. The plan will be included in the training provided to employees and be implemented during the operation of the solar power system. 	KUA	Emergency response plan prepared, and training completed	As required, visual inspection of plan and training records	KUA

Project activity	Potential impact	Management and mitigation		Monitoring		
		Proposed mitigation measure	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Decommissioning phase						
Decommissioning of solar PV array and batteries.	Inappropriate disposal of waste	<ul style="list-style-type: none"> All equipment will be removed from the subproject sites (e.g. PV modules, batteries, invertors) and will be reused or recycled where possible. Equipment that cannot be reused or recycled will be disposed of at a facility approved by KIRMA or, if no facility is available, transported to an appropriately licenced facility elsewhere in FSM or another country. 	KUA	Appropriate disposal of waste	As required, visual inspection of waste disposal during commissioning	KUA
Hazardous materials	Release of hazardous materials to the surrounding environment	<ul style="list-style-type: none"> The decommissioning contractor will be required to develop a hazardous materials management plan prior to the commencement of any works on the subproject site. 	Decommissioning contractor	Decommissioning plan completed	Once, visual inspection of plan prior to decommissioning	KUA
Revegetation	Erosion of project sites	<ul style="list-style-type: none"> If the subproject site is not reused it will be revegetated with species appropriate to the future land use of the site. 	KUA	Completion of revegetation	As required, visual inspection of revegetation	KUA

10. CONCLUSIONS

290. In order to meet the objectives and goals of the FSM National Energy Policy and its own State Energy Action Plan Kosrae must increase the percentage of energy generated from renewable energy sources. The subprojects included in this IEE will increase the percentage of energy generated from renewable resources on Kosrae to 34% as well as electrify Walung Village. The subprojects will further reduce the use of existing diesel generators for electricity generation on Kosrae thereby reducing diesel fuel usage by at least 100,000 gallons avoiding the emission of 1,023 tonnes CO₂e per year and securing electricity supply by reducing reliance on diesel.

291. Environmental assessments have not identified any significant negative environmental impacts associated with the construction or operation of either of the proposed subprojects. The construction of subprojects 1a, 1c and 2 will involve the loss of vegetation. Subproject 1 is located on reclaimed land and vegetation at subproject sites 1a and 1c is degraded and dominated by introduced species. The construction of subproject 2 will involve the clearing of native vegetation for the distribution line and powerhouse however, the area of clearance is small (approximately 15 ha) and the vegetation types present are common on Kosrae.

292. The operation of the subproject 1 will not result in any air or noise emissions. The operation of subproject 2 will result in air and noise emissions through the operation of the generator. The generator is small and will be run infrequently as a redundancy when load demand cannot be met. Air emissions will be insignificant and noise modelling suggests noise generated will not impact the amenity of nearby residents. Noise modelling will be rerun with the selected model of generator and mitigation measures are available to further reduce noise emissions.

293. The subprojects are not expected to have a negative impact on any species listed as threatened on the IUCN Red List. One flora species, the forest tree *Pterocarpus indicus* (Lach), listed as Vulnerable on the IUCN Red List was recorded at the subproject 2 site but will be avoided by the project. The subproject sites may be used by four fauna species listed on the IUCN Red List. However, the subproject sites do not provide priority habitat and the clearance of a small area of vegetation will not have a significant impact on any of the species.

294. The subprojects are not expected to have any negative impacts on local communities, but instead are expected to provide employment opportunities for local contractors.

295. Provided the mitigation measures outlined in this IEE and EMP are appropriately implemented then the project is not expected to have any widespread, irreversible or significant or long-term environmental impacts. As such, it is considered that a category 'B' level of assessment as per the ADB's SPS is appropriate to the scale and nature of the project.

ANNEX 1: FLORA AND FAUNA ASSESSMENT

Survey Report for RE sites in Tofol & Walung

1. Introduction

1.1 Background

The Kosrae State Energy Master Plan calls for the achievement of 50% renewable energy contribution by 2030. Ongoing efforts in Kosrae via the Kosrae Utilities Authority (KUA) are aimed at achieving this RE contribution target. KUA has already identified potential solar sites in government properties within the Tofol and Okat areas for the installation of these solar PV systems. Solar PVs are expected to be ground mounted at several sites in Tofol as well installed on rooftops of government buildings. PV floating farm is also being explored. Additionally, KUA is committed to providing electricity service to Walung village. Solar PV will be installed in Walung along with a small diesel generator system to provide the electricity for the village.

1.2 Scope

Construction of the solar photovoltaic systems in Kosrae and the installation of the Walung mini-grid and the diesel generator house (Refer to Figure 1) will require clearing, filling and levelling of land. This flora and fauna site assessment was conducted for sites 1a and 1c in Tofol and the Walung sites (distribution line and generator house) to identify types of flora and fauna present within the proposed sites, dominant species, and species of special and significant values for Kosraeans. The following tasks were undertaken as part of the assessment:

- A review of existing flora and vegetation surveys and relevant information pertaining to the site and surrounds as available to determine if any of the following are present or likely to be present within the sites:
 1. Threatened or Priority flora; and,
 2. Threatened Ecological Communities.
- Flora and Fauna site assessment – field survey

The results of the assessments are being compiled for submission to Entura.

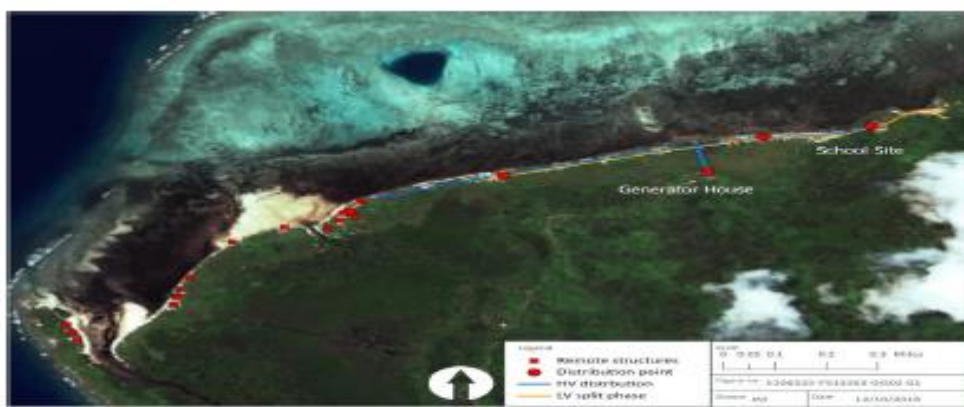


Figure .1: Proposed Walung PV line distribution and generator house

2. Methods

The flora and fauna surveys for the Tofol and Walung sites were completed on different dates. The surveys for the two sites in Tofol were completed on the 2nd of November 2018 by Andy George and Carlos Cianchini and the Walung sites on the 14th of November 2018 by Andy George, Carlos Cianchini, and Jason Jack. Additional survey was conducted by Andy George and Carlos Cianchini on June 1st, 2019 for the proposed power station site in Walung.

The survey methodology that was used for the site assessments was direct observation. FOR IDENTIFICATION OF FLORA AND FAUNA, WE TOOK PHOTOS, COLECTED SPECIMENS AND IDENTIFIED SPECIES AT THE SITES. At the Tofol sites, surveyors walked around the proposed project sites in a random manner and recorded all flora and fauna species present. For the Walung sites, surveyors walked the footpath from Mwot (northern end of the distribution line) up to the proposed generator house and down south to Panyea (southern end of the line) and recorded flora and fauna found within a 30 feet corridor, 15 ft. on either side of the path. Surveyors also observed and recorded flora and fauna species present at the proposed location of the generator house. All species of flora and fauna encountered during the survey were recorded.

Aerial photographs of the sites were reviewed prior to the actual field assessments. Habitat suitability and importance for fauna species were observed and documented for both sites. Dominant plant species and species of relative abundance were noted as well.

2.1. Challenge/Limitation

The two survey sites in Tofol (1a and 1c) were easily accessible compared to the Walung sites. Access to Walung is only possible by boat. Surveyors arrived in Walung during low tide; therefore, they had to walk from the reef flats to the shore to conduct the survey. In addition, surveyors had to follow the footpath across nearly the entire village to complete the survey. Some flora species were only identified by their family name.

2.2 Criteria for determining flora and fauna species of conservation significance

The conservation significance of the flora and fauna within the survey area was assessed based on local knowledge and whether they are of social and commercial value to the community. Nineteen out of the seventy five (75) plants identified in Walung have medicinal uses. These plants are common across the island and are widely distributed along the coast of Kosrae. *Citrus aurantifolia* is the one of Kosrae's exportable products. *Artocarpus altilis*, *Pandanus tectorius*, and *Musa paradisiaca* are staple food for Kosraeans. These plant species are also widely distributed throughout Kosrae. These plants are not endangered and are not at risk and therefore it is unlikely that the project will have adverse impact on them.

3. Results

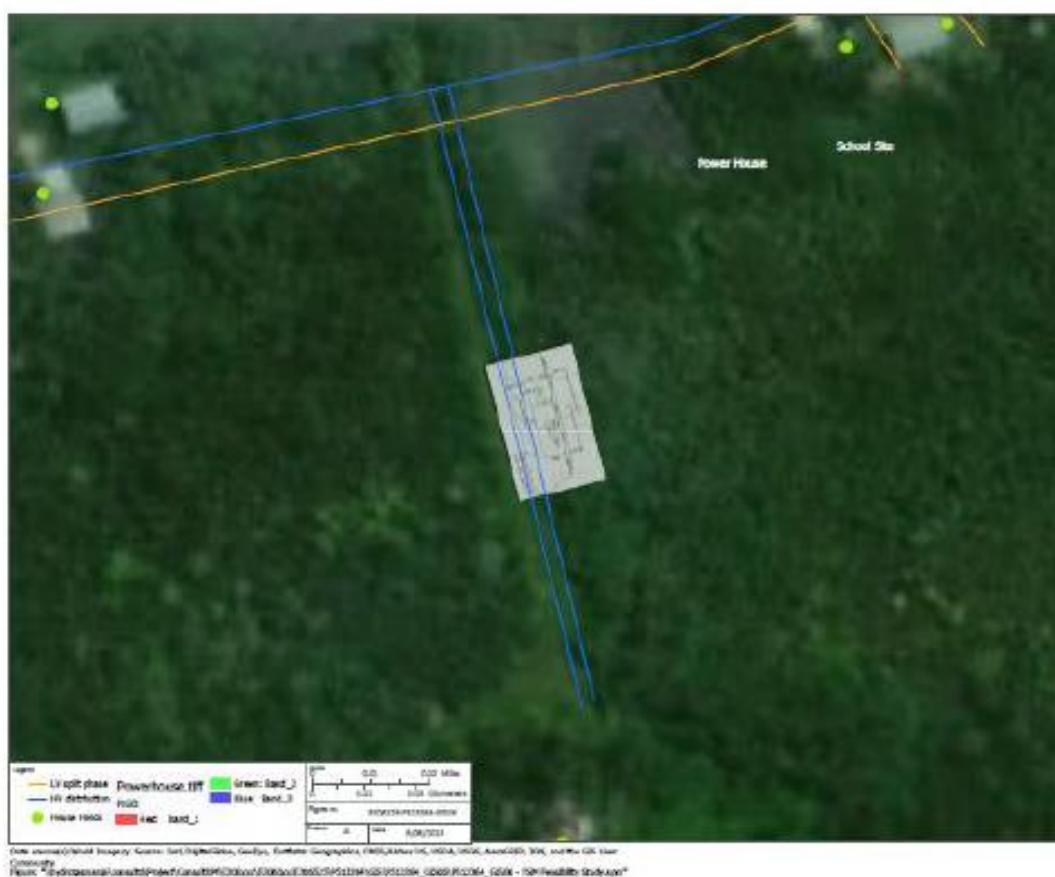
3.1. Flora

In Tofol, the two sites surveyed (1a and 1c) have secondary growth, dominated by a tall grass called *Phragmites karka* and other invasive weeds and vines such as the *Merremia peltata* and *Mikania micranta*. The entire area where sites 1a and 1c are located was once part of the Tofol wetland ecosystem. It was cleared and filled in the 1980's as part of the government's efforts to convert the area for other land uses. Aerial photos from the 1980s

show that the area was predominantly covered with *Nypa* palms (*Nypa fruticans*), *Terminalia carolinensis*, and *Hibiscus tiliaceus*.

In site 1a, we found two other pieces SPECIES of grass and other pioneer bushes (first to sprout) that grow after the land has been cleared. We found only one *Morinda citrifolia* which was covered with *Merremia peltata*. There were some patches of *Merremia peltata* and *Mikania micranta* (invasive vines). We found only one large plant species, *Terminalia carolinensis*, during the survey.

The Walung PV line distribution sites, as shown in figure 1, have more large plant species. The dominant and widely spread species found in the survey areas in Walung were *Cocos nucifera*, *Pandanus tectorius*, *Calophyllum inophyllum*, *Premna serratifolia*, *Barringtonia asiatica*, and *Artocarpus altilis*. *Sonneratia alba* were found in abundance but only concentrated in two main sections of the survey area. But, perhaps the most important plants in Walung are the ones that protect the community from coastal erosion. These species include *Calophyllum inophyllum* and *Barringtonia asiatica*.



The proposed Walung power station will be located on the northern side of the causeway roughly in the middle (see figure above) The proposed site is a wetland and much of the water in this area is stagnant due to blockage caused by inappropriate designing and construction of the road and seawall. The area is predominantly covered by *Nypa fruticans* palms, *Barringtonia racemosa*, and some *Premna Serratifolia* shrubs. As noted, *Premna serratifolia* grows fast in cleared areas. The rest of the area has secondary and pioneer vegetation. This vegetation includes the fern *Nephrolepis obliterated*, the vine

Derris trifoliata, and one vine of *Dioscorea* species. Also found were *Cyanthillium cinereum* and the invasive *Chromolaena odorata*. One type of grass was dominant, possibly *Ischaemum polystachyum* (no flower for identification).

The survey recorded 13 flora species at the two sites in Tofol and 75 species in Walung. Most of the species in Tofol were weeds, grasses, and vines. Almost all of them are introduced and/or invasive. Only one *Morinda citrifolia* and one *Terminalia Carolinensis* were recorded in Tofol. The species found in Tofol are common in Kosrae. Clearing of the project site will not have a negative impact on any of the species. For Walung PV line distribution site, most of the plants species recorded are coastal plants, vines, and some orchids. These coastal plants stabilize the coastline and protect the shorelines against erosion. These plants also have cultural or commercial values to the community. *Cocos nucifera*, *Musa paradisiaca*, and *Artocarpus altilis* provide food for the community. For the power station site, the most dominant plant species within the area is *Nypa fruticans*.

3.2. Fauna habitat

Tofol sites – The survey area in Tofol is home to several avifauna. The endemic Kosrae White-eye, *Zosterops cinereus*, the Blue-faced Parrotfinch (*Erythrura Trichroa*), and the Pacific Golden Plover (*Pluvialis Fulva*) live in the area and were spotted during the survey. These birds can also be found in other parts of the island. The wetland adjacent to the survey areas is an habitat for birds like the migratory ducks and Native Pacific Reef Heron. The project in Tofol will require some filling, clearing, and levelling of the land. Regular cleaning will keep the grass low and therefore attract birds like the Parrotfinch and Golden Plover as they prefer to live in low grass areas. The White-eye may lose some nesting grounds but they could easily find other nesting grounds in adjacent areas. The area is also home to toads and skinks. Although we did not find any geckos, we believe the area is suitable for geckos. We believe that the project will have minimal impact on these species.

Walung PV Line Distribution sites – The survey areas in Walung are important habitats for birds, skinks, and Crustacea (land crab). Pacific Golden Plover, Brown Noddy, Micronesia Honeyeater, and Kosrae white-eye were some of the birds that commonly live in the coastal areas of Walung and were sighted during the survey. Three species of skinks were also sighted. Walung Power station site – The survey identified some small crabs, skinks, and birds species within and adjacent to the proposed site.

4. Impact Assessment and Mitigation Measures

The proposed project sites in both Tofol and Walung will involve some earthmoving activities and may require removal of certain trees and plants. The removal of trees and plants could change the natural ecosystem that provides habitats for birds and other animals. But, if activities are controlled to a minimum, these plants may be able to re-grow and at the same time impacted animals may be able to adapt and/or find refuge in adjacent areas. Removal of coastal trees and plants may also exacerbate coastal erosion in Walung. To ensure that the project has minimal effects on the biodiversity and ecosystems, project activities must comply with the EIS requirements of the state government of Kosrae. Additionally, it is recommended that:

- Removal of any large coastal trees is not allowed as these trees provide not only habitat for birds but also serve as coastal defenses.

- Control and management measures must be put in place for invasive weeds and vines from spreading after land is cleared or filled.
- Work areas should be marked out prior to works commencing to avoid unnecessary vegetation, plant, or tree removal which may expose soils to the risk of erosion and associated sedimentation.
- Soil stabilisation and erosion control measures are implemented following the completion of works to minimise the risk of ongoing erosion and sedimentation.
- Any areas of the wetland that are cleared are rehabilitated to allow the native vegetation to re-establish.

Prepared by: Andy George

Appendix A

Tofol Sites 1a & 1c – Flora

Species	Site	Description
Cyperus javanicus; also known as Javanese flatsedge	Found in site 1a	This weed has no cultural or economical significance in Kosrae.
Phragmites Karka	Found in both sites 1a and 1c	This grass has some cultural and economical value for Kosraeans. It is used as an important part of the thatch-roof system and sometimes woven to make walls. This grass is common in Kosrae and can be found in all wetlands throughout the island.
Merremia peltata	Found in sites 1a and 1c	This is the most aggressive invasive vine in Kosrae. There is no cultural or commercial use for this plant in Kosrae.
Aeschynomene indica	Found in 1a	No cultural or commercial use
Vigna marina	Found in 1a	may have some cultural uses but they are also commonly found around the coastal ecosystem in Kosrae.
Abelmoschus moschatus	1a	No known uses in Kosrae
Hibiscus tiliaceus	Found in 1c	This tree is a culturally significant tree for Kosraeans. It is used for medicine (flower, etc).
Ludwigia species	Found in 1c	No cultural or commercial value/uses
Morinda citrifolia or noni	Found in 1a	This is an important medicinal plant species in Kosrae. Our survey identified only 1 noni plant within site 1a but it is covered almost entirely by the Merremia vine.
Stachytarpetta jamaicensis	Found in 1a	No known uses in Kosrae
Nypa fruticans	Found in 1c	Culturally significant plant. Leaves of the plants are used for local thatch roof.
Terminalia carolinensis	Found in 1c	Culturally significant tree used for timbers and canoe building. Kosrae is home to the largest Terminalia carolinensis forest in the world.
Mikonia micrantha	both 1a and 1c	No cultural or commercial value/uses

Appendix B

Walung– Flora

Family	Species	Presence/Distribution	Significance/Use
Pteridophytes (Ferns)			
Asplenidae	<i>Asplenium nidus</i>	Found to grow on some trees	N/A
Davalliaceae	<i>Davallia solida</i>	Naturalized and concentrated in certain areas	N/A
Lomariopsidae	<i>Nephrolepis</i> sp.	Naturalized and concentrated in certain areas	N/A
Polypodiaceae	<i>Microsorium scolopendria</i>	Found to grow on some trees	N/A
Monocotyledons			
Amaryllidaceae	<i>Crinum</i> sp	A patch is found in the northern end of Walung	N/A
Amaryllidaceae	<i>Hymenocallis littoralis</i>	Limited	Decoration
Araceae	<i>Alocasia macrorrhizos</i>	Limited	local medicine, LEAVES USED TO COVER EARTH OVEN
Arecaceae	<i>Cocos nucifera</i>	Most dominant and widely distributed	Construction materials, food, drinks, medicine, handicrafts, cooking oil, fragrance, etc.
Arecaceae	<i>Nypa Fruticans</i>	Dominant in wetlands (near generator house)	Used for thatch roof, local broom
Cannaceae	<i>Canna indica</i>	Limited	
Cyperaceae	<i>Cyperus javanicus</i>	Limited - alien species	
Dioscoreaceae	<i>Dioscoreaceae</i> sp	Limited	Food
Dioscoreaceae	<i>Tacca leontopetaloides</i>	Limited - found toward southern end of Walung	Food. Local starch
Musaceae	<i>Musa paradisiaca</i>	Widely distributed	staple food crop
Orchidaceae	<i>Dendrobium</i> sp. (orchid)	Limited	Ornamental NATIVE, NO USES
Pandanaceae	<i>Pandanus tectorius</i>	Most dominant-found along the coast, widely distributed	Food, medicine, handicrafts, local mats etc
Poaceae	<i>Bambusa vulgaris</i>	Limited	building, raft, handicrafts
Poaceae	<i>Centosteca lappaceae</i>	Limited	N/A

Poaceae	<i>Paspalum vaginatum</i>	Found to grow near the beach in some areas - not widely spread	N/A
Poaceae	<i>Phragmites karka</i>	Concentrated in swampy areas	Used in making walls, thatch roof, etc.
Poaceae	<i>Eleusine indica sp 2</i>	Widely distributed	N/A
Poaceae	<i>Eleusine indica sp 3</i>	Widely distributed	N/A
Poaceae	<i>Eleusine indica sp 4</i>	Widely distributed	N/A
Zingiberaceae	<i>Hedychium coronarium</i>	limited	Decoration & fragrance
Dicotyledons			
Acanthaceae	<i>Pseuderanthemum carruthersii var. atropurpureum</i>	Limited	N/A, DECORATION, INVASIVE
Apocynaceae	<i>Cerbera manghas</i>	spread along the coast AND MOUNTAINS	coastal tree POISONOUS
Araliaceae	<i>Polyscias fruticosa</i>	Limited	N/A DECORATION
Asteraceae	<i>Chromolaena odorata</i>	Grown in patches	invasive
Asteraceae	<i>Melanthera biflora</i>	Limited	N/A
Campulidaceae	<i>Hippobroma longiflora</i>	Limited	N/A POISONOUS
Casuarinaceae	<i>Casuarina equisetifolia</i>	Only 1 found	N/A
Chrysobalanaceae	<i>Atuna racemosa</i>	Only 1 found	timbers for construction, medicine
Clusiaceae	<i>Calophyllum inophyllum</i>	Dominant - widely spread	Medicine, coastal plants (defence)
Combretaceae	<i>Terminalia catappa</i>	spread along the coast	coastal plant, fruits
Convolvulaceae	<i>Ipomea littoralis</i>	Limited to certain areas	medicine
Convolvulaceae	<i>Ipomea sp</i>	Limited to certain areas	N/A
Convolvulaceae	<i>Merremia peltata</i>	Dominant in some areas	invasive
Euphorbiaceae	<i>Codiaeum variegatum</i>	Limited to certain areas	House plants for decoration
Euphorbiaceae	<i>Euphorbiaceae sp</i>	Limited to some areas	Decoration
Fabaceae	<i>Acacia auriculiformis</i>	Limited to northern part of Walung (6 trees found)	Protect against coastal erosion/coastal plant , IMPROVE SOIL FERTILITY

Fabaceae	<i>Aeschynomene indica</i>	Dominant in some areas	Alien species
Fabaceae	<i>Caesalpinia bonduc</i>	Limited	Vine
Fabaceae	<i>Derris trifoliata</i>	spread along the coast	Used as strings to tie breadfruit and/or firewood
Fabaceae	<i>Falcataria moluccana</i>	Limited	N/A
Fabaceae	<i>Pterocarpus indicus</i>	Limited	N/A
Fabaceae	<i>Vigna marina</i>	Widely distributed	medicine
Fabaceae	<i>Fabaceae sp (vine)</i>	Limited	N/A
Goodeniaceae	<i>Scaevola taccada</i>	Widely distributed	Medicine
Hernandiaceae	<i>Hernandia nymphaeifolia</i>	Widely distributed	N/A
Lamiaceae	<i>Clerodendrum inerme</i>	Limited	medicine
Lamiaceae	<i>Premna serratifolia</i>	Widely distributed & Dominant	firewood, medicine
Lamiaceae	<i>Solenostemon scutellarioides</i>	Limited	Decoration
Lamiaceae	<i>Vitex trifolia</i>	Widely distributed	insect repellent, medicine
Lecythidaceae	<i>Barringtonia asiatica</i>	Dominant along the coast	medicine, coastal plants
Lecythidaceae	<i>Barringtonia racemosa</i>	Limited in wetland	medicine
Lythraceae	<i>Pemphis acidula</i>	Only 1 found	Spear for fishing etc
Lythraceae	<i>Sonneratia alba</i>	Present from Walung church area toward the community health center	firewood, medicine, coastal tree, habitat for fish and crabs
Maesaceae	<i>Maesa carolinesis</i>	limited	N/A
Malvaceae	<i>Hibiscus tiliaceus</i>	Dominant - widely spread	Used for medicine, canoe, carvings, ropes (bark) and etc
Malvaceae	<i>Melochia villosissima</i>	Limited	N/A
Malvaceae	<i>Sida acuta</i>	Widely spread	N/A
Malvaceae	<i>Thespesia populnea</i>	Limited to certain areas	coastal plant
Moraceae	<i>Artocarpus altilis</i>	dominant -widely spread	food, canoe, building materials, etc
Moraceae	<i>Ficus tinctoria</i>	widely distributed	firewood
Myrtaceae	<i>Syzygium samarangense</i>	Only 1 found	fruit
Onagraceae	<i>Ludwigia hyssopifolia</i>	Limited to certain areas	invasive - medicine
Piperaceae	<i>Piper ponapense</i>	Grow on Artocarpus altilis VINE, GROWS ON VARIOS TREES	N/A
Rhizophoraceae	<i>Rhizophora sp</i>	Limited	timbers for construction, medicine

Rubiaceae	<i>Guettarda speciosa</i>	Limited	medicine
Rubiaceae	<i>Ixora casei</i>	Limited	Decoration
Rubiaceae	<i>Morinda citrifolia</i>	Widely spread	medicine
Rutaceae	<i>Citrus aurantifolia</i>	Widely spread	juice, fruit, export
Scrophulariaceae	<i>Angelonia angustifolia</i>	Limited	Decoration
Urticaceae	<i>Elatostema sp</i>	Limited	N/A

References:

Local Experts: Carlos Cianchini (Former Plants and People Project Assistant) & Jason Jack (Invasive Species Coordinator, Kosrae Government)

Balick, Michael J. 2009. *Ethnobotany of Pohnpei: plants, people and island culture*. University of Hawaii Press.

Buden, Donald W. and Taborosi, Danko. 2015. *Reptiles of the Federated States of Micronesia*

Maragos, James, 1987. *Kosrae Coastal Resources Atlas*. U.S. Corps of Engineers. Aerial Photos of Tofol.

ANNEX 2: LIST OF STAKEHOLDERS/COMMUNITIES CONSULTED

Name	Organisation	Role
Lyndon Jackson	Kosrae Government	Governor
Garson Sigrah	Kosrae Government	Lt. Governor
Jeffrey Tilfas	Kosrae Government	Attorney General
Alik Alik	FSM Government	Congressman and Chairman of National Climate Change Committee
Fred Skilling	KUA	General Manager
Lipar George	KUA	Chairman
Hairom Livaie	KUA	AO
Casey	KUA	Legal Officer
Gregory Ribau	KUA	System Administrator
Legislators	Kosrae Government	R&D Committee
Joe Wigner	Surveying & Mapping Office	State Surveyor
Lupalik Wesley	Division of Land Management	Land Management Specialist
Ruly Charley	Land Court Registry	Assistant Registrar
Salik Taulung	Land Court Registry	Land Assessor
Gister Edmond	Land Court Registry	Assistant Land Assessor
Yosiro Anton	Office of Statistics	Statistics Specialist
Blair Charley	Kosrae Island Resource Management Authority	Director
Betwin Tilfas	Kosrae Island Resource Management Authority	GIS Administrator
Bob Skilling	Department of Transport & Infrastructure	Director
Leandro Olano	Department of Transport & Infrastructure	Civil Engineer
Serlenda Nena	Walung Village	Resident
Gloria Benjamin	Walung Village	Resident
Ruben Charley	Malem Municipality	Acting Mayor
Alex Sundakov	Castalia	Project Director
Ken Ash	Castalia	Project Engineer
Julia McDonald	Castalia	Project Engineer
Mike Trainor	ADB	Project Officer
Taniela Faletau	ADB	Safeguards Officer
Jim Lynch	ADB	Project Consultant
Olly Norojono	ADB	Transport and Energy Officer
Istvan Ponsot	Vergnet	Head of Business Development
Hubert Yamada	FSM Energy Division, R&D	Assistant Secretary



KOSRAE UTILITIES AUTHORITY
P.O. BOX KUA
TOFOL, KOSRAE FM 96944

Minutes for Walung Land Owners Consultation Meeting

Date: August 08, 2019

Held at: Tafunsak Municipal Government Office

Time: 10:15am to 12:25pm

Attendees:

Gov. Carson Sigrah, Lt. Gov. Arthy Nena, Tafunsak Delegation to Kosrae State Legislature Chairman of Tafunsak Delegation Senator Alokoa J. Sigrah, Vice Speaker Rolner Joe, Senator Nena Ned, Senator Harry Jackson, KUA Board Of Directors Chairman Lipar George, KUA BOD Utwe Rep. Linson Waguk , KUA BOD Lelu Rep. Isao Mike, KUA GM Fred Skilling, KUA LC Casey Freddy, KUA Staff Members: Mrs. Adella P. George and Ms. Sandy-Connie Nithan.

Present Land Owners:

Notwe Mongkeya, Ruth N. Tolenoa, Canney Palsis, Moses Taulung, Houver Alik, Stoner Sanney, Lilla R. Allen, Alik Kiyus Jackson, Lulina E. Salik, Carlise Fred, Lydon Nena, Sylvan Ashley, Shra R. Seymour, Nena L. Kilafwasru, Roger Skilling, Martha Jeason, Kenye Roger, Segyl Albert, Kanako Tolenoa, Tulpe Shelton, Arnold Kelab, Shelton Tolenoa, Maxmiller Mongkeya.

Objective: To perceive a YES or NO answer from Walung Land Owners and reps for each family for the Mini-Grid Project.

Intro: KUA LC Freddy started the meeting with an opening remark by Lt. Gov. Arthy Nena who also blessed the day with an opening prayer then continued with an overview of previous meetings held at Walung back in May 2019 in which he attended.

DISCUSSION: Land properties in Walung are mostly still under "Heirs", therefore Walung residents along with other land owners who are not residing in Walung seem to agree to this energy project. However a few questions were raised concerning the power plant oil outflow and the safety of the underground circuits. Somehow residents are worried about getting electrical shock in times of soaring tides. Response from KUA GM and LC came to assure that observations have been made targeting prospects such as that (questions raised) and the safety for residents will not be overlooked.

MISCELLANEOUS BUSINESSES: Tafunsak Delegation to the KSL and other attendees offered to help with the easements by contacting off island owners who haven't sign. Some individual land owners that were present willingly signed easements.

ADJOURNED: Meeting ends at 12:25pm.



(RUA) AUG 2019 CONSULTATION MEETING

Name:	Signature	Contact/Phone
1. Rop/ndk		28. Kavaok. T
2. John J...		29. Taje Shalton
3. Camo of J/L		30. Jerald Cah
4. Natchwo. (S)		Shaldon Tolawa
5. Ruth N. Tolawa		
6. MOSES Taulung		
7. Hoan - Alik		
8. Stan L. Samney		
9. Ida Richard Allar		
10. Alik K. Jackson		94kj @ phone. 201 970-9252
11. NENA NED		
12. ISAAC MIRA		
13. Lubia E. Salk		370-3211
14. Carlise Fred		"
15. Lydon Nena		"
16. Harry Jackson		370-2134
17. SYLVAN JACKSON		
18. STAN R. Seymour		
19. Nana I. Kilafuan		
20. Linson Watuk		
21. Raimond Tukensm		
22. Jacob. Asher		
23. Nelson Kilafuakan		
24. Roger Skilling		
25. Martha Jeasofa		
26. Kenye ROGER		
27. SEBUL ALBERT		370-2639

2931

Yon Nua
3256000
8683

Name:	Signature
31.	G. Singh
32.	N. K. K.
33.	K. S.
34.	V. per George
35.	A. S.
36.	ALOKIA JOAS SIGRAH
37.	
38.	
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45.	

(KUA) AUG 2019

CONSULTATION MEETING

NAMES OF ATTENDEES TYPED COPY

1. VICE SPEAKER ROLNER JOE
2. JOHNSON TAULUNG
3. CANNEY PALSIS
4. NATCHUO MONGKEYA
5. RUTH N. TOLENNOA
6. MOSES TAULUNG
7. HOVER ALIK
8. STONER SANNEY
9. LILLA RICHARD ALLEN
10. ALIK K. JACKSON
11. SENATOR NENA NED
12. KUA BOD MEMBER ISAO MIKE
13. TAFUNSAK MUNICIPAL MEMBER LULINA E. SALIK
14. CARLISE FRED
15. LYDON NENA
16. HARRY JACKSON
17. SYLVAN JACKSON
18. SHRA R. SEYMOUR
19. NENA L. KILAFWASRU
20. LINSON WAGUK
21. RAIMOND TULENSRU
22. JACOB ASHER
23. NELSON KILAFWASRU
24. ROGER SKILLING
25. MARTHA JEASON
26. KENYE ROGER
27. SEGAL ALBERT
28. KANAKO TEROA TOLENOA
29. TULPE SHELTON
30. ARNOLD CELAB
SHELTON TOLENNOA
31. GOVERNOR CARSON SIGRAH
32. MAXMILLER MONGKEYA
33. KUA GM FRED SKILLING
34. KUA BOD CHAIRMAN LIPAR GEORGE
35. LT. GOV. ARTHY NENA
36. CHAIRMAN OF TAFUNSAK DELEGATION SENATOR ALOKOA JOAB SIGRAH